SEP - OCT 2025
Vol. 42, No. 05

DENTAL ADVISOR™

Product insights you can trust.

ECO-FRIENDLY DENTISTRY



THE IMPORTANCE OF ECO-FRIENDLY DENTISTRY FOR A SUSTAINABLE FUTURE

UNI-Q BOND™ UNIVERSAL IN VITRO EVALUATION

EMPOWER™ MULTI-ENZYMATIC DETERGENT EFFICACY

IN VITRO EVALUATION OF ENAMEL CARIOUS LESION TREATMENT WITH CURODONT™ REPAIR FLUORIDE PLUS

EFFICIENT AND PREDICTABLE RESTORATIONS USING CLEARFIL™ MATERIALS

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FROM THE DESK OF
Dr. Sabiha S. Bunek
CEO & Editor-in-Chief

PUBLISHER: DENTAL CONSULTANTS, INC.
John M. Powers, Ph.D.
Sabiha S. Bunek, D.D.S.

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Please send inquiries and address changes to:
DENTAL ADVISOR

1310 S. Main St., Suite 10
Ann Arbor, MI 48104
Call: 734.665.2020
Fax: 734.665.1648
Email: connect@dentaladvisor.com
Website: dentaladvisor.com

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This month we turn our attention to eco-friendly dentistry, a topic that is gaining momentum as patients and practices alike look for ways to make a positive impact. Dr. Ashton Prince, one of our Clinical Ambassadors, shares practical approaches to reducing environmental footprints while maintaining the highest level of care.

With more sustainable products available, clinicians can now make choices that benefit both patients and the planet. Digital workflows help cut down on impression and model waste, packaging is becoming more recyclable, and long-lasting restorative materials reduce the need for replacements. But what does sustainable really mean? In theory, it suggests being green. In practice, it should mean dependability. A sustainable choice must integrate smoothly into clinical routines, minimize waste and energy use, and still deliver consistent, predictable outcomes.

I always enjoy hearing from our readers, and your feedback helps guide future topics. Please feel free to reach out at drbunek@dentaladvisor.com or connect@dentaladvisor.com.

– Sabiha S. Bunek

CLINICAL AMBASSADOR PROFILE



Dr. Tiffani Dunn graduated from Florida State University with a BSc in Biology in 2003. She graduated from the Medical College of Georgia in 2009 and has made Kona, Hawai'i her home ever since.

Since her graduation, she has continued to pursue the top courses for continuing education. She is a Kois Graduate, the first female in the state of Hawaii. She is an Accredited dentist with the American Academy of Cosmetic Dentistry where there are less than 400 accredited dentists in the world. She completed her biomimetic residency at Magne Education and is now visiting faculty.

She is published in the Journal of Cosmetic Dentistry and Clinician's Choice journal, Clinical Life. She regularly participates with the Seattle Study Club and is the only Hawaii Key Opinion Leader with Ivoclar. She maintains a private practice with focus on interdisciplinary care and cosmetics. She has incorporated cerec milling and align technology for the past decade and counting.

Eco-Friendly Dentistry

and Its Importance for a Sustainable Future



Ashton Prince, DMD
Clinical Ambassador

Why This Matters

Traditional dental products packaged in plastic and other non-biodegradable materials contribute significantly to long-term environmental waste. These materials take decades, even centuries, to decompose, if they do at all. This creates overfilled landfills, strains environmental resources, and increases the urgency of adopting sustainable practices.

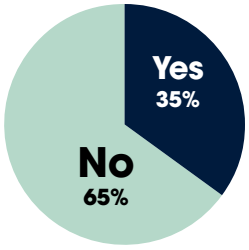
According to the 2020 United States Environmental Protection Agency (EPA) Municipal Solid Waste Report, the U.S. annually generated approximately 36 million tons of plastic packaging (12% of total waste), 67 million tons of paper packaging (23%), and 12 million tons of glass packaging (4%). Yet, only 9% of plastics, 68% of paper, and 25% of glass were recycled.

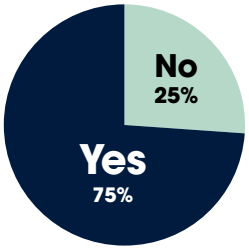
People everywhere are becoming more mindful of the limited resources our world depends on. Businesses that ignore their environmental impact risk contributing to long-term damage that disrupts ecological balance. As concerns about climate change and resource scarcity continue to rise, so does the demand for eco-friendly companies and products from consumers who want to make responsible choices.

In dentistry, both clinicians and patients are seeking ways to reduce waste from non-biodegradable packaging and to adopt materials that are safer for the environment. Sustainable alternatives are moving into the mainstream as expectations grow. Items such as biodegradable toothbrushes, naturally derived toothpastes, recyclable packaging, and energy-efficient technologies are helping to shift the culture of dentistry toward a greener future.

DENTAL ADVISOR's Take on Current Trends

Are you using eco-friendly products in your dental practice?





Do you have any environmental concerns about waste generated by your practice?

What concerns do you have about changing to an eco-friendly dental practice?



Eco-Friendly Dentistry

What Makes a Product or Company "Eco-Friendly"



As a company chooses renewable, recyclable, or environmentally sustainable materials in their packaging and products, they are reducing the need to utilize new raw materials. An eco-friendly company will also do its best to reduce non-renewable energy sources, implement "closed-loop" systems that allow for waste from one process to become the starting material for another process, minimize its carbon footprint, and apply zero-waste-to-landfill policies. Some companies may also look to receive certifications from groups like LEED or Energy Star, which are third-party organizations that set rating systems and specific standards for companies to abide by. A designation of B-Corp status may also be obtained, which sets social sustainability and environmental performance standards.

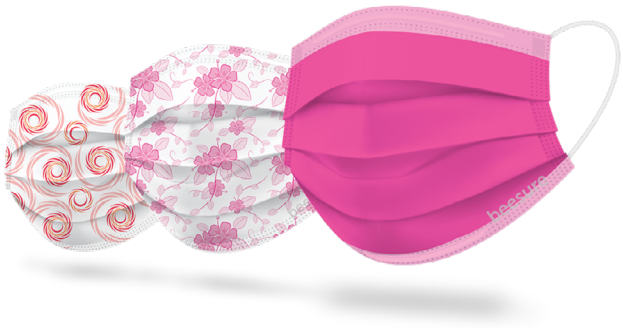
How to Find Eco-Friendly Dental Products

When a dental office attempts to find ways of becoming more supportive of the eco-friendly movements, they may find that products are slightly more expensive, and the availability of some materials can be limited. To begin transitioning towards these products, they can start by assessing what materials they use daily and consider finding companies that are associated with initiatives to be eco-conscious. Search the companies' websites for their stance on environmental concerns or contact local representatives and inquire about their products' environmental impact from production to disposal. Very little searching is required, as most companies will be very proud of their internal initiatives and will strongly express their environmentally friendly position.

EXAMPLES OF ECO-FRIENDLY PRODUCTS AND COMPANIES

Dentsply Sirona

Dentsply Sirona has made sustainability a core mission, with one of its key pillars being a "Healthy Planet." The company is focused on reducing greenhouse gas emissions, lowering water consumption, and minimizing waste. In collaboration with the FDI World Dental Federation, they created the "Sustainability in Dentistry" Massive Open Online Course (MOOC), designed to help dental professionals understand their environmental impact and adopt sustainable practices.



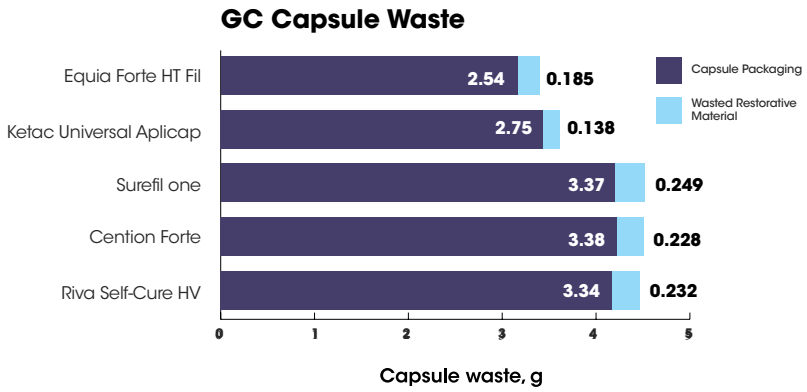
EcoBee Beesure develops gloves and face masks with conservation in mind, using recycled materials. Their disposable products such as prophy angles, saliva ejectors, brush applicators, syringe tips, and 3-in-1 trays are all made from recycled plastic. This reduces the need for new plastic resins derived from non-renewable natural resources.



Independent Test Results Provided by the **DENTAL ADVISOR Biomaterials Laboratory**

GC Capsule Waste for Restorative Materials

Research Report Number 164, March 2023



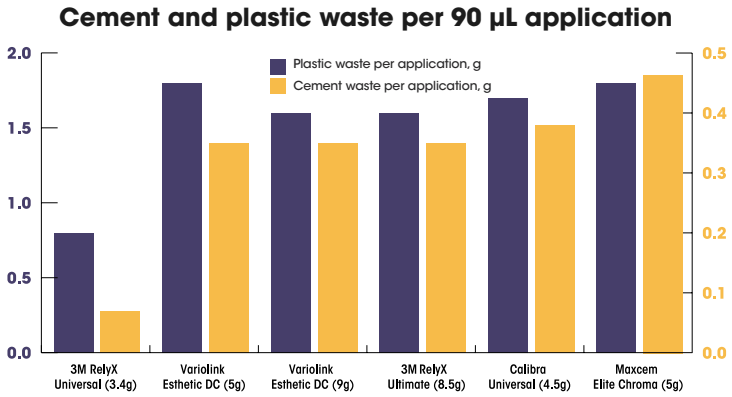


Click to Read the Full Report

This study focused on the sustainability of the dental packaging design of capsule-based restoratives which are mixed using a triturator. We also examined the amount of usable restorative that can be applied from the capsule after mixing compared to what is originally packaged to give an idea of the efficiency of the packaging system. ***Equia Forte HT Fil*** capsule packaging has less total mass than the otherproducts tested while wasting the least amount of packaging per gram of usable restorative, making it the most efficient packaging design.

