

3M

Filtek™

Universal Restorative

**Technical
Product
Profile**



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Introduction

3M's global leadership in restorative dentistry is defined by more than 50 years of innovation. The most notable achievement in recent years was the creation of a unique new category of dental material in 2002—the nanocomposite.

In true 3M tradition, we didn't stop there.

Research shows that dentists use single-shade restorations in about 80% of their cases.* In recent talks with opinion leaders and dentists, they expressed a concern that the composite market was becoming overly complex. What they really wanted was a composite they could use for a majority of their cases, that helped them create high-end, single-shade esthetics—in a more simple way.

Building on dentists' insight and our clinically proven technologies, we created 3M™ Filtek™ Universal Restorative.

After multiple customer focus groups, prototype evaluations and market research, we were able to deliver on the key attributes and features dentists were looking for in our next-generation universal composite.

We started by simplifying the esthetics and shade selection.

- NaturalMatch technology
- Universal opacity
- Just 8 designer shades cover the 16 VITA classical shades A1 through D4
- An improved Extra White (XW) covers the 3 VITA bleach shades
- A Pink Opaquer effectively masks out dark areas
- Natural tooth-like fluorescence
- Natural-looking esthetics and excellent polish retention
- Improved radiopacity

Introducing 3M's proprietary low-stress monomers in a Filtek™ universal restorative for the first time.

Filtek Universal Restorative sets itself apart from traditional universal composites by combining our patented TRUE nanofiller technology with the modernized low-stress monomers that were pioneered in our bulk-fill composites. The result is a class of universal composite that offers high-end esthetics, strength and durability in a simpler way.

*3M internal data

2002

3M™ Filtek™ Supreme Restorative

The first true nanocomposite.

2005

3M™ Filtek™ Supreme Plus Universal Restorative

Advancements include:

- Optimized shades to provide more vibrant, lifelike restorations

2010

3M™ Filtek™ Supreme Ultra Universal Restorative

Advancements include:

- Easier-to-use shading system
- Better polish retention
- Improved fluorescence
- Supreme-like handling
- Improved translucent shades

2019

3M™ Filtek™ Universal Restorative

Advancements include:

- Simplified shading system with NaturalMatch technology
- A universal opacity
- An improved Extra White
- 3M's first paste Pink Opaquer
- Low-stress monomers in a universal composite

Product Description

3M™ Filtek™ Universal Restorative is a visible-light-activated restorative composite, optimized to create esthetic anterior and posterior restorations. The shades have a body-like opacity, enabling up to a 2mm depth of cure. All shades are radiopaque.

Filtek Universal Restorative is offered in the following shades: A1, A2, A3, A3.5, A4, B1, B2, D3—plus an XW. Additionally, a Pink Opaquer option can be used to mask discolored or stained tooth structure, metal discolorations and amalgam stains. It can be placed in 1mm-thick increments.

Product Features

- 8 designer shades: A1, A2, A3, A3.5, A4, B1, B2, D3
- Improved Extra White (XW)
- Universal opacity
- Pink Opaquer
- Patented nanofiller technology
- Modernized low-stress monomers
- Increased radiopacity
- Longer, 8mm capsule tip for easy access and adaptation
- Available in 0.2g capsules or 4.0g syringes
- Capsules can be warmed*

*See Instructions for Use

Composition of 3M™ Filtek™ Universal Restorative

The fillers are a combination of a non-agglomerated/non-aggregated 20nm silica filler, a non-agglomerated/non-aggregated 4 to 11nm zirconia filler, an aggregated zirconia/silica cluster filler (comprised of 20nm silica and 4 to 11nm zirconia particles), and a ytterbium trifluoride filler consisting of agglomerated 100nm particles. The inorganic filler loading is about 76.5% by weight (58.4% by volume). Filtek Universal Restorative contains AUDMA, AFM, diurethane-DMA, and 1,12-dodecane-DMA.

Filtek Universal Restorative is applied to the tooth following use of a methacrylate-based dental adhesive, such as manufactured by 3M, which permanently bonds the restoration to the tooth structure.

Indications for Use

- Direct anterior and posterior restorations (including occlusal surfaces)
- Core buildups
- Splinting
- Indirect restorations including inlays, onlays and veneers



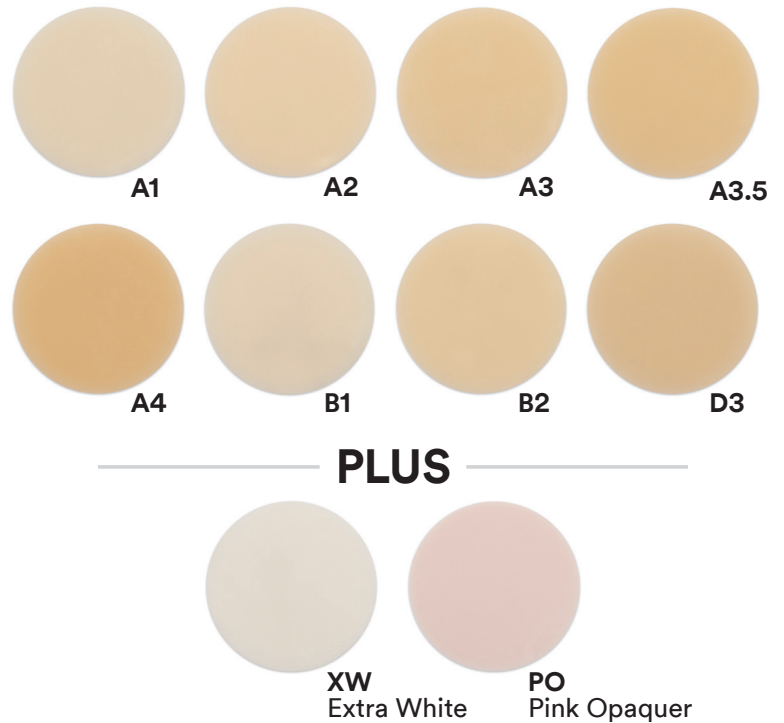
Shades

Simplified esthetics and shading

- NaturalMatch technology (nanofillers, pigments and proprietary low-stress monomers)
- Just 8 designer shades (A1, A2, A3, A3.5, A4, B1, B2, D3) cover the 16 VITA classical shades A1 through D4
- An improved Extra White (XW) covers the 3 VITA bleach shades
- A universal opacity helps shades blend more invisibly with surrounding dentition
- A Pink Opaquer (PO) efficiently masks out dark areas
- Natural tooth-like fluorescence adds a vibrant, lifelike effect
- Improved radiopacity enables easier identification on recall visits

8 designer shades

3M NaturalMatch technology lets you match most of your patients' dentition with a time-saving, 8-shade inventory.



