It’s hard to believe it has been almost two years since we have written about resin cements and universal bonding agents! It’s a frequent topic of my lectures and I am continually amazed at how much confusion is out there regarding use of these products. The concept of universal means many things to many people. When I think of universal, it means I can use a material in any clinical situation and it can be adapted to the exact case I am working on for the highest possible success rate. It means that no matter the substrate, type of preparation, or any other clinical consideration, the universal material will successfully work and result in a happy patient and a happy doctor. In the case of resin cements and bonding agents, it will not discolor over time, and most importantly, will not debond. As we review universal bonding agents and resin cements this month, we make an attempt to simplify what is happening on the market. Sometimes simplifying things to universal concepts only adds to the confusion which is why dentists regularly reach out to us with questions. As always, we welcome your feedback. Reach out to our team at connect@dentaladvisor.com, or to me at drbunek@dentaladvisor.com.

—— Sabiha S. Bunek

PRODUCT SHOWCASE

Maxcem Elite, Maxcem Elite Chroma, and OptiBond Universal (Kerr)

Editor’s Choice Maxcem Elite and Maxcem Elite Chroma Universal Resin Cement now have expanded indications to be used as a self-adhesive cement or with any leading universal bonding agents when maximum retention is needed. Maxcem Elite’s amine-free redox initiator system provides long term color stability, and when used with a universal bonding agent like OptiBond Universal, doesn’t require additional light curing. Maxcem Elite Chroma provides an additional clean-up color change indicator. With the expanded usability, Maxcem Elite is now truly universal and can be used with any dental substrate in all indirect procedures.

Online: www.kerrdental.com
Evolution of Cements

What makes a good cement?

- A strong bond, regardless of prep design
- Consistent mix
- Easy clean-up
- Lack of post-op sensitivity

PRODUCT SHOWCASE

3M™ RelyX™ Universal Resin Cement (3M Oral Care)

Award-Winning Features:

Outstanding Physical Properties: As tested in DENTAL ADVISOR laboratories, 3M RelyX Universal Resin Cement outperformed competitors in both self-adhesive and adhesive modes. Bond strength to dentin and zirconia was the highest of any cement ever tested by DENTAL ADVISOR.

Innovative Syringe: Tip design significantly reduces waste; syringe is small and comfortable in hand, and a window shows amount of material left in syringe.

Evaluator Comments:

- “It’s genius to combine two of my favorite cements, RelyX Unicem and RelyX Ultimate. Now I have one kit that does everything!”
- “The new syringe and tip are a wonderful combination! Excellent engineering.”

Online: www.oralcare.3m.com

G-CEM ONE™ (GC Americia, Inc.)

G-CEM ONE™, the new self-adhesive resin cement from GC, simplifies all cementation procedures. G-CEM ONE brings together high bond strength, effortless clean-up and long-lasting esthetics as well as an excellent self-curing ability for a wide range of indications in ONE product solution.

G-CEM ONE is a truly universal, non-technique sensitive, versatile, and reliable product that gives the flexibility of using G-CEM ONE ADHESIVE ENHANCING PRIMER (AEP) for challenging clinical situations. G-CEM ONE + AEP showed the highest bond strength to enamel and dentin among the cements tested by DENTAL ADVISOR.

- Excellent bond strength to enamel, dentin and to all indirect materials
- Optimal bond strength for retentive and non-retentive preparations thanks to AEP
- Exceptional self-curing for your peace of mind when thick or opaque restorations are used
- Tack cure feature for easy excess removal of excess
- Increased moisture and saliva tolerance when AEP is used
- Optimised flow of the paste
- Virtually no post-operative sensitivity
- Invisible, wear resistant margin for aesthetic outcomes
- 4 stable shades: A2, Translucent, AO3, BO1 (White Opaque)

Online: www.gcamerica.com

TheraCem® (Bisco)

Delivering a strong bond to zirconia and most substrates, along with easy clean up and high radiopacity, TheraCem® offers clinicians an effortless, reliable and durable cementation of indirect restorations.