3M Automix Applications and Mixing Efficiency

Research Report Number 134, June 2023





Click to Read the Full Report

Total plastic and cement waste is divided by the number of applications to give a comparison of the waste generated by each application. ***3M RelyX Universal*** generates less than half the plastic waste per application as the other cement systems tested, and between 5.0-6.6X less cement waste from mixing.

Eco-Friendly Dentistry

Product Highlight

TePe Interdental Brushes Original

(TePe Oral Health Care, Inc.)

TePe Interdental Brushes are designed to support optimal patient outcomes by effectively disrupting and removing interdental biofilm—reducing gingival inflammation, caries risk, and halitosis. Using interdental brushes can remove up to 40% more plaque than toothbrushing alone. Developed in collaboration with dental professionals, these brushes are available in 9 color-coded sizes to ensure precise adaptation to each interdental space. The plastic-coated wire allows for safe use around natural dentition, implants, and orthodontic appliances. Manufactured with 100% renewable energy, ***TePe Interdental Brushes*** combine proven efficacy, patient compliance, and environmentally responsible design, making them a trusted solution for preventive care.

Online: www.tepeusa.com





Brush with Bamboo is one of the world's first plant-based bamboo toothbrushes, focusing on plastic-free alternatives.



Bleeker & Rowe produces a 100 percent biodegradable floss pick, including an option for fully biodegradable charcoal floss, making this a premium eco-friendly choice.



Cocofloss produces the ***Cocofloss Cocobrush,*** made from ocean plastic. The company further states that with every purchase, they will remove the equivalent of 10 toothbrushes' worth of ocean plastics.



EXAMPLES OF ECO-FRIENDLY PRODUCTS AND COMPANIES



Micrylium is a professional disinfection company that offers ***BioSURF*** for hard surfaces, ***BioTEXT*** for textured surfaces, BioSON for ultrasonic cleaners, Lines for waterline cleaning, ***BioVAC*** for evacuation cleaning, ***MouthOFF*** for cleaning oral appliances, and the disinfectant ***LeCLOTH*** wipe. These products are designed to work in harmony, reducing the risk of toxic chemical reactions that could harm clinicians or patients.





Hager Worldwide provides eco-friendly products such as the ***"Bio" Vacuum Tip***, a high-volume, bio-based aspiration tip made from sugarcane, as well as the ***BioGuard*** vacuum cleaning system from ***BullFrog***. ***BioGuard*** dissolves and consumes organic waste, reducing it to natural elements.



EcoRoot Bamboo Floss is made from biodegradable silk and bamboo fibers, unlike traditional nylon, which is a plastic derivative. This floss incorporates activated charcoal, vegan wax, peppermint oil, and tea tree oil.



The Humble Co. offers floss picks that are 53 percent plant-based and double-threaded for a smooth, sturdy, and shred-resistant experience. They are available in both mint and charcoal.



Huppy Toothpaste Tablets are an alternative to billions of non-recyclable plastic toothpaste tubes that are produced annually. The key ingredients for the ***Huppy Tablets*** are nano-hydroxyapatite, coconut oil, baking soda, and xylitol.

Eco-Friendly Dentistry

EXAMPLES OF ECO-FRIENDLY PRODUCTS AND COMPANIES



Cavex ProphyPaste is offered in both Regular (RDA 130–150) and Fine (RDA 50–60) abrasiveness. It is packaged in a tube to help minimize the waste created by using individual, single-use prophy cups.



Flaus offers an electric flosser that reduces environmental impact by using 95 percent less floss and incorporating recyclable plastic.



PhytoDental Solutions developed ***DenticDS,*** a plant-based and natural rinse that reduces inflammation, infection, and recovery time associated with dental disease, procedures, and appliances. It aids in patient comfort, wound healing, and the support of bone and soft tissue.

Conclusion

As dentistry transitions toward more eco-friendly practices, a model can be built that not only avoids environmental harm but also helps restore a sustainable balance. Even the smallest steps toward implementing eco-friendly routines can make a meaningful impact. Positive changes are already underway in many areas, yet much more remains to be done. The key is to begin with manageable adjustments and gradually expand those efforts until they become lasting habits.

With greater awareness and intentional, environmentally focused action, every individual can make a difference. The most effective approach is often a combination of small, consistent changes rather than trying to take on the entire eco-friendly movement all at once.



Solventum™ Filtek™ Easy Match Flowable ++++½

Solventum www.solventum.com

DENTAL ADVISOR ++++½

37 CLINICAL EVALUATORS

656 TOTAL USES

91% CLINICAL RATING

Key features: Three shades: Bright, Natural, Warm • Naturally adaptive opacity • Ergonomic and color-coded syringes

Description

Filtek Easy Match Flowable is a three-shade, flowable restorative with body-like opacity that delivers a simplified workflow for single-shade restorations and natural-looking results. It is available in syringes in shades bright, natural, and warm.

Indications

- Direct restorations of all cavity classes (I-V)
- Base/Liner under direct restorations
- Repair of small defects in the esthetic indirect restorations
- Repair of resin and acrylic temporary materials
- Pit and fissure sealants

Unique Attributes

- Quick, easy and intuitive shade selection without sacrificing opacity
- Simplified single-layer restorations, including high-end esthetic restorations
- Excellent shade match for most anterior and posterior restorations
- Tip designed to reduce bubbles and stop material "run-on" during and after dispensing





Photos courtesy of Dr. Anthony Valentine



Clinical Tips

- Use smaller increments as using too much may be difficult to handle because of the viscosity.
- Dispense the material incrementally by placing the metal tip very close (but not into) the uncured material.
- To match esthetics, consider using it with ***3M™ Filtek™ Easy Match Universal Restorative***.

"EXCELLENT SHADE MATCH AND FINAL POLISH."

Evaluators' Comments

"It's a good flowable and nice that it has 3 shades."

"The final polish of the restoration is very good."

"Consistency of the material allows for sufficient working time and flows well within the prep."

"The syringes are great and easy to handle. The tips bend and are very useful."

"It did slump a bit too easily."

"I do not like that you have to use the special/non-universal tips with Solventum flowables."

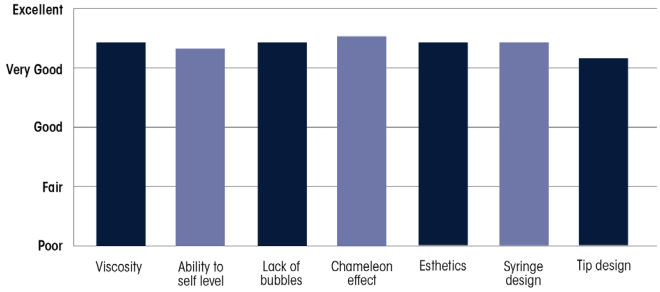
92% **Consultants who would:**
Recommend to a colleague

Consultants who would want to stock in office:

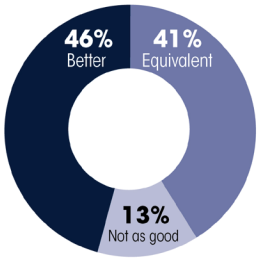
22% Yes, instead of current product

62% Yes, in addition to current product

Evaluation Summary:



Compared to Competitive Products:



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Biomaterials Research Report
DENTAL ADVISOR Biomaterials Research Center
Ann Arbor, MI 48104

Number 173 – August, 2025

UNI-Q Bond™ Universal In Vitro Evaluation

Matt Cowen, B.S., Margaret Gilmartin, B.S., John M. Powers, Ph.D.



Introduction:

UNI-Q Bond™ (B.J.M. Laboratories Ltd.) is a new universal adhesive with indications for bonding to all materials while having minimal color appearance compared to other adhesives. The change in color after adhesive application can become apparent, especially when used for orthodontic bonding, and when used in combination with very white restoratives making this an important feature for certain indications where adhesive color may be apparent. In this study, we measured the bonding performance, film thickness, and appearance of color of this new adhesive. We also did an assessment of the procedure time of the product compared to a bioactive adhesive on the market.

Conclusions:

UNI-Q Bond universal bonding agent has excellent bond strength and durability after artificial aging to dentin and high initial bond strength to zirconia and enamel. There is little to no perceptible color change when ***UNI-Q Bond*** is applied and cured to surfaces. The film thickness and ease of application is on par with other leading universal adhesives on the market.

Experimental Design:

MATERIALS:

UNI-Q Bond universal bonding agent (B.J.M. Laboratories Ltd.), ***3M™ Scotchbond™ Universal Plus*** (Solventum), ***RE-GEN™ Universal Adhesive*** (Vista Apex)

Tests:

Direct Shear Bond Strength: 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. Zirconia plates were previously cut to be ~12 mm x 12 mm x 2-3 mm thick, processed according to manufacturer instructions, embedded in acrylic resin discs, finished through 600 grit diamond paper, and surfaces treated. The surface treatment was sandblasting with 3 bar (0.3 MPa) pressure and 50 µm particles to ***Katana™ Zirconia STML*** (Kuraray Noritake Dental, Inc.) Zirconia. Specimen surfaces had a bonding agent placed according to manufacturers' instructions. Composite 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 with an ***3M™ Elipar™ DeepCure-S*** (3M) curing light. The specimens were then transferred to a 37°C deionized water bath for 24 hours storage until testing. Additional test groups were subjected to 10,000 thermocycles, which consisted of 25-second immersions in deionized water at 5°C and 55°C for 10,000 cycles. Testing was performed using a universal testing machine at a crosshead speed of 1 mm/min. Means and standard deviations were calculated.