NaturalMatch Technology

What is “NaturalMatch?”

NaturalMatch is the term that describes the combination of 3M technologies and features present within 3M™ Filtek™ Universal Restorative.

Filtek™ Universal Restorative contains NaturalMatch technology. NaturalMatch technology consists of nanofillers, pigments and proprietary low-stress monomers that give Filtek™ Universal Restorative a combination of esthetic and physical properties.

NaturalMatch: 3 Technologies and Attributes Categories

Nanofillers	Pigments	Proprietary Low-Stress Monomers
<ul style="list-style-type: none"> • Patented nanotechnology • Allows for excellent wear resistance and polish retention • Manages opacity and translucency 	<ul style="list-style-type: none"> • Used to cover the VITA classical and bleach shades • Used to create a universal opacity • Improved XW • Pink Opaquer 	<ul style="list-style-type: none"> • Increased fracture toughness • Low-stress monomers help reduce stress. Stress buildup may contribute to “white lines” at the margins.

Background Information

Resin System

One aspect that often gets overlooked in *universal* composites is the shrinkage stress exhibited by the composite resin system. This shrinkage stress may impact the clinical success and outcomes of restorations. With previous generations of universal composites, all have an inherent tendency to shrink during polymerization to a certain degree. Those traditional methacrylate monomers shrink to varying degrees; however, they frequently tend to have higher levels of shrinkage stress when compared to some of the newer monomers that have been developed.

Knowing we could improve in this category, a primary focus in developing **3M™ Filtek™ Universal Restorative** was employing a resin system that had the ability to relieve the amount of shrinkage stress upon light curing.

To create a *universal* composite that could reduce shrinkage stress even further, we leveraged two proprietary methacrylate monomers—AUDMA and AFM—that were pioneered with, and proven by, our bulk-fill restoratives. **When these two proprietary methacrylate monomers are combined, they act to lower polymerization stress.**

AUDMA (Aromatic Urethane Dimethacrylate)

One monomer, a high-molecular-weight aromatic urethane dimethacrylate (AUDMA) (Figure 1), decreases the number of reactive groups in the resin. This helps to moderate the volumetric shrinkage, as well as the stiffness of the developing and final polymer matrix—both of which contribute to polymerization stress.

AUDMA

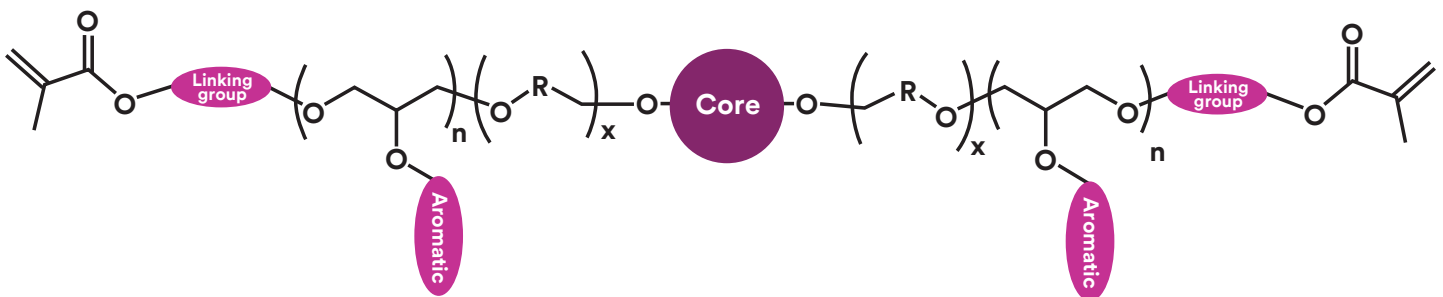


Figure 1: AUDMA structure
Source: 3M internal data

AFM (Addition-Fragmentation Monomer)

The second unique methacrylate represents a class of compounds called addition-fragmentation monomers (AFM) (Figure 2). During polymerization, AFM reacts into the developing polymer methacrylate matrix, including the formation of cross-links between adjacent polymer chains. AFM contains a third reactive site that cleaves through a fragmentation process during polymerization. This process provides a mechanism for the relaxation of the developing network and subsequent stress relief. The fragments, however, still retain the capability to react with each other or with other reactive sites of the developing polymer. In this manner, stress relief is possible while maintaining the physical properties of the polymer.



Figure 2: AFM structure
Source: 3M internal data

Conclusion: By applying the two innovative low-stress monomers—AUDMA and AFM—to a universal composite, and using an incremental placement technique, the shrinkage stress could be further reduced compared to traditional universal composites.

A visual example of how different monomers respond to polymerization.

Traditional Monomers



A traditional monomer containing composites cured in a thin film. The resulting shrinkage curls the thin film.