- Calcium & Fluoride release: Continuous calcium and fluoride release
- Alkaline pH: Transitions from acidic to alkaline pH in minutes
- Contains MDP: Contains MDP allowing for a strong bond to zirconia, metal, and alumina substrates without the use of a primer
- High Degree of Conversion: A high degree of conversion ensures a higher physical strength
- Self-Adhesive Cement: Self-adhesive, no bonding agents required
- Radiopaque: Easy to identify on radiographs for quick and effective diagnosis
- Dual-Cured: Dual-cured, material will cure even in deep restorations where light cannot reach
- Auto-Mix: Auto-mix, dual-syringe provides a consistent mix for immediate delivery
- Low Film Thickness: Low film thickness ensures the restoration is completely seated
- Strong Bond to Zirconia: Delivers a strong bond to zirconia and most substrates with no priming or etching
- Easy Clean Up: Formulated to allow for quick and easy removal of excess cement

Online: www.bisco.com

Clinical Tips:

- Utilize surface treatments and restoration cleaners routinely — they enhance bond strength.
- Bring cements to room temperature before using.
- Tack cure with a light where possible; this increases bond and flexural strength of dual-cured cements, as opposed to self-cure mode.

RMGI CEMENTS

Resin-modified glass ionomer cements have become more popular as a simple solution that does not require use of a bonding agent. Due to fluoride release, they offer added reduction of sensitivity as well as caries prevention.

SELF-ADHESIVE RESIN CEMENT

Self-adhesive cements serve to simplify the process of cementation, and do not require the use of a bonding agent. Some self-adhesive cements contain calcium and fluoride ions and act similarly to RMGI cements.

ADHESIVE RESIN CEMENT

Adhesive resin cements came on the market when all-ceramic restorations became more popular. They incorporate the use of a bonding agent to increase bond strength. These cements are typically dual-cured and often have a higher strength than self-adhesive cements.

ESTHETIC RESIN CEMENT

As ceramics became more translucent, a need for more esthetic cements to effectively match final shades came about. They are typically available in traditional VITA™ shades. Esthetic resin cements incorporate try-in pastes as well as light-cured options to be used along with a bonding agent and cement. They offer higher strength than self-adhesive cements.
New universal adhesives have gained popularity because they are designed to simplify the steps involved with direct and indirect bonding protocols. The idea that one adhesive system can be used with different etching techniques, can bond to the different substrates and can dual-cure, all without the use of separate activators or primers, is very appealing to clinicians. However, not all universal bonding agents can make that claim.

While the term universal implies the product can be used in all situations, it is important to understand that not all manufacturers define universal the same way; it does, however, generally relate to two or more of the following:

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

### Consultant Viewpoint:
We asked our consultants their opinion on bonding agents

**If you could create your ideal bonding agent, what features would it have?**

- Clear, no discoloration, thin, gives distinct shine to tooth surface
- Have the bonding agent be incorporated into the restorative material to reduce steps
- Strong, reduces or eliminates post-operative sensitivity, inexpensive, easy to apply
- Hydrophilic
- Universal applications, thin coat, high strength bond, minimal cost
- Self-etching, high bond strength with thin film thickness in a single bottle
- Bonds to dentin, short light cure time, clear
- Universal, has a desensitizer in it, has hemostasis qualities, one-coat only, easily dispensed, and easy to see on x-rays
Product Showcase

3M™ Scotchbond™ Universal Plus Adhesive
(3M Oral Care)

Award-Winning Features:
Radiopaque: First radiopaque universal adhesive
Excellent Bond to Ceramics: As measured in DENTAL ADVISOR Laboratories, Scotchbond Universal Plus Adhesive provides consistently high bond strength to both glass ceramics and zirconia.

Evaluator Comments:
• “I’ve had zero issues with de-bonds or sensitivity with this adhesive — it’s the best!"
• “The viscosity of this adhesive makes me confident that I’m properly coating the cavity preparation.”

Online: www.oralcare.3m.com

G2 Bond Universal
(GC America, Inc.)