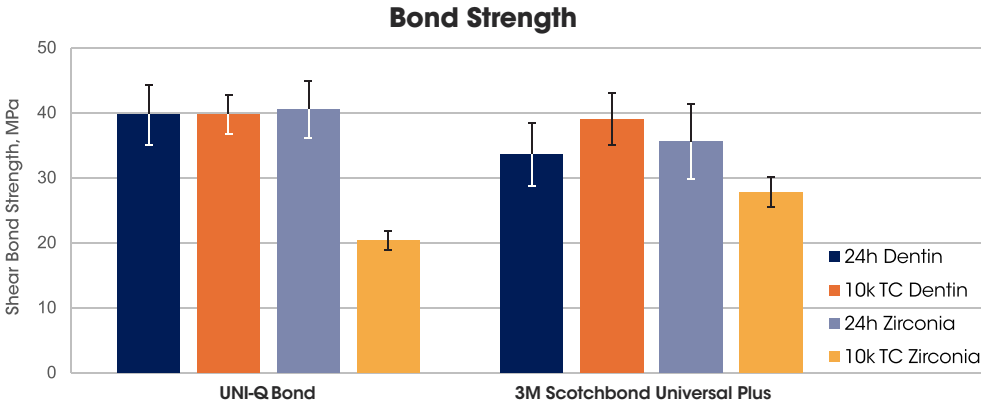
RE-GEN Universal was only tested to dentin and enamel with and without Clean & Boost at 24h for comparison purposes as it is not indicated for ceramic use. Procedures with ***RE-GEN Universal*** and ***UNI-Q Bond*** were performed according to the manufacturer's provided instructions and were timed and rounded to the nearest 5 seconds.

Color Measurements: Adhesives (n=5) are applied to standard white opaque ceramic blocks (Macor, surface roughness Ra = 1.2 µm, L* 97.6, a* -0.4, b* 0.8), and air thinned and cured according to manufacturers' instructions. Color values are presented in the results with means and standard deviations compared to the initial white ceramic values.

Film Thickness (n=5): Specimens prepared for the color measurement testing had the film thickness measured with a high accuracy micrometer (Mitutoyo 293-831-30) to 0.001 mm resolution before and after adhesive placement with a glass cover slip to minimize local effects on thickness. This is meant to simulate the effect that adhesive film thickness will have on indirect restoration fit.

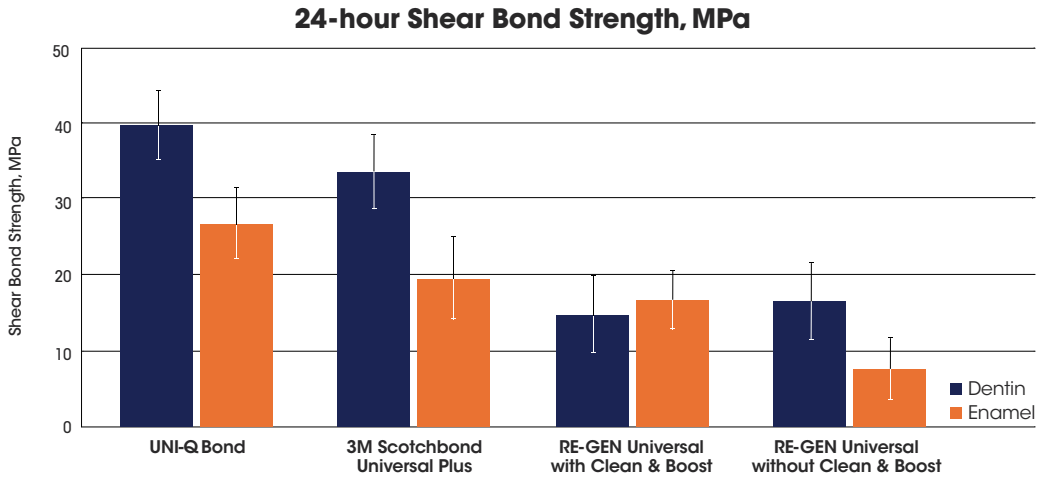
SEM Evaluation: Class 2 restorations (n=2) were prepared in molars, and bonding agents, ***UNI-Q Bond*** and ***3M Scotchbond Universal Plus***, were applied according to the manufacturers' instructions with ***3M™Filtek™ Supreme Ultra*** (Solventum) composite. The molars were then sectioned into several 1-mm thick slices, dried through successive ethanol immersions, sputter coated with 80:20 gold: palladium and examined using a TESCAN RISE scanning electron microscope to measure the thickness of the bonding layers in at least 15 areas.

Results:



This test includes thermocycling which artificially ages the bonding interface by accelerating hydrolytic degradation, and exposes the bonding interface to stresses from heating and cooling, expanding and contracting the materials. Measuring the change from the initial bond strength after 24 hours of storage to after thermocycling is one of the ways of evaluating bond durability.

UNI-Q Bond has excellent dentin bond strength and durability to artificial aging in this test. ***UNI-Q Bond*** has comparable bond strength durability to zirconia to other universal adhesives we have tested after thermocycling but may be less durable than dedicated ceramic primers.



Bond strength to enamel for ***UNI-Q Bond*** and ***3M Scotchbond Universal Plus*** were in the self-etching mode. The initial bond strength for ***RE-GEN Universal*** to dentin is significantly lower than the other adhesives tested, while the enamel bond strength requires application of ***Clean & Boost*** to achieve sufficient bond strength. ***UNI-Q Bond*** has good initial bond strength to self-etched enamel, which in this test, rarely goes above 30 MPa in the self-etched mode among other adhesives.

Procedure Time Comparison Under Ideal Conditions

		Step 1	Step 2	Step 3	Step 4	Step 5	Total Time
UNI-Q Bond	Time, s	30	10	25			65
	Description	Dispense and apply to preparation, leave undisturbed for 20 seconds	Air Drying	Light Cure for 20 seconds			
RE-GEN Universal	**Time, s**	**40**	**30**	**40**	**20**	**15**	**145**
	Description	Attach syringe tip and apply Clean & Boost followed by 10 seconds of agitation, and thorough rinsing	Dispense a drop of RE-GEN, apply first coat and allow to dwell for 20 seconds	Apply two additional coats of RE-GEN	Air Drying- Takes Additional time due to large amount of adhesive	Light Cure for 10 seconds	

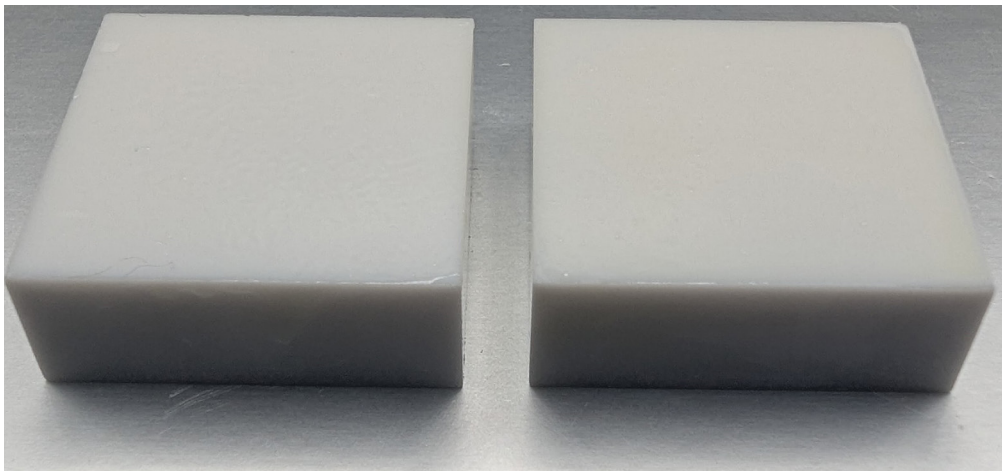
This shows the breakdown of the procedure times comparing ***UNI-Q Bond*** which has relatively straightforward procedures compared to ***RE-GEN Universal***. The procedure times were timed in a laboratory environment and rounded to the nearest 5 seconds, but keep in mind that clinical environments may increase procedure times. Another notable difference between the ***UNI-Q Bond*** applications listed in the IFU is that it doesn't require constant agitation or rubbing of the adhesive into tooth structure that is often indicated by other adhesives. ***RE-GEN Universal*** claims to have other benefits to restorative procedures related to bioactivity not evaluated in this study, and it's important to note that initial bond strength is not the only indicator for clinical success.

Color:

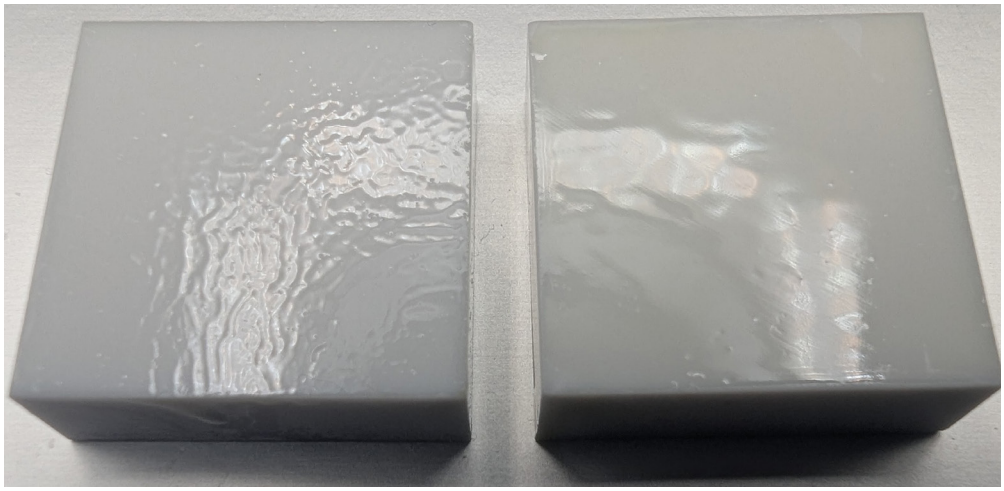
Product	Standard White Background					With Adhesive Applied				
	L*	a*	b*	C*	h°	L*	a*	b*	C*	h°
UNI-Q Bond	97.6 (0.1)	-0.4 (0)	0.9 (0.1)	1.0 (0)	112.7 (1.3)	97.1 (0.1)	-0.6 (0.1)	1.4 (0.3)	1.5 (0.3)	111.4 (0.8)
3M Scotchbond Universal Plus	97.6 (0)	-0.4 (0)	0.8 (0)	0.9 (0)	114.5 (0.8)	96.7 (0.1)	-1.1 (0.1)	-3.8 (0.4)	3.9 (0.4)	106.5 (0.7)