Resin with AFM Monomer



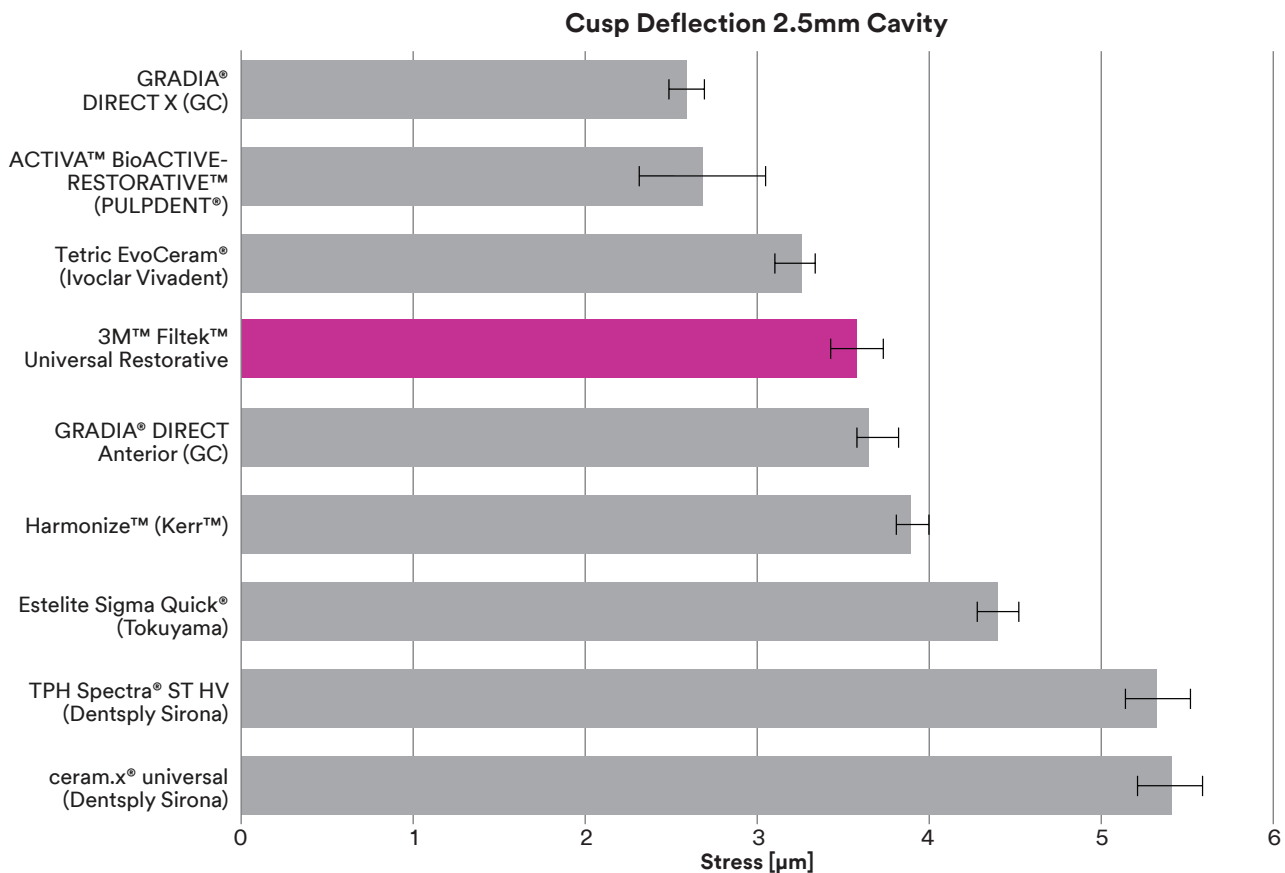
A composite that includes resin and AFM monomers. When cured, those monomers create stress relief, and the remaining shrinkage that occurs curls the thin film less.

Low Stress/Shrinkage

Cusp Deflection

Shrinkage can cause stress in the tooth, in the bonding layer and within the composite. Stress can be a result of the combination of shrinkage and modulus. For materials with *similar shrinkage*, the material with the higher modulus (or stiffness) usually will produce greater stress. Conversely, for materials with *similar moduli*, the material that exhibits the highest shrinkage will usually produce greater stress.

Cusp deflection is a test method that was designed to prove a relative estimate of polymerization shrinkage stress resulting from placing and curing a dental composite in a 2 x 2.5mm, open-ended cavity. The cavity dimension roughly simulates a large cavity preparation (e.g., mesial-occlusal-distal (MOD) preparation). The surface of the aluminum cavity was sandblasted and silane-treated, and a dental adhesive was applied. The composite was then placed in the aluminum cavity to a final depth of 2.5 mm and cured with a dental curing light. A linear variable displacement transducer was used to measure the displacement of the aluminum cavity wall due to polymerization shrinkage stress. *Aluminum was selected as the block material because it has a modulus similar to human enamel.* A similar cusp deflection method using an aluminum block has been described in the literature. 3M™ Filtek™ Universal Restorative has lower shrinkage stress than Dentsply Sirona ceram.x® universal, Tokuyama Estelite Sigma Quick® and Dentsply Sirona TPH Spectra® ST HV; and has shrinkage stress comparable to GC GRADIA® DIRECT, Ivoclar Vivadent Tetric EvoCeram® and Kerr™ Harmonize™.



Nanotechnology

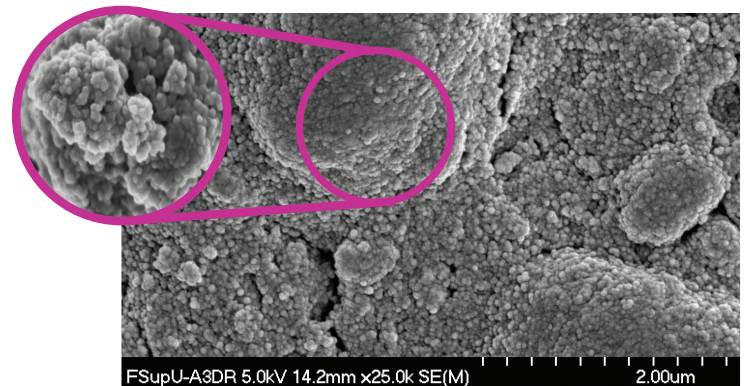
New composites entering the market use different names and confusing terms to describe their technologies. So, it's no surprise then, that two of the most common questions we get asked are:

- What are the differences between a nanocomposite, nanohybrid/microhybrid or microfill?
- Do I get different levels of performance between the different classes of materials?

3M is the only company in the dental industry that has patented TRUE nanofiller technology, which means we have the only TRUE nanocomposites on the market.

But why does this matter?

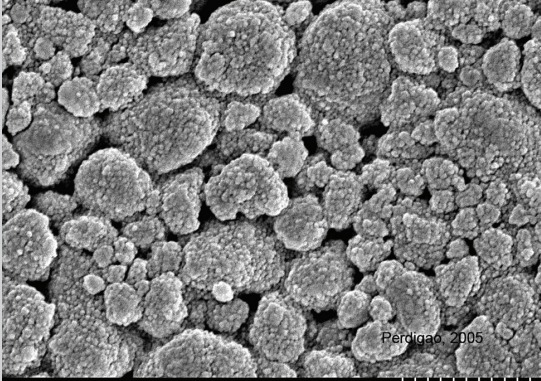
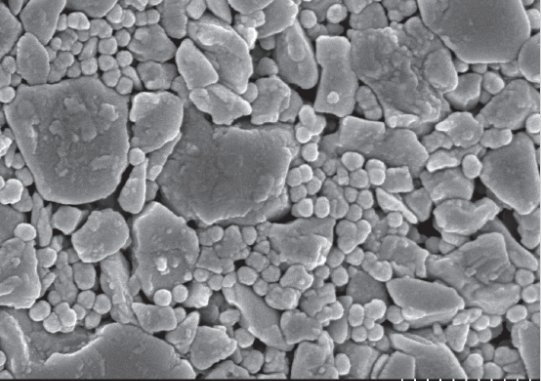
The significant distinction between 3M™ Filtek™ Universal Restorative (a **TRUE nanocomposite**) and microhybrids/nanohybrids is that our nanoparticles are uniquely *formed* from sub-100nm particles, and are not the result of a grinding process. Some nanoparticles are fused into nanoclusters which shear at a rate similar to the wear of the surrounding resin matrix during abrasion, such as toothbrush abrasion. That's why restorations made from Filtek Universal Restorative maintain a smooth surface gloss for excellent esthetics. Additionally, the nanoclusters are around 1–3 microns in size—a size range similar to fillers found in the hybrid composites. That provides for high filler loading, which results in excellent physical and handling properties.