G2-BOND Universal is an all-around universal 2-bottle adhesive system that combines the features and benefits that clinicians expect from both self-etch and etch-and-rinse “gold standard” adhesives, and even more! G2-BOND Universal provides great results with your choice of etching mode (total-etch, self-etch, or selective-etch), with virtually no post-operative sensitivity. Its unique Dual-H Technology offers superior durability and shear bond strength in both direct and indirect applications. It delivers superior resistance to marginal staining, low technique sensitivity, and efficient dispensing, which helps eliminate waste.

• Your choice of preferred etching mode
• High durability and bond strength
• Excellent resistance to marginal staining
• Easy dispensing and low technique sensitivity
• Appropriate for many applications

G2-BOND UNIVERSAL is available in a convenient bottle kit, as well as 5mL bottle refills of the 1-PRIMER and 2-BOND components.

Online: www.gcamerica.com

CLEARFIL™ Universal Bond Quick
(Kuraray America, Inc.)

Why This Product Was Chosen:
Quick Application: Requires no scrubbing and takes only 3 seconds to bond.

Evaluator Comments:
• “Excellent bond strengths as reported in DENTAL ADVISOR Biomaterials Laboratories to both dentin and enamel.”
• “When isolation is difficult, especially in a high moisture area, the quick application time is highly beneficial.”

Online: www.kuraraydental.com

All-Bond Universal (Bisco)

Bisco’s All-Bond Universal allows you to standardize clinical protocols for effective delivery of adhesion with a single-bottle.

• Single bottle: Truly universal single bottle system.
• No activator required: No need for a separate activator.
• Total universality: Can be used for direct and indirect restorations in all cure modes, and with any bonding technique.
• Contains MDP: Contains MDP monomers for enhanced durability.
• Compatibility: Compatible with all light-, self-, and dual-cured materials.
• Versatility: Can be used with self-, total-, and selective-etch bonding techniques.
• Strong Bond to Dentin: High shear bond strength to dentin.
• Unparalleled Bond: Impressive bond strength to ALL substrates.
• Low Film Thickness: Allows adhesive to readily flow into etched surfaces.
• Moisture Tolerant: Bonds in the presence of moisture.
• Light-Cured: Light-cured adhesive.

Online: www.bisco.com

Futurabond U (VOCO)

VOCO’s Futurabond U is the world’s first truly universal adhesive system. Available in a SingleDose delivery system, Futurabond U maximizes ease-of-use in terms of application and consistent results, as well as long-term bond strengths. Nano-reinforced, it only requires a single layer application in just 35 seconds and its nanoparticles ensure high total-etch bond strength as well as superior wettability no matter what etch & cure methods of application are utilized.

• One adhesive for all your adhesive dentistry - self-etch, selective-etch or total-etch, all direct or indirect materials, all light-, dual- and self-cure resin materials and all substrates
• SingleDose System eliminates the problem of solvent evaporation as known issue of standard bottle systems. Ensuring reliable high bond strength with each use
• Apply, dry and cure in 35 seconds
• Virtually no post-operative sensitivity
• Over 30 MPa adhesion to dentin and enamel with LC composites while reaching total-etch adhesion levels with DC and SC composites

Media Link: https://www.youtube.com/watch?v=amQo1v1zTyw
What are the most important properties of a Bonding Agent?

Properties of bonding agents must work in unison to prevent short- and long-term failure. Smear Layer: acid etching removes the smear layer, while self-etching bonding agents incorporate the smear layer into a hybrid layer. Treating this layer will allow penetration into dentinal tubules. Water resistance: Resins should be hydrophobic to prevent microleakage and weakening of bond over time. Accelerated Aging: It is important to look at initial wetness, treatment of surface and saliva contamination as factors that can weaken bond strength over time.

What are the most important properties of a Cement?

A cement should adapt well to both the tooth and restortion interface without voids. Complete cure of light-cured cement or tack curing is important initially. Maintaining marginal integrity when exposed to toothbrushing or abrasion as well as a resistance to washout will help with avoiding recurrent decay.

Are there laboratory or clinical outcomes regarding cements or bonding agents where you would like to see more research?