Product	ΔL*	Δa*	Δb*	ΔC*	Δh*	ΔE^*_{00}
UNI-Q Bond	-0.5 (0.1)	-0.2 (0.1)	0.5 (0.3)	0.6 (0.3)	-1.3 (1.3)	0.7 (0.3)
3M Scotchbond Universal Plus	-0.9 (0.1)	-0.7 (0.1)	3.0 (0.4)	3.0 (0.4)	-8.1 (1.3)	2.9 (0.3)

3M Scotchbond Universal Plus on a white background has a ΔE^*_{00} value of 2.9, with most of the change in the b* value (more yellow) which is a visible difference. ***UNI-Q Bond*** has a ΔE^*_{00} of 0.7, which is not considered a visible difference (ΔE^*_{00} <0.8 perceptibility threshold). ***UNI-Q Bond*** shows the ability to be applied and cured to the surface without any significant color change and this can be beneficial in many clinical situations such as orthodontic treatments, pit and fissure sealants and esthetic restorations. This test showed the color change on a white background, and it should be expected that any color change on a tooth-colored background will be even less noticeable.



UNI-Q Bond **3M Scotchbond Universal Plus**



UNI-Q Bond **3M Scotchbond Universal Plus**

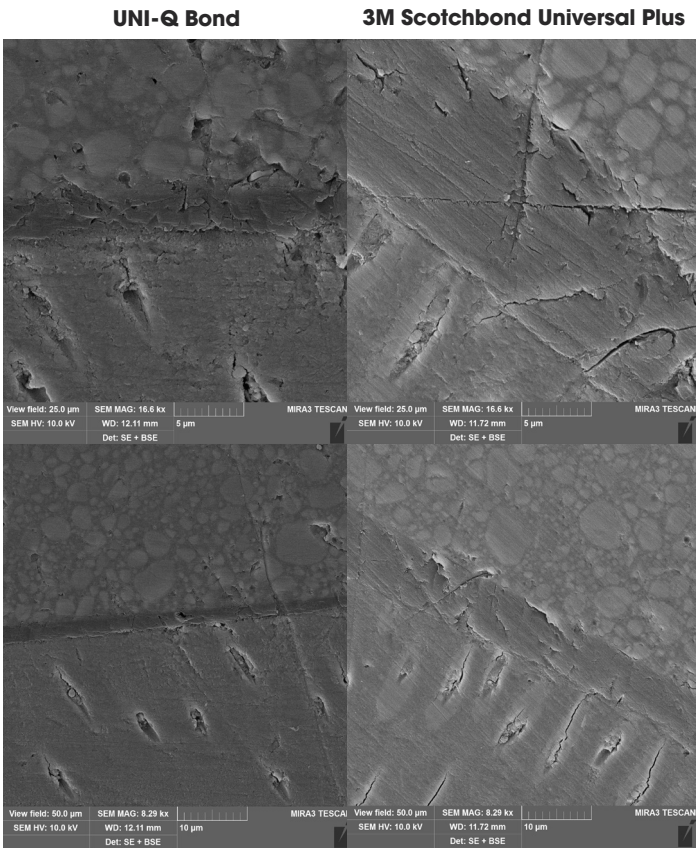
Fig. 1: White Ceramic blocks with adhesive applied. The top image shows the apparent color change without gloss, while the bottom image shows the difference with gloss and surface texture.

Film Thickness and SEM imaging:

Film Thickness on Ceramic Plates	
Adhesive	**Film Thickness, µm**
UNI-Q Bond	12 (1)
3M Scotchbond Universal Plus	11 (1)

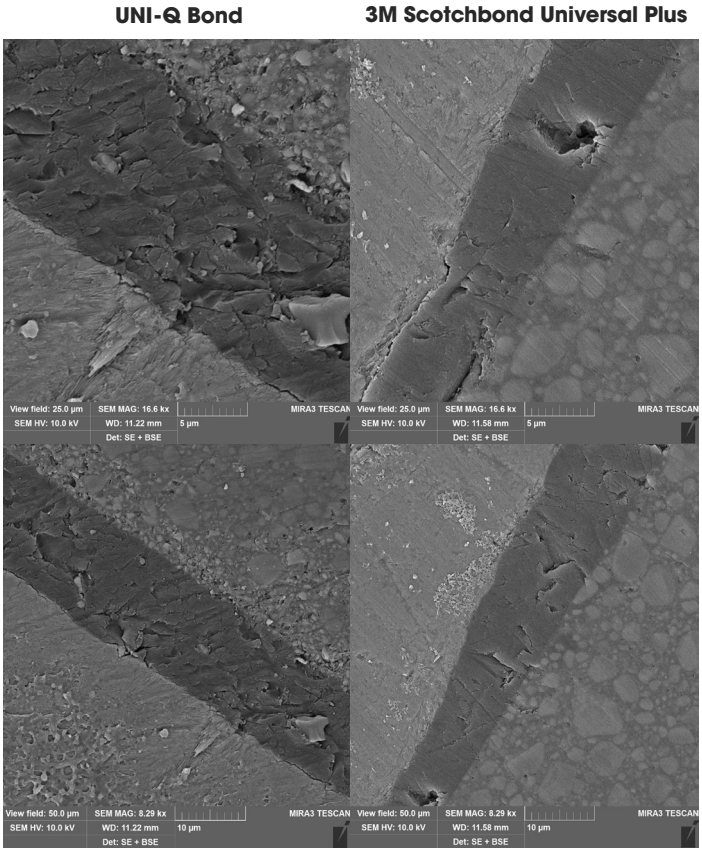
Both adhesives have minimal film thickness that should not interfere with the fit of indirect restorations. The likely difference between the two measurement methods seen is that the plate measurement method is limited by measuring peak to peak thicknesses, or whatever is the highest points on the surfaces, while the SEM measurements are on single point thicknesses.

SEM Imaging Film Thickness, µm - Means (Std Dev) [Range]		
Adhesive	**Dentin**	**Enamel**
UNI-Q Bond	4.1 (1.9) [1.6 - 8.1]	4.5 (2.0) [1.5 - 9.5]
3M Scotchbond Universal Plus	3.3 (1.7) [1.6 - 6.9]	4.1 (2.0) [1.4 - 8.9]



Dentin

Fig. 2: SEM images of adhesives applied to dentin, with ***UNI-Q Bond*** on the left, and ***3M Scotchbond Universal Plus*** on the right.



Enamel

Fig. 3: SEM images of adhesives applied to enamel, with ***UNI-Q Bond*** on the left, and ***3M Scotchbond Universal Plus*** on the right.

Overall, SEM imaging revealed no significant visible difference between the two adhesives with similar film thickness, and tubule penetration. This also rules out film thickness playing any significant factor in having an impact on the color measurements as both adhesives have nearly identical film thicknesses when air dried.

Research Supported by B.J.M. Laboratories Ltd., 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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Microbiology Research Report

DENTAL ADVISOR Biomaterials Research Center
Ann Arbor, MI 48104

Number 174– August, 2025

EmPower™ Multi-Enzymatic Detergent Efficacy

Margaret Gilmartin, B.S., Matt Cowen, B.S., J.A. Molinari, Ph.D.



Introduction:

High-volume evacuation (HVE) lines are crucial for controlling aerosols and maintaining a safe clinical environment; however, they are highly susceptible to internal debris buildup and biofilm formation. If not properly cleaned, the accumulation can reduce suction efficiency and increase the risk of cross-contamination during patient care. Maintaining consistent flow through HVE lines is not only important for maintaining suction performance but also supports the effective removal of oral fluids and pathogens during procedures. Evacuation line cleaning solutions are used to maintain cleanliness and pressure in vacuum lines, reducing biofilm and organic matter that accumulate over time. Thorough cleaning is essential prior to sterilization, as debris can block steam contact and compromise sterilization. For reusable instruments like burs and endodontic files, retained soils also increase the risk of cross-contamination. Ultrasonic cleaning is widely used for removing debris from dental instruments, but its performance depends heavily on the cleaning solution selected. Multi-enzymatic detergents are commonly used for the pre-treatment of critical and semi-critical instruments, as they are specifically designed to break down organic material such as blood, tissue, and protein more effectively than water. In this study, we evaluated the cleaning efficacy of ***EmPower™ Multi-Enzymatic Detergent*** when used in ultrasonic instrument cleaning, as well as its effectiveness in cleaning used evacuation lines and preserving cleanliness in newly installed lines.