100K magnification of nanocluster. SEM photo courtesy of Dr. J. Perdigão, University of Minnesota.

How do composites compare?

TRUE nanotechnology gives 3M™ Filtek™ Universal Restorative excellent wear resistance and polish retention—a key differentiator between it and competitive nanohybrids, microhybrids and microfills.

Classification	Nanocomposite	Hybrids: Nanohybrids/Microhybrids
Image	 <p>SupremeA2B 4.0kV 12.0mm x30.0k SE(M) 1.00um</p>	 <p>Evo-Ceram 5.0kV 13.2mm x30.0k SE(M) 1.00um</p>
Particle Sizes	Sub-100nm particles and clusters* *(0.6 - 20 micron clusters assembled from sub-100nm particles)	Sub-100nm particles to micron (1,000 nm) size
Polish Retention	Higher Polish Retention	Lower Polish Retention
Strength	High Strength	High Strength
Indications	Universal	Universal
Examples	<ul style="list-style-type: none"> • 3M™ Filtek™ Universal Restorative • 3M™ Filtek™ Supreme Ultra Universal Restorative • 3M™ Filtek™ One Bulk Fill Restorative 	<ul style="list-style-type: none"> • Ivoclar Vivadent Tetric EvoCeram®

Performance

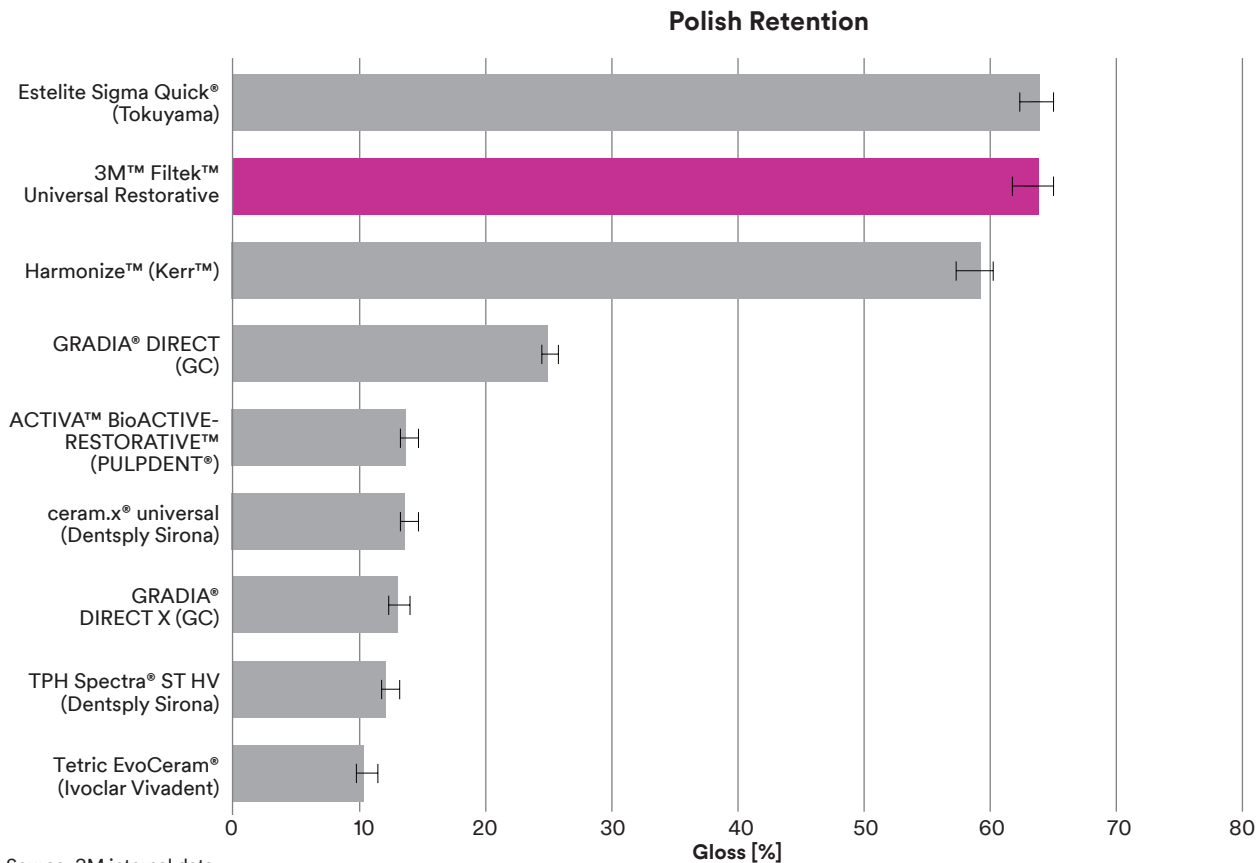
Polish Retention



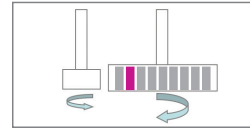
When any composite material undergoes abrasion (toothbrushing, chewing, etc.), the resin around the particles is worn. During this wear, the protruding filler particles (bumps) are exposed. Eventually after enough wear and time, the entire filler particle falls away from the surface of the composite, resulting in divots within the material’s surface. When a material contains many of these bumps and craters, it creates an uneven, rough surface, which results in the loss of reflectivity (loss of polish retention) on the composite surface.

Toothbrush Abrasion

Composite materials were shaped into tiles and thoroughly cured. The surfaces were polished wet using a Buehler variable-speed grinder-polisher to remove the air-inhibited layer and to ensure a uniform surface. They were stored in water at 37°C (98.6°F) for 24 hours. Gloss was measured at 60 degrees. The samples were brushed with toothpaste and a toothbrush that was mounted on an Automatic Toothbrush Machine. Gloss measurements were taken after every 1,500 cycles until the completion of 6,000 toothbrush strokes at 60 degrees. The polish retention of 3M™ Filtek™ Universal Restorative is significantly better than most universal composites tested including GC GRADIA® DIRECT, GC GRADIA® DIRECT X, PULPDENT® ACTIVA™ BioACTIVE-RESTORATIVE™, Dentsply Sirona TPH Spectra® ST HV, Dentsply Sirona ceram.x® universal, Kerr™ Harmonize™ and Ivoclar Vivadent Tetric EvoCeram®. Filtek Universal Restorative has polish retention comparable to Tokuyama Estelite Sigma Quick®.