A greater emphasis on long-term durability of materials is needed. Research should focus on the length of time materials are expected to survive in-vivo. The true test is whether materials actually are successful as permanent restorations, which calls for a minimum of 7 years. A review of cement and bonding agents when used together to prevent gap formation would be very interesting. When the cement layer is too thick and being cured on an opposite side, there is a tendency for the cement to shrink which can lead to sensitivity and greatly reduced bond strength because of the gap. Using a bonding agent that can initiate a chemical cure at the interface will create a higher bond strength. Testing the limits of self-cure cements if light cured too soon would also be interesting.

Where do you see the future going in terms of creating ideal bonding agents and cements?

Integrating or combining molecules that reduce enzymatic degradation of the bonding layers to improve long term bond durability is going to be a big factor in future products. Current solutions under investigation to inhibit enzymatic activity include chlorhexidine, galardin, benzalkonium chloride, quaternary ammonium methacrylates, proanthocyanidins and more. At this point, there still needs to be more research that integrating these molecules will ensure the products will be safe and effective, but there’s many promising in-vitro studies showing increased long-term bond stability. Otherwise, the continued integration of more “bioactive” properties making products more biocompatible, increase remineralization, are self-healing or provide bacterial resistance will provide a boost to the efficacy of all dental restorative products.
Introduction:
The purpose of this project was to measure the number of applications dispensed from an auto-mix syringe and compare the material waste of different cement systems. The number of applications from an auto-mix syringe can vary based on the clinical application and technique. While small veneers or short crowns can use as little as 60 µL of cement, the median clinical application size uses around 90 µL of cement. As a large portion of cement is wasted using an auto-mix tip, using a system with minimal waste can greatly increase the number of applications from each syringe.

<table>
<thead>
<tr>
<th>Wasted cement</th>
<th>Usable cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M RelyX™ Universal (3.4 g) new minimal waste Automix syringe</td>
<td>15 20</td>
</tr>
<tr>
<td>Variolink® Esthetic DC (5 g) Automix syringe</td>
<td>9 10</td>
</tr>
<tr>
<td>3M RelyX™ Ultimate (8.5 g) Automix syringe</td>
<td>16 18</td>
</tr>
<tr>
<td>Calibra® Universal (4.5 g) Automix syringe</td>
<td>8 9</td>
</tr>
<tr>
<td>Maxcem Elite™ Chroma (5 g) Automix syringe</td>
<td>8 8</td>
</tr>
</tbody>
</table>

Methods:
Cement portions from 5 syringes of each cement were extruded using the tips supplied by the manufacturer of each material onto a measuring paper placed on an accuSeries 224 scale (Fisher Scientific) accurate to 0.1 mg. The density of each material was measured using a density determination kit (Denver Instruments). A new tip was used for each portion extruded and the total number of applications counted per syringe. To determine waste from mixing, 10 mixing tips for each product were measured before and after use to give an average mass of material wasted inside the mixing tips. Syringes were weighed before and after use to find the amount of usable cement per syringe, the mass of the syringe packaging, and plastic caps. The total number of applications per syringe, cement waste per tip, plastic waste per application, and total measured packaged cement were used to determine how much usable cement was available, compared to the amount that was wasted by mixing.

Conclusion:
The new 3M mixing tips were about five times more efficient in terms of cement waste than the Mixpac helical taper mixing tips included with four common cements and over six times more efficient than the longer helical mixing tip included with Maxcem Elite chroma. The new 3M syringe packaging had half as much plastic waste per application as other automix cement systems. Overall, the new 3M system utilized around 67% of the packaged cement towards filling crowns, while the next closest system used less than 32%. The 3M RelyX™ Universal system can give up to 15 full applications for an average use of 90µL, and up to 20 applications for cases requiring 60 µL aliquots.
Bond Strength of G2-BOND Universal

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

Introduction:

G2-BOND Universal™ is the latest 2-bottle addition to GC’s adhesive portfolio to compete with self-etch and etch and rinse system. The primer has optimal hydrophilic properties to increase dentin penetration for sealing, strength and self-etching properties, while the HEMA-free hydrophobic layer reduces hydrolytic degradation for increased durability and interfaces with composite. Dental Advisor tested the initial bond strength and bond strength after accelerated aging of this new system compared to gold-standard self-etching Clearfil SE Bond 2™, and Etch and Rinse Optibond FL™.