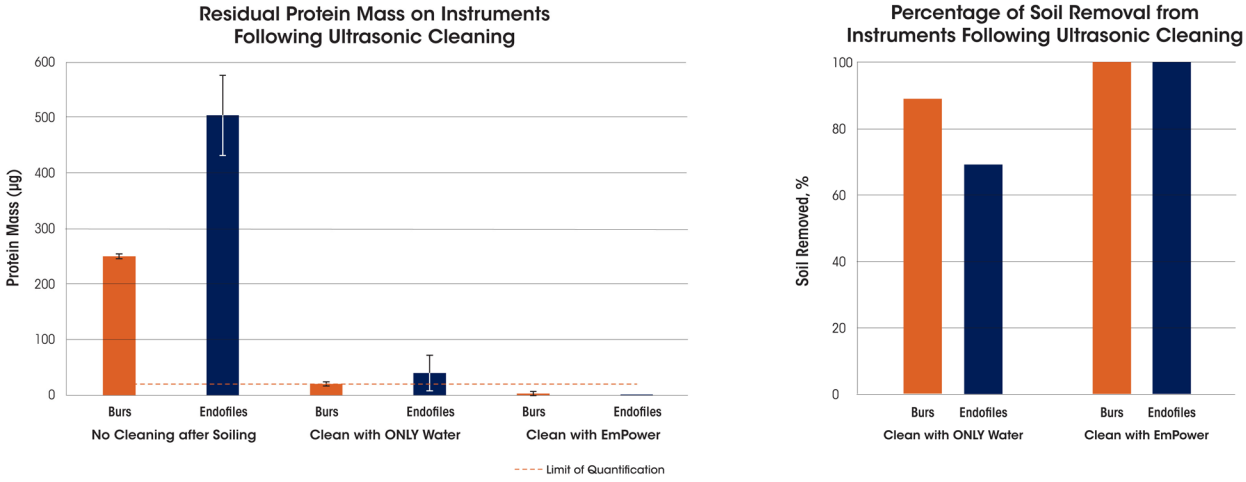
Results Summary:

Metrex's ***EmPower Multi-Enzymatic Detergent*** demonstrates strong performance in specific applications. It is particularly effective when used to ultrasonically clean soiled dental instruments and excels at maintaining the cleanliness of newly installed evacuation lines.

Experimental Design:

Materials and Methods:

Ultrasonic Instrument Cleaning Efficacy: Four test groups, each with three replicates of endodontic files and coarse diamond burs, were exposed to an artificial test soil formulated for dental cleaning validation. The soil was composed of purified bovine proteins (hemoglobin, albumin), polysaccharides, pigments, bone particulates, mucin, artificial saliva, and a salt solution. Instruments were immersed in the soil and air-dried at room temperature for 60 minutes. Before and after soiling, instruments were examined under 40× light microscopy, with images and mass measurements recorded. After cleaning treatments, instruments were sonicated in 2 mL of 0.1% sodium dodecyl sulfate (SDS) for 30 minutes. The extracted protein content was quantified using the Pierce BCA Protein Assay Kit (#A55864) and a Thermo Fisher Scientific SPECTRONIC 200 Spectrophotometer.



Graph 1. Comparative Soil Removal Percentage Across Cleaning Methods and Instrument Types.

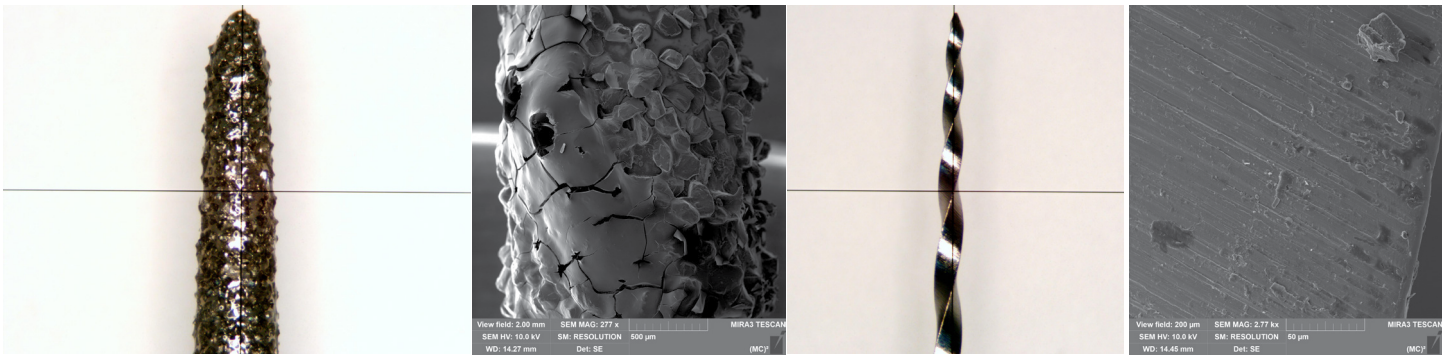


Figure 1. Microscope and SEM images of a bur and an endodontic files cleaned with only water.

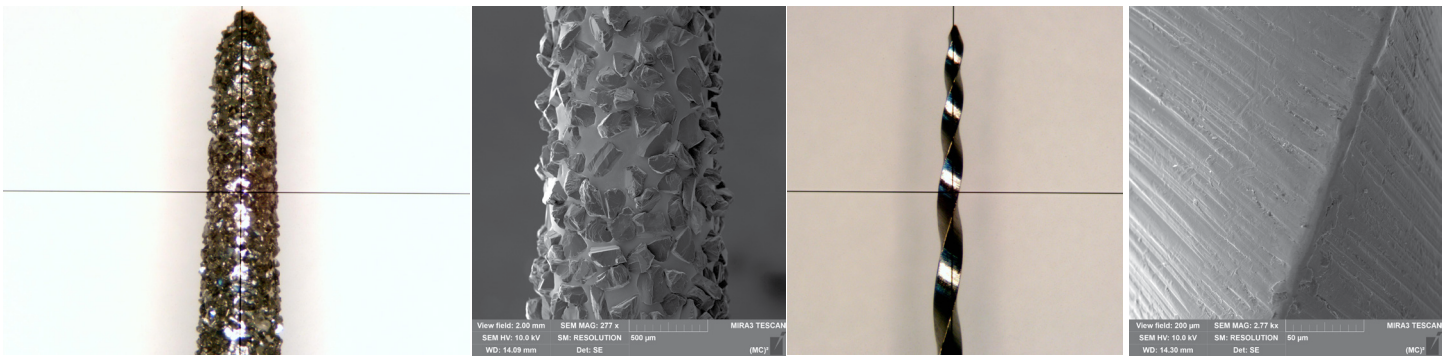
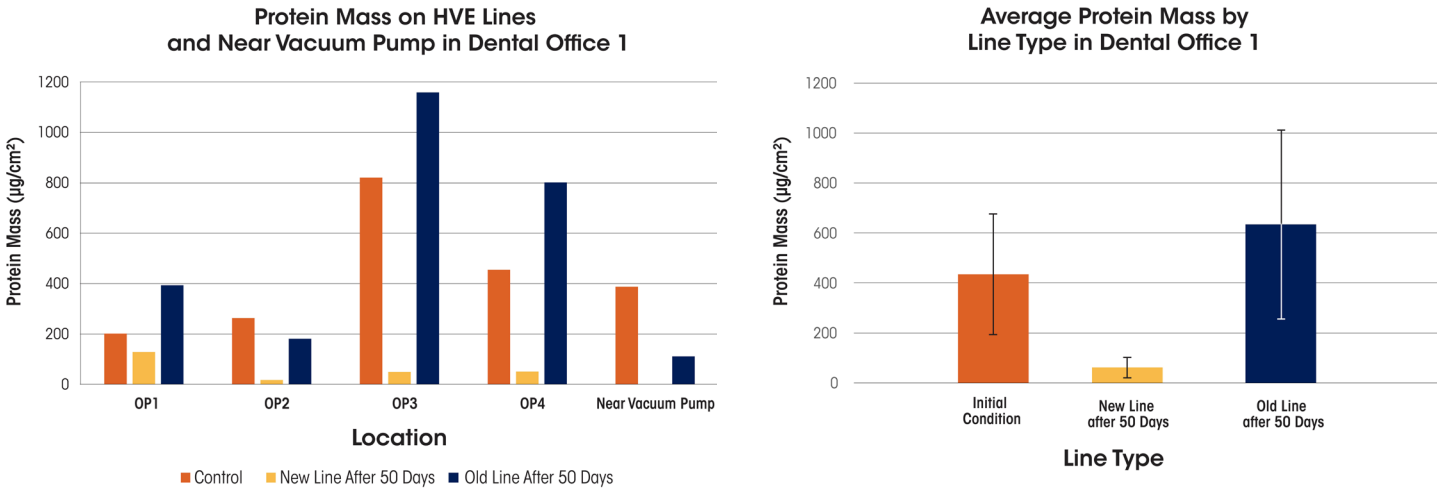


Figure 2. Microscope and SEM images of a bur and an endodontic file cleaned with ***EmPower***.

Ultrasonic cleaning with Metrex's ***EmPower Multi-Enzymatic Detergent*** was the most effective method across all test groups. Burs and endodontic files cleaned with ***EmPower*** showed over 99% protein and residue removal within just two minutes, falling below the quantification limits of the assay and mass analysis. In contrast, ultrasonic cleaning with water alone achieved only about 92% protein removal, and SEM imaging revealed significant debris remaining. These results demonstrate that ultrasonic cleaning is far more effective when combined with ***EmPower***.

Evacuation Line Cleaning: Two clinical practices, each with four operatories, were included in the study. Four high-volume evacuation (HVE) lines from each clinic, plus the line near the vacuum pump, were sampled. Clinics were instructed to flush each line with 1 quart of diluted solution according to the manufacturer's instructions at the end of the day and leave it overnight. A total of 16 cm of HVE tubing, including sections near the vacuum pump, was removed for scanning electron microscopy (SEM) and BCA protein analysis, then replaced with new tubing. After 50 days of continued treatments, the full HVE line was removed for evaluation. The new tubing was assessed to determine the detergent's ability to maintain cleanliness over time, while the original tubing was assessed its cleaning effectiveness on previously used line.



Graph 2. Residual Protein Mass at Various Sampling Locations Tested Over Time Following Treatments in Dental Office 1.