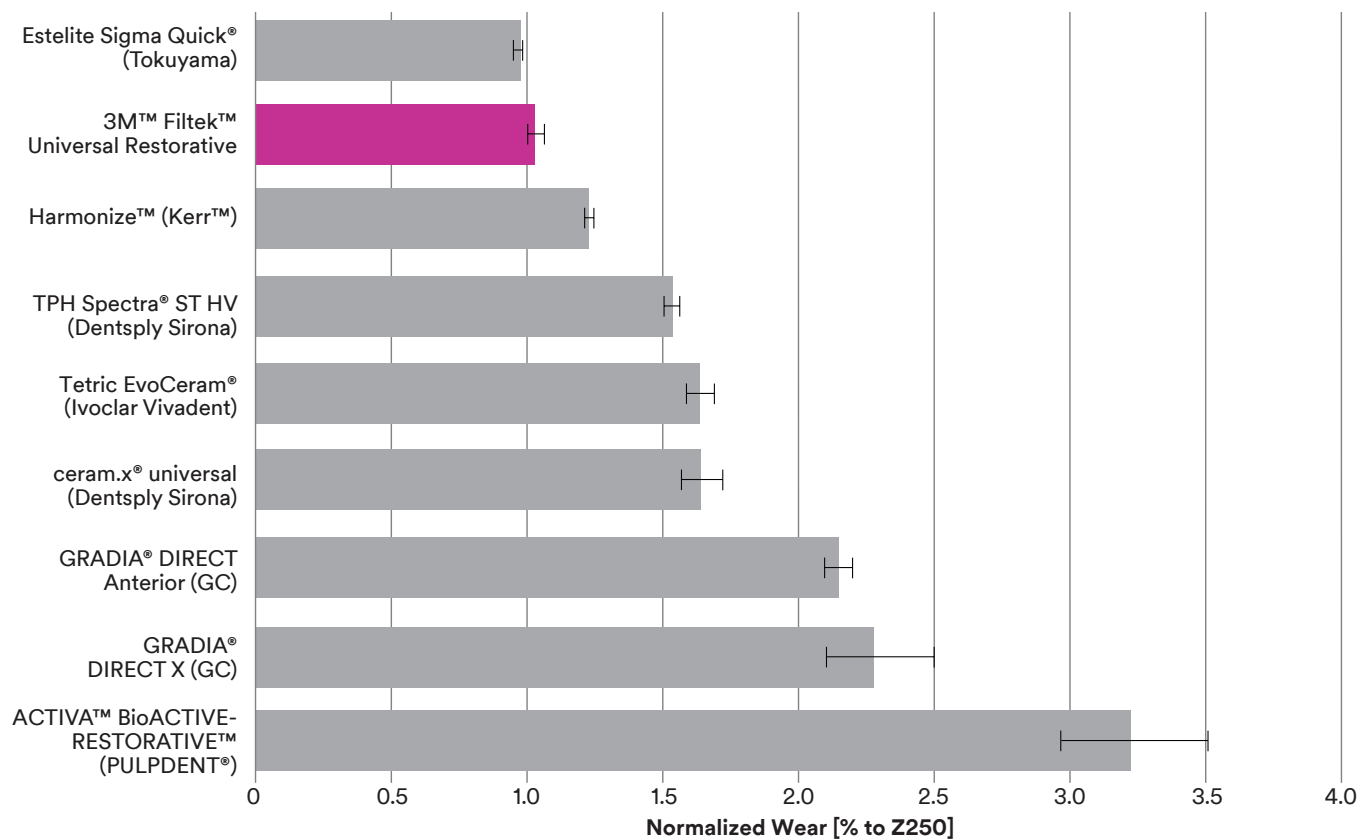
Wear Resistance



3-Body Wear Based on ACTA Methodology

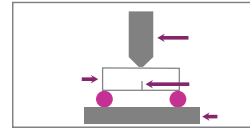
Wear rate was determined using an in-vitro 3-body wear test. In this test, composite (1st body) is loaded onto a wheel, which contacts another wheel, which acts as an “antagonistic cusp” (2nd body). The two wheels counter-rotate against one another, dragging abrasive slurry (3rd body) between them. Dimensional loss is determined by profilometry at the end of 200,000 cycles. In tests where wear is monitored at regular intervals, it is found to be linear. Consequently, wear rates can be predictive beyond the length of the actual test. The 3-body in-vitro wear test data shows 3M™ Filtek™ Universal Restorative has better wear resistance than Ivoclar Vivadent Tetric EvoCeram®, Dentsply Sirona ceram.x® universal, GC GRADIA® DIRECT, GC GRADIA® DIRECT X, Dentsply Sirona TPH Spectra® ST HV and PULPDENT® ACTIVA™ BioACTIVE-RESTORATIVE™. Filtek Universal Restorative has wear resistance comparable to Tokuyama Estelite Sigma Quick® and Kerr™ Harmonize™.