Experimental Design:

MATERIALS:

Bonding Agents: GC G2-BOND Universal™ (GC America), Clearfil SE Bond 2™ (Kuraray), Optibond FL™ (KaVo Kerr)

Composite: G-aenial Universal Injectable™ (GC America)

TEST PARAMETERS:

Substrates: Human Superficial Dentin, Human Ground Enamel

Etching Mode: Self-etch, Total-etch

Storage Conditions: 24 hours, 10,000 Thermocycles (TC)

Methods:

Direct Shear Bond Strength [n=8] per bonding agent to dentin, enamel with self-etch and total-etch modes: Human adult molars, sterilized in a 1% Chloramine T 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. Specimen surfaces were treated and bonding agent placed according to manufacturer instructions. G-aenial Universal Injectable™ was then placed on top of the bonding agent utilizing the Ultradent Shear Test mold and jig to produce a 2.38 mm diameter shear test cylinder according to ISO 29022:2013. The cylinder was light cured for 20 seconds while in the mold. The specimens were then transferred to a 37°C deionized water bath for 24 hours storage until testing or thermocycling. Thermocycling was performed by transferring specimens between a 5°C and 55°C water bath with a 20s dwell time for 10,000 cycles.

Results:

No application issues were observed with G2-BOND Universal™ and achieving a consistent bonding film thickness was simple.

Conclusion:

G2-BOND Universal™ performed better than Clearfil SE Bond 2™ and Optibond FL™ tested in their respective etching modes to dentin and enamel in immediate 24h shear bond strength and after accelerated aging.
OMNICHROMA Flow

Description

OMNICHROMA Flow is a flowable composite that:
• Utilizes Smart Chromatic Technology, with supra-nano, uniformly-sized spherical fillers
• One shade recreates all tooth shades from A1 to D4
• Obtains high polishability and luster
• Features high compressive and flexural strength
• Has low polymerization shrinkage

Indications

• All classes of direct anterior and posterior restorations
• Cavity base or liner
• Repair of porcelain/composite

Unique Attributes

• OMNICHROMA Flow - one shade technology in a flowable composite
• Highly filled flowable that can be used for all cavity classes
• Supplemental OMNICHROMA BLOCKER Flow that can be used in conjunction with OMNICHROMA Flow to mask tooth stains. It can also be used to overcome shade-matching interference due to little tooth structure and lack of surrounding dentition.

Clinical Tips

• You may need to use the BLOCKER more than you think. If there is any brown or gray in a Class I case, then use the BLOCKER; otherwise, your restoration is going to look gray.
• Do not worry about the pre-cured shade; it will match after curing.

Evaluators’ Comments

“The color matching was superb. I already use OMNICHROMA and this is a great addition to the family of products.”

“I prefer to use flowable for Class V restorations, and I like the esthetics of OMNICHROMA. Now I can have it all!”

“It streamlined our workflow by limiting the need for additional shades.”

“The BLOCKER is great for implant screw holes! Looks perfect.”

“The BLOCKER is an excellent tool. Use it to mask show-through from the oral environment.”

“No air bubbles!”

“I would like to see a low flow and high flow version.”

“In some cases, you may need to use the blocker even when not indicated to get a good shade match.”

Evaluation Summary:

Consultants who would:

94% Recommend to a colleague

27% Yes, instead of current product

67% Yes, in addition to current product

I might want to order this product for certain cases
Young™ Infinity Cordless Hygiene Handpiece

Key features:
- Cordless hygiene handpiece
- Cordless Bluetooth foot pedal
- Light weight and quiet

Description
The Infinity Hygiene Handpiece is a cordless polishing handpiece with:
- Nose cones that work with any disposable prophy angle
- A Bluetooth foot pedal
- Removable and autoclavable nose cones that comply with CDC guidelines
- A lightweight and balanced design
- 4x longer lasting battery life than other handpieces
- Quiet operation

Indication
- Cleaning and polishing of tooth surfaces

Unique Attributes
- This handpiece is truly lighter and more balanced than others on the market.
- The battery lasts all day, so it can easily sit on the counter without cords or chargers and just be charged at the end of the work day.
- The foot pedal is cordless and connects automatically. It feels like a seamless transition between using air-driven and cordless without the cord weight.