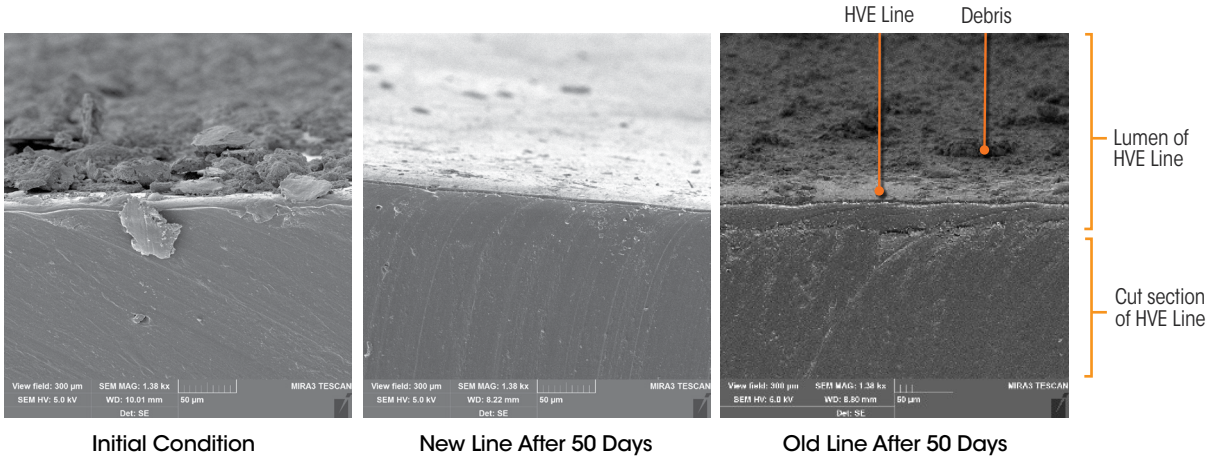
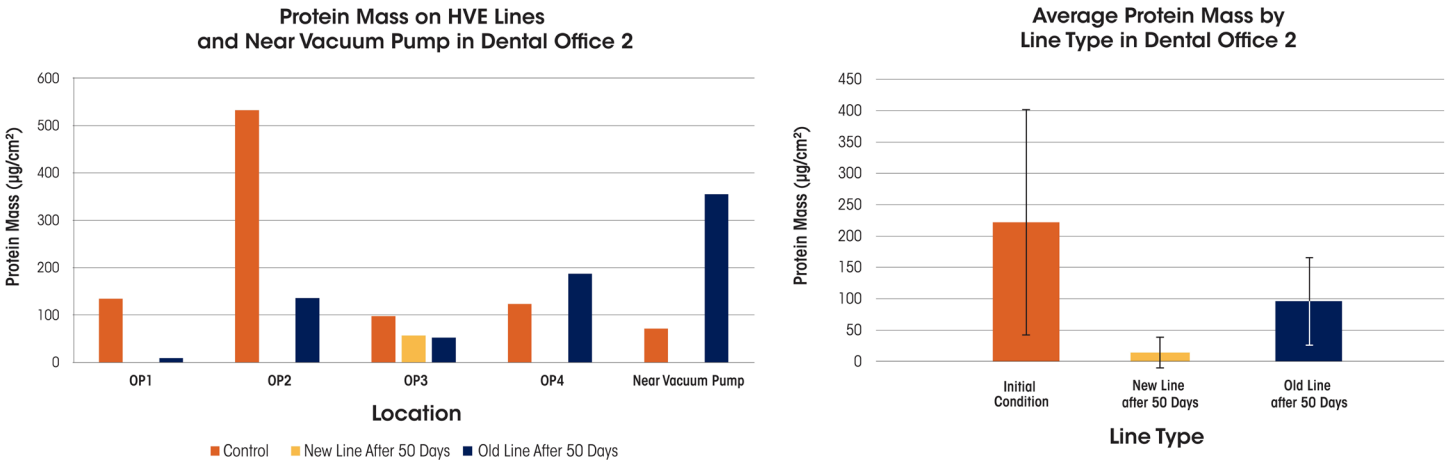


Figure 3. SEM Images of the Edges of HVE Lines at Different Treatment Stages in Dental Office 1 Operatory 2.



Graph 3. Residual Protein Mass at Various Sampling Locations Tested Over Time Following Treatments in Dental Office 2.

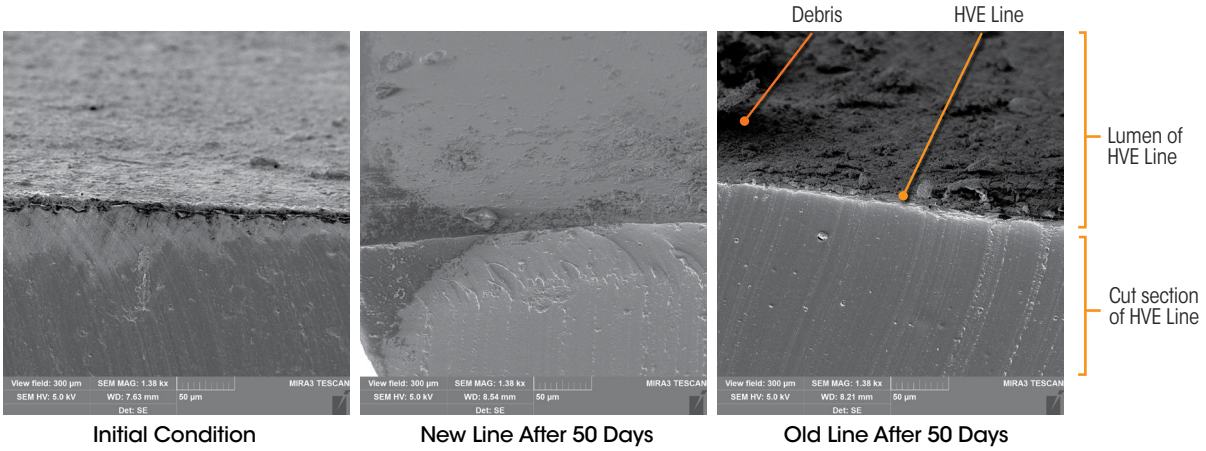


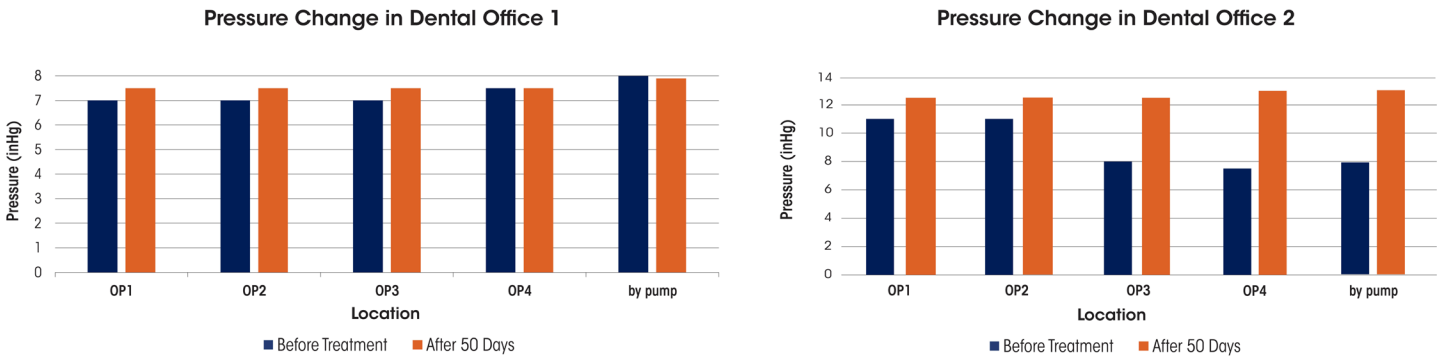
Figure 4. SEM Images of the Edges of HVE Lines at Different Treatment Stages in Dental Office 2 Operatory 2.

In Dental Office 1, results varied by operatory. OP2 showed a significant decrease in protein concentration in the old HVE line after 50 days, while OP1, OP3, and OP4 had higher concentrations compared to the initial condition.

In Dental Office 2, OP1, OP2, and OP3 showed significant reductions, but OP4 exhibited increased protein levels after treatment.

Variations in cleaning performance across both offices may be due to differences in operatory use, pre-existing buildup, and debris composition. Materials like amalgam, composite resin, and silica-based particles can clog lines and limit detergent penetration. In contrast, the new lines showed minimal to no detectable protein after 50 days, with an average 88% reduction compared to the initial condition.

EmPower is highly effective at preventing soil accumulation in new evacuation lines, while its performance in older, contaminated lines and near vacuum pumps varies.



Graph 4. Pressure Measurements Across Different Locations After Treatments in Dental Office 1 and Dental Office 2.

In Dental Office 1, vacuum suction pressure remained relatively stable and close to manufacturer specifications over the 50 days.
In Dental Office 2, vacuum suction pressure increased across all operatories, returning to optimal levels, indicating the treatment reduced line buildup and improved airflow.

Variations between the two offices may be attributed to differences in baseline contamination levels or discrepancies in vacuum system models, where the pressure within individual operatories affects pump pressure. Overall, removing debris from evacuation lines optimizes airflow and improves overall vacuum efficiency.

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Biomaterials Research Report

DENTAL ADVISOR Biomaterials Research Center
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Number 175 – August 2025

In Vitro Evaluation of Enamel Carious Lesion Treatment with Curodont™ Repair Fluoride Plus

Matt Cowen, B.S., Margaret Gilmartin, B.S., John M. Powers, Ph.D.



Introduction:

This study evaluates the performance of ***Curodont™ Repair Fluoride Plus*** (vVARDIS) in increasing the mineral density throughout the entire depth of an enamel carious lesion. Transverse microradiography (TMR) or MicroCT analysis of the lesions was conducted to compare the relative mineralization change from the initial to final state. Teeth were also sectioned and examined with high magnification scanning electron microscopy to examine the appearance of the hydroxyapatite 2 weeks post-treatment. An increase in mineralization of enamel can include different mechanisms including remineralization, the formation of new hydroxyapatite crystals and reformation of damaged hydroxyapatite crystals. The goal of this study was to determine if there is any difference in the location of the increase in mineral density, and visualize the appearance of hydroxyapatite.

The low-viscosity formulation penetrates the pseudo-intact enamel surface and disperses throughout the sub-surface lesion body. The proprietary formulation generates hydroxyapatite throughout the depth of the lesion, resulting in the restoration of the lost or damaged hydroxyapatite crystals, ultimately treating the early stage lesion and helping restore the natural tooth integrity.