ACTA Wear—3-Body

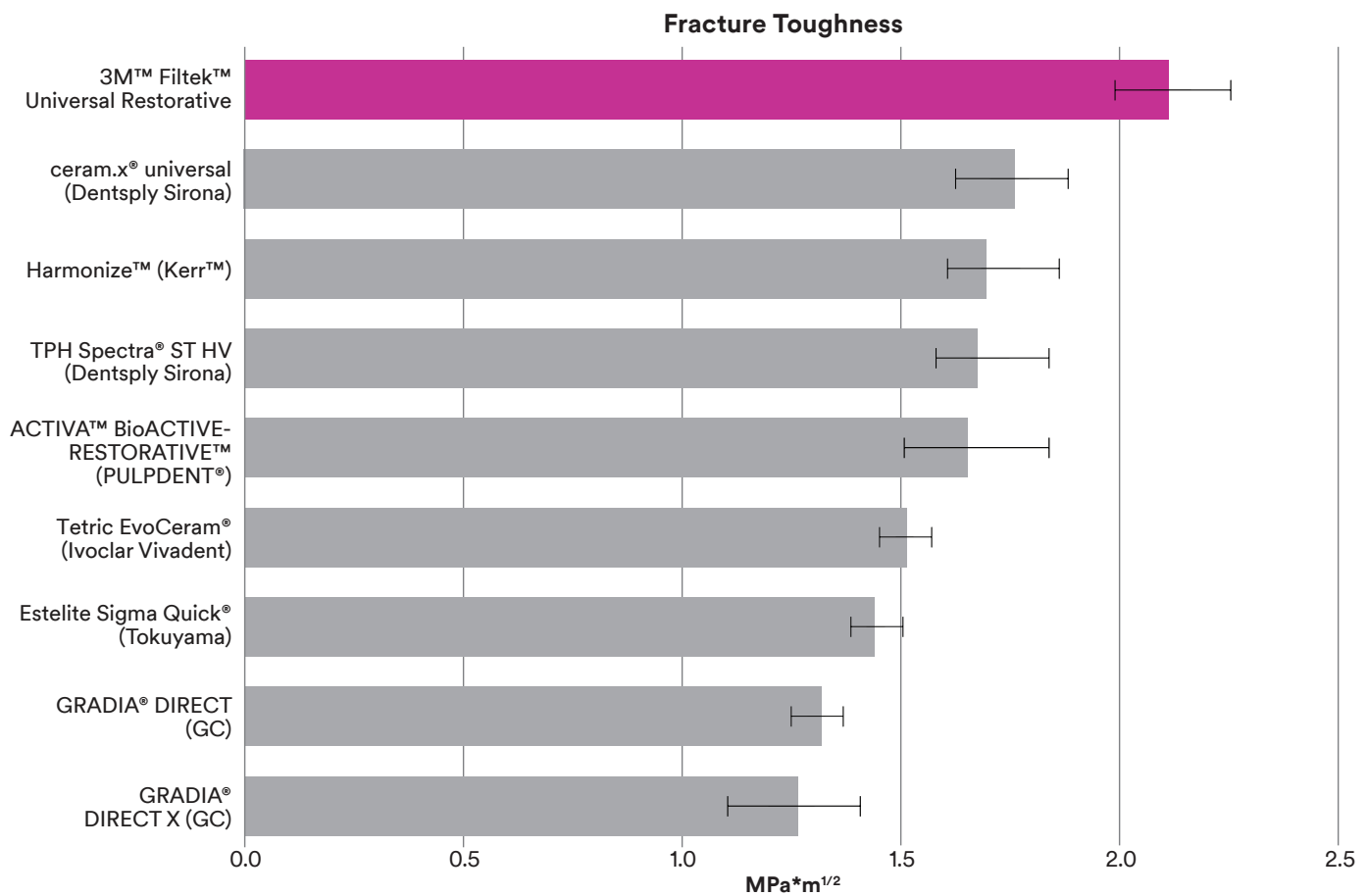


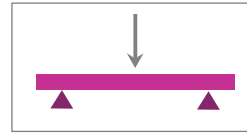
Strength

Fracture Toughness



The values reported for fracture toughness are related to the energy required to propagate a crack. In this test, a short bar of material is cured. A notch is cut into it. The bar is placed on a fixture that supports either end, and an anvil is positioned above the notch. The anvil presses down until the bar breaks. Higher values mean the material is more resistant to fracturing. The fracture toughness of 3M™ Filtek™ Universal Restorative is better than that of Tokuyama Estelite Sigma Quick®, GC GRADIA® DIRECT, GC GRADIA® DIRECT X, Ivoclar Vivadent Tetric EvoCeram®, Dentsply Sirona TPH Spectra® ST HV, Kerr™ Harmonize™, PULPDENT® ACTIVA™ BioACTIVE-RESTORATIVE™ and Dentsply Sirona ceram.x® universal.

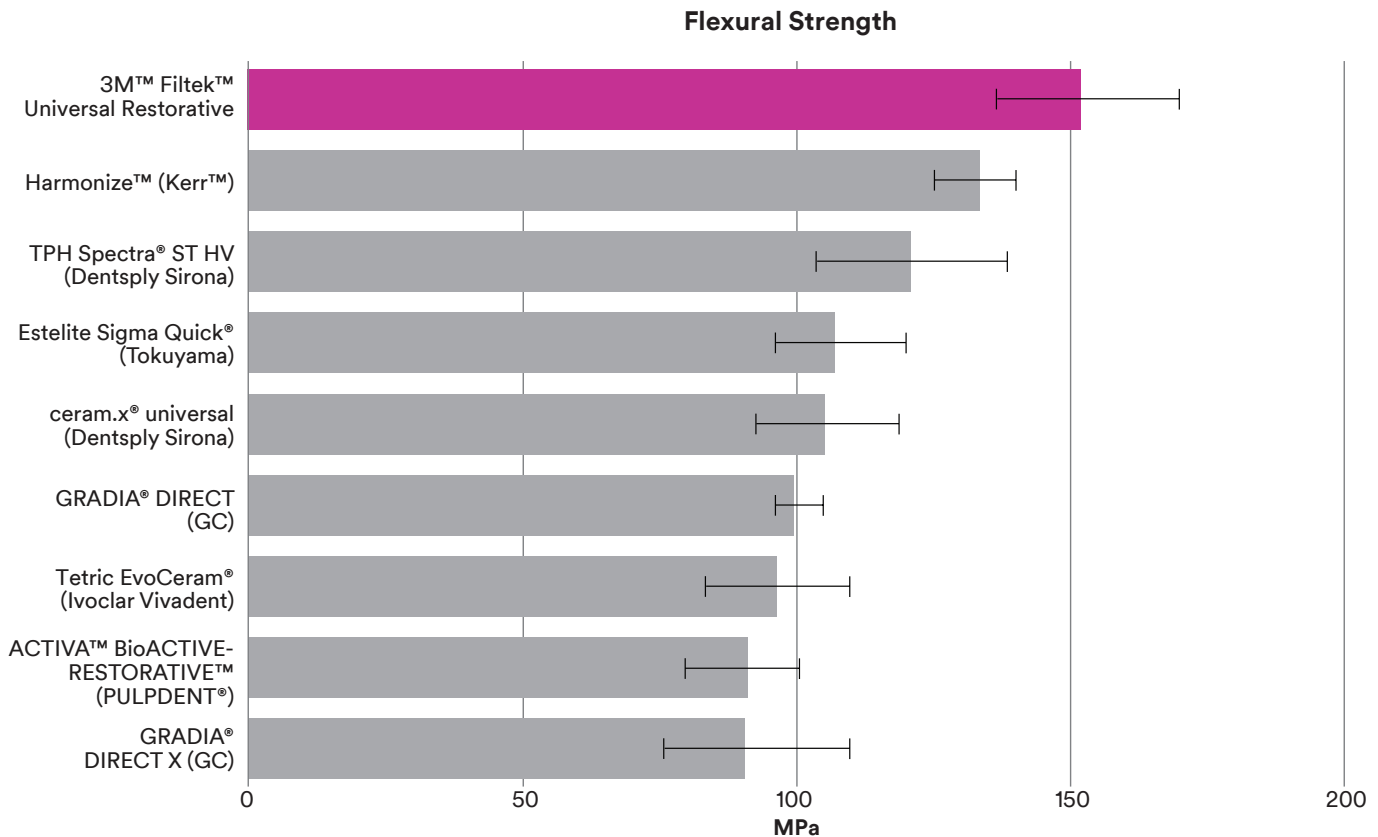


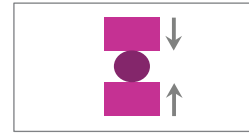


Flexural Strength

Flexural strength is the value obtained when the sample breaks. This test combines the forces found in compression and tension.