Clinical Tips
- Good for all hygiene clinical situations and it’s nice to use with the splatter guard prophy angles.
- Cordless handpieces are better with children - would strongly recommend in any pediatric practice.

Evaluator’s Comments
"I really liked the foot pedal option, it gave me quicker control over the speed and stop of the polisher."

"The quiet motor doesn’t startle kids or patients with sensory issues."

"I liked that I could use any brand of prophy angle in this handpiece."

"Light weight and great battery life."

"I would like the addition of more powerful speeds."

"It is great and lightweight, I loved the varying speeds!"

"Ease of use and has good control."

"Did not swivel very easily, I had to use two hands to swivel the head."

Evaluation Summary:

Compared to Competitive Product

Consultants who would:
- Recommend to a colleague
- Yes, instead of current prod
- Yes, in addition to current
**Description**

The Splatter Guard Classic Petite Web LF is a prophy angle that:
- Features a wiper, designed to significantly reduce or eliminate splatter
- Has a short length
- Has a narrow neck line
- Features Young’s Petite Web cup
- Flexes and flares around tooth contours due to the smooth four-webbed cup

**Indications**

- Cleaning and polishing of all tooth surfaces

**Unique Attributes**

- These prophy angles can be used on any handpiece; however, it is maximized to work with the Infinity Hygiene Handpiece.
- An already popular-style prophy angle improved with the addition of the anti-splatter wiper.

**Clinical Tips**

- Take advantage of the built-in flex to adapt to all tooth surfaces.
- The cup is firm, pushing harder doesn’t help and the harder you push, the less effective the splatter guard reacts.

**Evaluators’ Comments**

"They seemed to have a good grip on the teeth and were incredibly easy to use."

"The short narrow neck made for easy access."

"One of my patients said she felt I was using something different and she commented that she liked the way it felt on her teeth."

"The wiper is amazing! No ropy saliva whipping everywhere!"

"Great design - I will definitely incorporate this into our hygiene program."

"The cup was very firm."

"The cup seemed smaller to me; I would have liked a little bigger flare"

"Excellent product, especially during Covid, to avoid splatter"

"Very Smart Product!"

**Evaluation Summary:**

- **Excellent**
- **Very Good**
- **Good**
- **Fair**
- **Poor**

**Score:**

- **Access to tooth surfaces:** 52%
- **Splatter reduction:** 38%
- **Polishing effectiveness:** 52%
- **Fit in handpiece:** 38%
- **Ease of use:** 52%

**Compared to Competitive Products:**

- **90%**
  - Would recommend to a colleague

- **33%**
  - Yes, instead of current product

- **47%**
  - Yes, in addition to current product

- **10%**
  - No; however, I might want to order for certain cases

**Clinical Rating:** 91%

**Total Uses:** 917

**Clinical Evaluators:** 35

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Looking for a speaker for your event?

DENTAL ADVISOR Speakers’ Bureau offers continuing education courses on a wide variety of topics for dentists, hygienists, assistants, lab technicians, and office teams. Each topic can be 1-2 hours, half-day or full-day lectures. Topics can be combined and adapted for a custom presentation. A complete course synopsis is available upon request.

To book a DENTAL ADVISOR speaker, or for more information, please contact:
connect@dentaladvisor.com

Cementation & Bonding: Clinicians and Researchers Weigh In

If you missed out on Dr. Sabiha S. Bunek’s webinar sponsored by Henry Schein on Cementation & Bonding, it is now available on demand!

Watch it here: https://www.youtube.com/watch?v=YmMg_0WrQUs&feature=youtu.be

SPECIAL THANKS TO:
Select Senior Clinical Evaluators (Over 20 years):

Clinical Evaluators (19 years or less):

Laboratory Consultants: Apex Dental Milling, MI

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