Conclusions:

Curodont Repair Fluoride Plus was effective in restoring 14.3% of the mineral content through the entire lesion in only 2 weeks. There was no significant difference in where the increase in mineral density occurred from the surface to the deepest part of the lesion, showing effectiveness in restoring lost mineral content in subsurface lesions including hydroxyapatite generation.

Methods:

Sound human molars (n=3) were cleaned and sterilized in 0.1% Chloramine T solution and roots mounted in acrylic with crowns exposed for immersion in solution and scanning. Test areas were created on each tooth with an acid-resistant varnish protecting the underlying enamel outside of the test area.

Artificial superficial cavities were created via immersion in 40 mL of a demineralization solution (2.2 mM $CaCl_2$, 2.2 mM NaH2PO_4, 50 mM acetic acid; pH adjusted with 1 M KOH to 4.4) for 4 d at 37°C which created lesions with an average depth of 100 µm. An initial MicroCT scan with a Xradia Versa 520 X-Ray Microscope was made capturing the entire lesion. Lesions were then pretreated with 10 µL of 2% NaClO to remove the enamel pellicle, rinsed, and air-dried at room temperature followed by application of ***Curodont Repair Fluoride Plus*** per manufacturer instructions. Teeth were then immersed in remineralization buffer simulating saliva exposure, containing 2 mM $Ca(NO_3)_2$, 1.2 mM $KHPO_4$, and 60 mM Tris/HCl (pH adjusted to 7.4 with 1 M KOH) for 14 days while changing the solution every second day. A second scan was then made of the same areas with the same settings and orientation for the final condition.

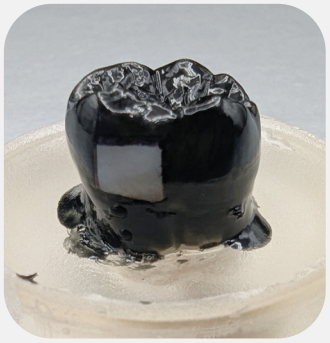
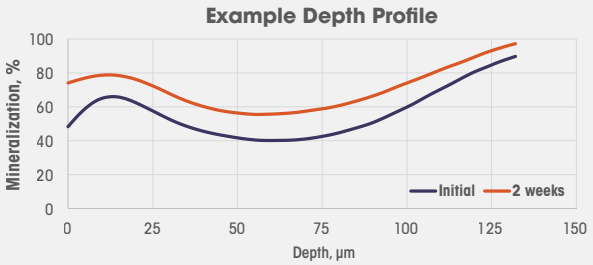


Fig 1. *Example of molar with area revealed for creating a lesion area.*

MICROCT ANALYSIS:

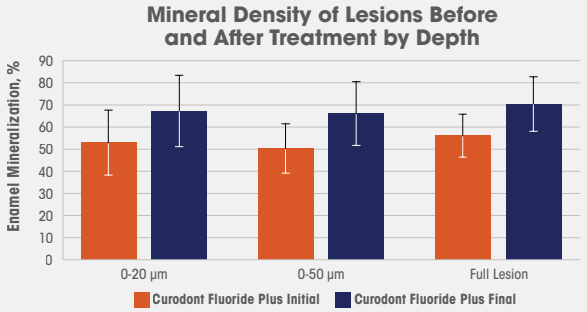
Dragonfly 3D World software was used for MicroCT analysis. The before and after scans were aligned on top of one another and histograms were normalized with respect to one another. Intensity levels were calibrated to relative mineral density percentage of the sound enamel and underlying dentin. Lesions were segmented using a custom AI model and a mask of the lesion area extracted based on a 90% mineralization content of the initial condition and expanded to encompass the full lesion. Depth profiling of lesions with 5 depth profile measurements taken per lesion starting from the surface covering the entire lesion, and mineral density calculated every 2 microns based on intensity levels averaged over a 50-micron disc area. Mineral density was compared to initial and final states, and between product groups. Relative mineral density was quantified and compared by the intensity calibrated depth profile curves. Data was analyzed by ANOVA and Tukey multiple comparison test for pair-wise comparison at a p-value of 0.05.



This is an exemplary depth profile up to 90% of the initial lesion. In all cases, there was significant increase in mineral density seen through the entire lesion.

Results Summary:

This is the average mineral density from the initial to the final condition at 2 weeks, where 100% mineralization is sound enamel. The referenced distance is measured from the surface of the tooth. The average initial depth of lesions was 100 (27) µm for CRFP. There is no significant difference in mineral density based on the depth (ANOVA, Tukey, p>0.5). There were significant differences in mineral density from the initial state to after 2 weeks (p<0.001) with an average increase in mineral density of 14.3% after only 2 weeks in an artificial saliva solution. The increase in mineral density is likely due to multiple processes including formation of new hydroxyapatite crystals, reformation of existing damaged hydroxyapatite crystals and some superficial remineralization due to the artificial saliva solution. The SEM imaging of the untreated control group revealed large porosities, whereas treated teeth showed pore closure consistent with new hydroxyapatite crystal generation following ***Curodont Repair Fluoride Plus*** application.



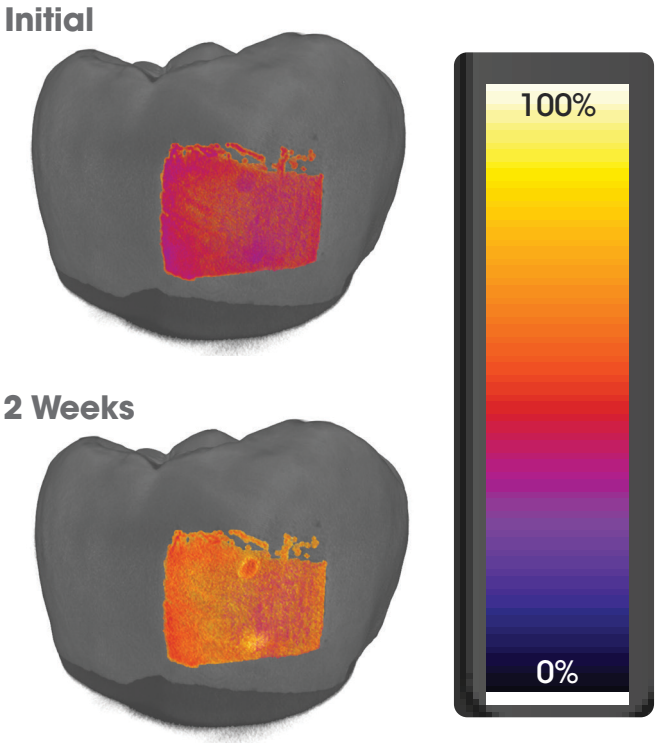


Fig 2. *Example of 3D scanned model of a tooth before and after* ***Curodont Repair Fluoride Plus*** *was applied. The lesion was segmented, and a color scale applied to calibrated intensity levels. The color profile is interpreted with areas of low mineral density as more blue or darker, and higher mineral density as yellow or lighter.*

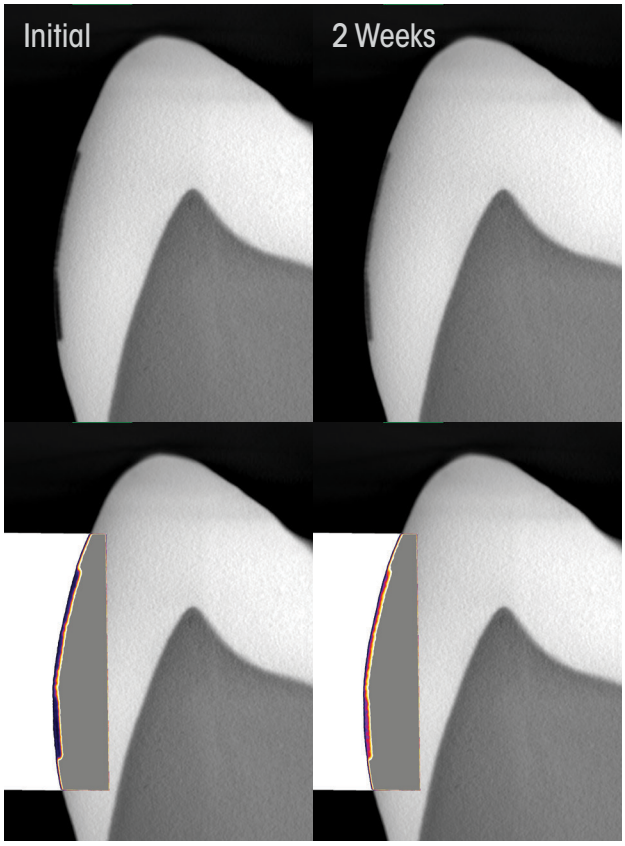


Fig 3. *Examples of transverse slices of* ***Curodont Repair Fluoride Plus*** *on the same tooth.*

SEM IMAGES:

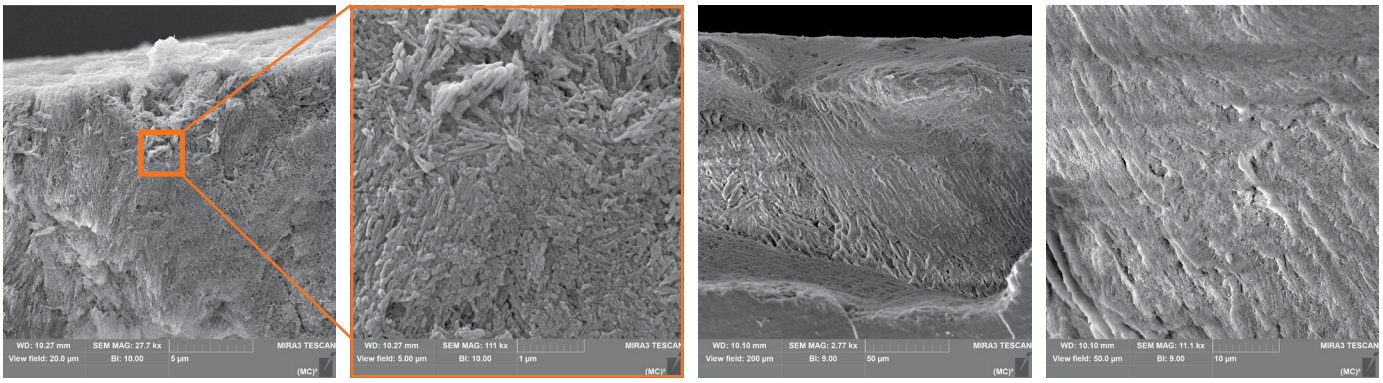


Fig 4. *SEM images of negative control sample which underwent 4 days of demineralization as an example of the initial state before* ***Curodont Repair Fluoride Plus*** *application. Partial removal of the lesion occurred during sample preparation due to weakness from demineralization. The appearance of porosities and smaller crystal sizes compared to the test groups are evident, with larger porosities, and smaller hydroxyapatite crystals.*