The flexural strength of 3M™ Filtek™ Universal Restorative is higher than the flexural strength of Tokuyama Estelite Sigma Quick®, GC GRADIA® DIRECT, GC GRADIA® DIRECT X, Ivoclar Vivadent Tetric EvoCeram®, Dentsply Sirona TPH Spectra® ST HV, PULPDENT® ACTIVA™ BioACTIVE-RESTORATIVE™ and Dentsply Sirona ceram.x® universal. Filtek Universal Restorative has flexural strength comparable to Kerr™ Harmonize™.

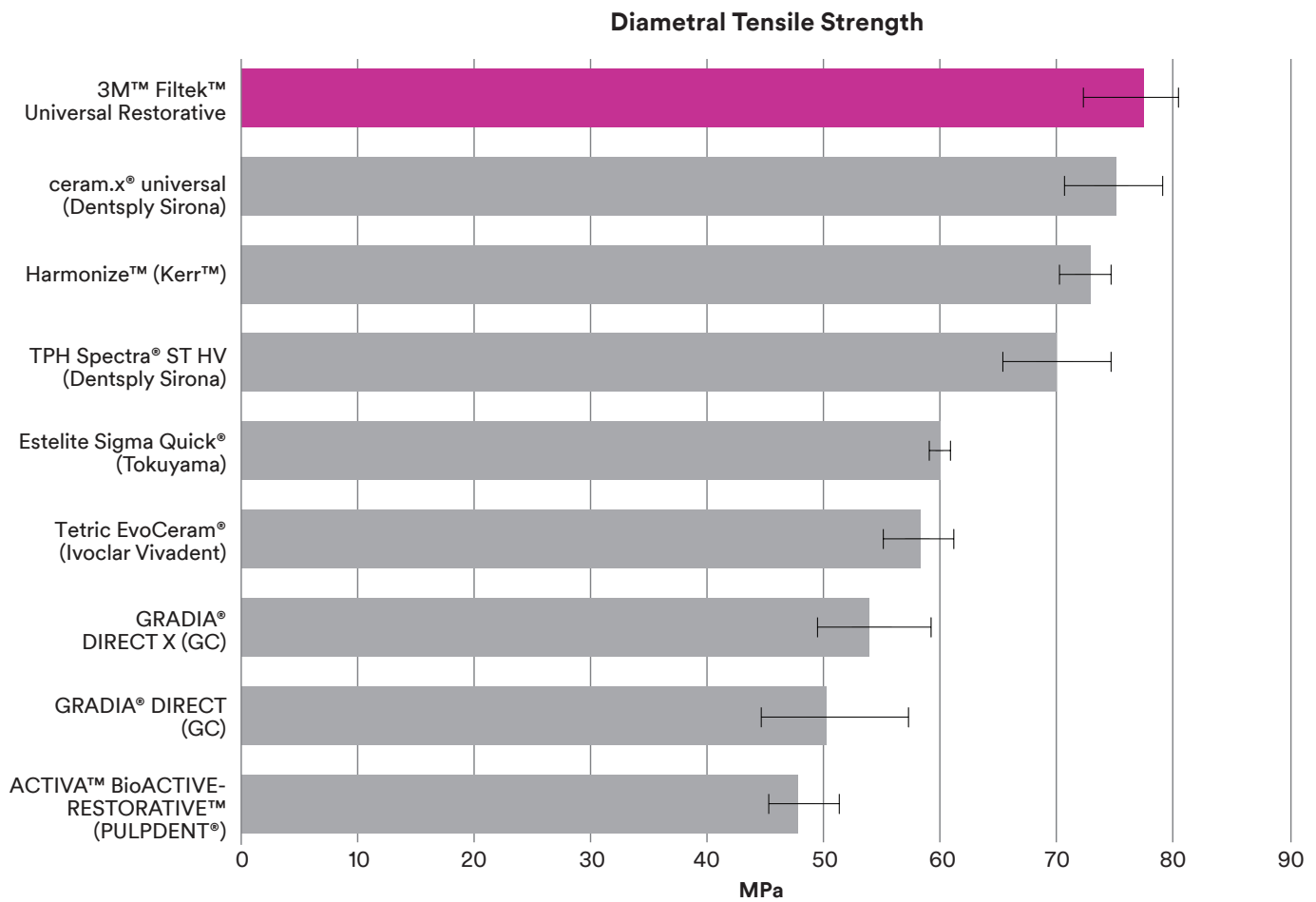




Diametral Tensile Strength

Diametral tensile strength is measured by applying compressive forces to the sides of the sample, not the ends, until the sample fractures.

The diametral tensile strength of 3M™ Filtek™ Universal Restorative is statistically better than Tokuyama Estelite Sigma Quick®, Ivoclar Vivadent Tetric EvoCeram®, GC GRADIA® DIRECT, GC GRADIA® DIRECT X, PULPDENT® ACTIVA™ BioACTIVE-RESTORATIVE™ and Dentsply Sirona TPH Spectra® ST HV. Filtek Universal Restorative has diametral tensile strength comparable to Kerr™ Harmonize™ and Dentsply Sirona ceram.x® universal.



Source: 3M internal data

Shading

Easy and simplified shade match

To make highly esthetic, single-shade restorations easier using a universal composite, we created 3M™ Filtek™ Universal Restorative with NaturalMatch technology—a blend of 3M composite technologies including nanofillers, pigments and proprietary low-stress monomers.

With NaturalMatch technology and universal opacity, one shade of Filtek Universal Restorative is a good match for multiple shades of dentition. That makes it possible to cover all 19 VITA classical and bleach shades (A1 through D4, plus OM1, OM2 and OM3), with just 8 designer shades and an Extra White (XW).