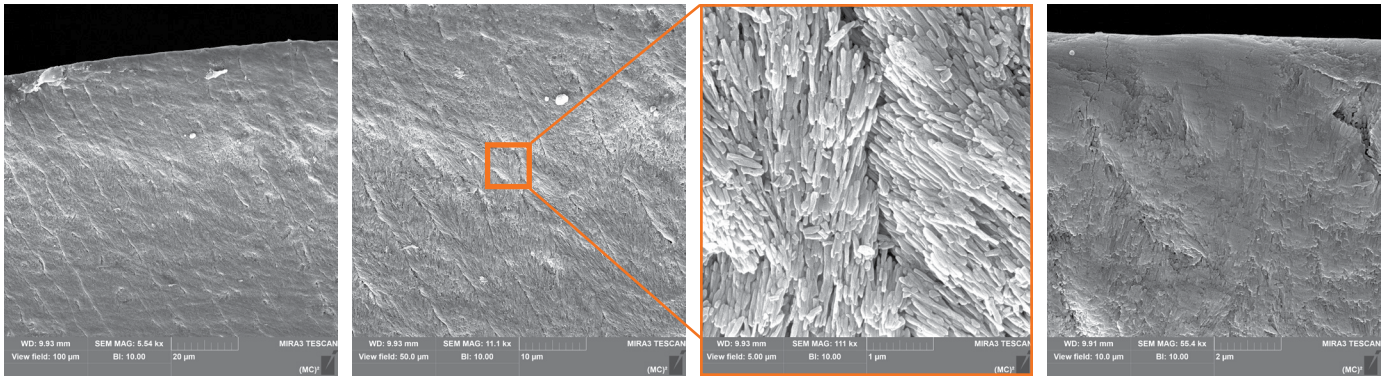


Fig 5. *SEM images of* ***Curodont Repair Fluoride Plus*** *lesion after sectioning. Areas near the surface have nearly fully fused into a sound enamel state. Areas which persist in a partially demineralized state have larger crystals than seen in the control group.*

Research Supported by vVARDIS, 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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Clinical Case Report

Marc Harrison Lai, DDS
Lai Dentistry, San Francisco, CA

Number 63 – September 2025

Efficient and Predictable Restorations Using CLEARFIL™ Universal Bond Quick 2 and CLEARFIL MAJESTY™ ES Flow Universal

(Kuraray Noritake Dental Inc.)



Introduction

One of the most common procedures in a restorative practice is the direct resin restoration. However, despite it being one of the most common procedures that dentists perform day in and day out, direct resin restorations are not without challenges and complexities. Biochemistry, biomechanics, and anatomy are all factors that can provide challenges in both the decision-making process and the eventual clinical process of placing the restoration. As procedures can range from a simple class I filling, to an aesthetically demanding anterior class IV, or even with the most difficult of deep class II restorations, having materials available that can handle each and all of these clinical situations can help ease the stress of both the clinician and assistant. Additionally, having a truly universal material can provide significant benefits to practices when it comes to inventory management. Ultimately, the use of these materials can lead to more efficient, successful and profitable clinical outcomes.

Description

CLEARFIL™ Universal Bond Quick 2 , used in conjunction with ***CLEARFIL MAJESTY™ ES Flow Universal***, is a pairing of dental materials that can provide solutions to the many challenges dentists encounter in clinical practice concerning restorative procedures. Beginning with ***CLEARFIL Universal Bond Quick 2*** , its chemical properties and simplified application protocol allow for more efficient and predictable workflows. Due to its unique hydrophilic amide monomer component, this allows for rapid absorption at both the enamel and the dentinal interface in just seconds of scrubbing, thereby negating any waiting time. Additionally, the newer formulation of this product still contains both silane and the original MDP monomer, which was first introduced by Kurarary Noritake in the 1980s. This, along with its now lower film thickness, helps to promote proper and complete seating of indirect restorations when used for cementation procedures. Most applicably, with regard to direct restorations, Universal Bond Quick 2 works incredibly well with ***CLEARFIL MAJESTY ES Flow Universal***. The flowable resin material uses Kuraray's proprietary "light diffusion technology," which allows for all sixteen Vita shades to be covered by just two material options. In many instances, universal materials may provide adequate shade matching, however may still require an additional shade layer for achieving proper aesthetics. Furthermore, with so many dental manufacturers moving towards universal shade composites, specifically flowable resins, few are able to replicate and match a multitude of shades and still maintain the structural strength to be used in larger size restorations and those that require such physical demanding properties. It is a highly viscous and highly filled resin material at 78wt%. With most resin composites on the market today, some of the most common and popular being used in clinical practice have a filler content ranging anywhere from 50-80 wt%, ***CLEARFIL MAJESTY ES Flow Universal*** rivals many of these more filled materials. This high filler content creates the ability to use the material in larger and deeper cavity restorations, without the need for a capping layer of a traditional paste or packable composite. Considering these factors, along with its capacity to polish to a high gloss, ***CLEARFIL MAJESTY ES Flow Universal*** can confidently be used in any restorative class, making it, by definition, truly a universal product.

Case 1



Fig. 1: *Pre-op view of teeth #20-21*

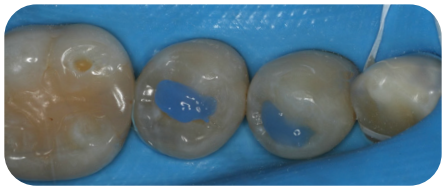


Fig. 2: *Selective etch of #20-21*

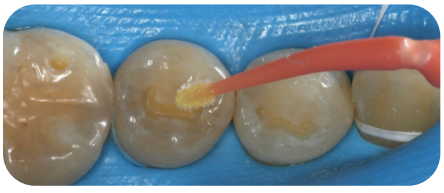


Fig. 3: *Applicaton of* ***CLEARFIL Universal Bond Quick 2***



Fig. 4: *Post-op view of #20-21*

Case Presentation

To highlight the true universal nature of both ***CLEARFIL Universal Bond Quick 2*** and ***CLEARFIL MAJESTY ES Flow Universal***, three separate cases will be discussed. Each case presented with varying restorative demands, when considering both structure and aesthetics.

The first case involves a 36-year-old male presenting with incipient clinical caries on his lower bicuspids #s 20-21 as shown in Figures 1-4.

The second case shows a 56-year-old male with a fracture line radiating through the mesial marginal ridge, leading to class II proximal caries.

Larger still is shown in case number 3, where a 42-year-old male presents with a failing amalgam restoration with open margins, fracturing of the tooth, and recurrent caries.

Even though each case involved varying demands with differences in restorative size, location of the lesions, and diverse types of functional strains, all were successfully treated with Universal Bond Quick 2 and ***CLEARFIL MAJESTY ES Flow Universal***.

Procedure

After the administration of anesthesia, all teeth in all cases followed the same clinical protocols. All teeth were isolated using a rubber dam. All caries were meticulously excavated and removed, followed by the necessary steps to prepare the natural tooth surface for bonding. Air abrasion was used in each case, followed by a selective etching technique. After the rinsing and drying of the prepared surfaces, ***CLEARFIL Universal Bond Quick 2*** was applied. Following the manufacturer's instructions for use, a quick but thorough rubbing motion was performed using a microbrush, and the resulting layers of bonding agents were air thinned. Due to the "quick" nature of the material, no waiting time was needed, and the bonding agent layers were then light-cured for ten seconds.

Case 2



Fig. 5: *Pre-op view*



Fig. 6: *Prep in isolation*



Fig. 7: *Post-op view*

For the smaller class I restorations in case 1, a single layer of ***CLEARFIL MAJESTY ES Flow Universal*** was used. Cases 2 and 3 required incremental layering due to the larger cavity size and the depth of the preparations. All restorations were light-cured per the manufacturer's instructions.

Following completion, all restorations were finished and polished with a combination of finishing diamond burs, polishing points, and discs. Isolation materials were removed, followed by verifying the contacts and occlusion, and adjusting them accordingly. Lastly, the restorations were repolished where necessary.

Case 3



Fig. 8: *Pre-op view*

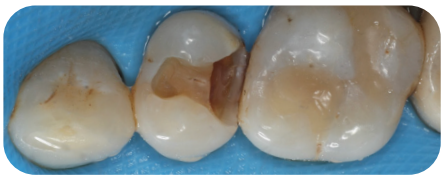


Fig. 9: *Caries removal*



Fig. 10: *Post-op view*

Summary

Utilizing both ***CLEARFIL Universal Bond Quick 2*** and ***CLEARFIL MAJESTY ES Flow Universal*** provided truly "universal" solutions in all three clinical cases. The ease of use for both materials allowed for efficient and predictable results. As single shade systems have become commonplace in dentistry, not all share the same optical and physical properties. However, it was evident that ***CLEARFIL MAJESTY ES Flow Universal*** not only polished well and was aesthetically pleasing, but its ability to be used in larger restorations due to a high filler content was equally impressive. As dentists search for restorative materials that can be used efficiently in numerous situations in their clinical practice, it is materials such as these that can simplify procedures and serve as clinical problem solvers. They will ultimately assist dentists in producing more predictable, less stressful restorations, which can result in more profitable dentistry.

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