How were the shades determined?

The 8 designer shades were based on the body shade targets of 3M™ Filtek™ Supreme Ultra Universal Restorative. This enables Filtek Universal Restorative to have a shade blending effect with natural dentition. A universal opacity means that it meets most clinical needs. The universal opacity is between dentin and enamel ... so it's not too opaque, and not too translucent. This “sweet spot” for single-shade restorations produces a chameleon effect, allowing shades to blend more easily with surrounding dentition.

8 designer shades and XW match 19 VITA shades

Third-party testing says the shades are a good match.

Based on third-party testing,* Filtek Universal Restorative shades and an XW demonstrate good coverage and an acceptable shade match to all 19 VITA classical and bleach shades (OM1, OM2, OM3, A1, A2, A3, A3.5, A4, B1, B2, B3, B4, C1, C2, C3, C4, D2, D3, D4).

This means you can cover all the VITA classical and bleach shades with fewer shades in your office, reducing the number of shades you need on hand, and the cost of product inventory.

*3M internal data

3M™ Filtek™ Universal Restorative Shades

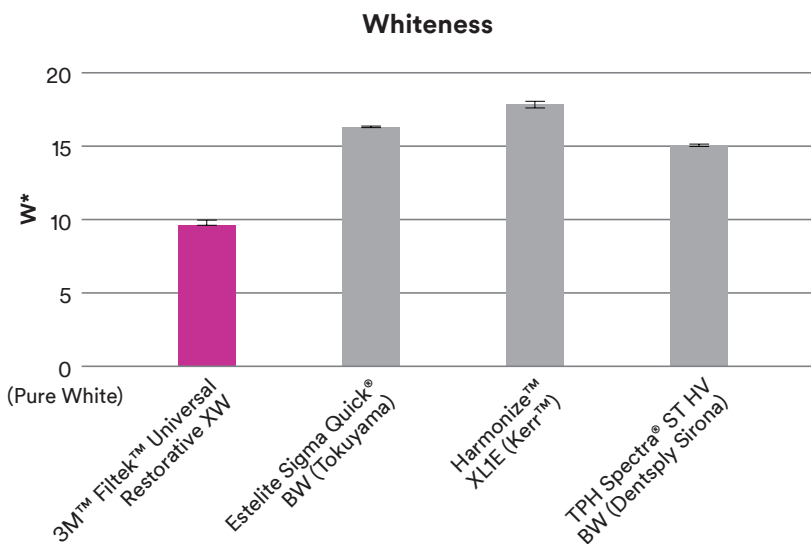
VITA Shades



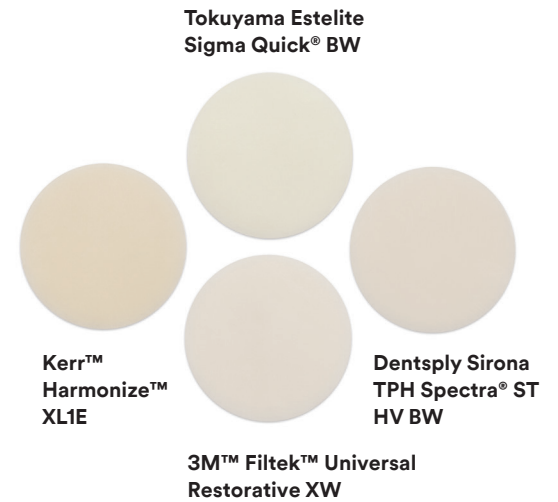
Why we improved our Extra White (XW)

As the global tooth-whitening business expands,¹ it becomes increasingly difficult to find composites that can match the whitest of white teeth. In the conversations we had with dentists, we heard that previous generations of XW/Bleach composite shades could be improved to meet this growing demand. So, we modified the pigment formulation and composition of Filtek Universal Restorative to provide a “Whiter White” (XW).

1. Expected size of the global teeth whitening products market by 2024. Hexa Research. (2017, August 17). *Teeth Whitening Products Market Size Worth USD 7.40 Billion By 2024* [Press release]. Retrieved from www.hexaresearch.com/press-release/global-teeth-whitening-products-market.



Source: 3M internal data



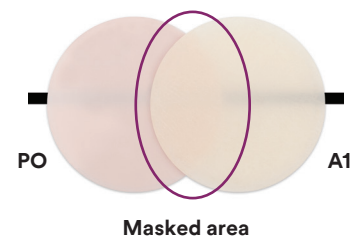
In the graph to the left, we measured W* values, which are the values of whiteness of a material. As a material becomes “whiter,” its W* value approaches zero. Pure white (W* = 0) is used as a reference for the test data. 3M™ Filtek™ Universal is significantly whiter in color than Tokuyama Estelite Sigma Quick® BW, Kerr™ Harmonize™ XL1E and Dentsply Sirona TPH Spectra® ST HV BW.

Why we created a Pink Opaquer (PO)

With the replacement of older fillings, staining of the underlying dentition is often seen. We often hear that this staining becomes a problem, and is especially hard to cover up with more translucent composites.

Customers have expressed a need for a highly opaque, dedicated opaquer that can mask metal and stained dentition. The Filtek Universal Restorative Pink Opaquer (PO) exhibits excellent masking ability in external testing.*

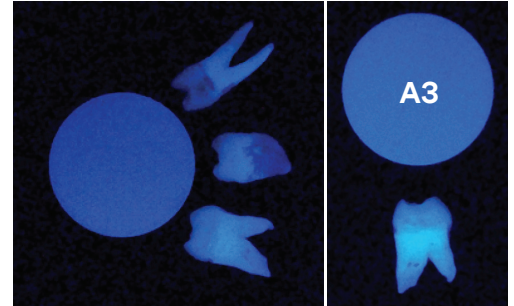
*3M internal data



A black line was drawn to represent a dark area or stain. A 1mm-thick disk created from Pink Opaquer (PO) was laid down first to demonstrate how it masks the dark area. Then, a 1mm-thick disk made from the A1 shade was laid, overlapping the PO disk. You can see how the PO shade enhances and improves the final restoration, making it simple to create a pleasing esthetic result.

Fluorescence

An important esthetic consideration in any restorative composite material is the ability of the composite to match natural dentition, of which one facet is fluorescence. Fluorescence helps contribute to the vitality and lifelike appearances of natural dentition. Fluorescence in teeth occurs when light energy is absorbed and emitted at a longer wavelength, giving the tooth structure a blue-white appearance. 3M™ Filtek™ Universal Restorative has fluorescent pigments added to help match natural dentition.

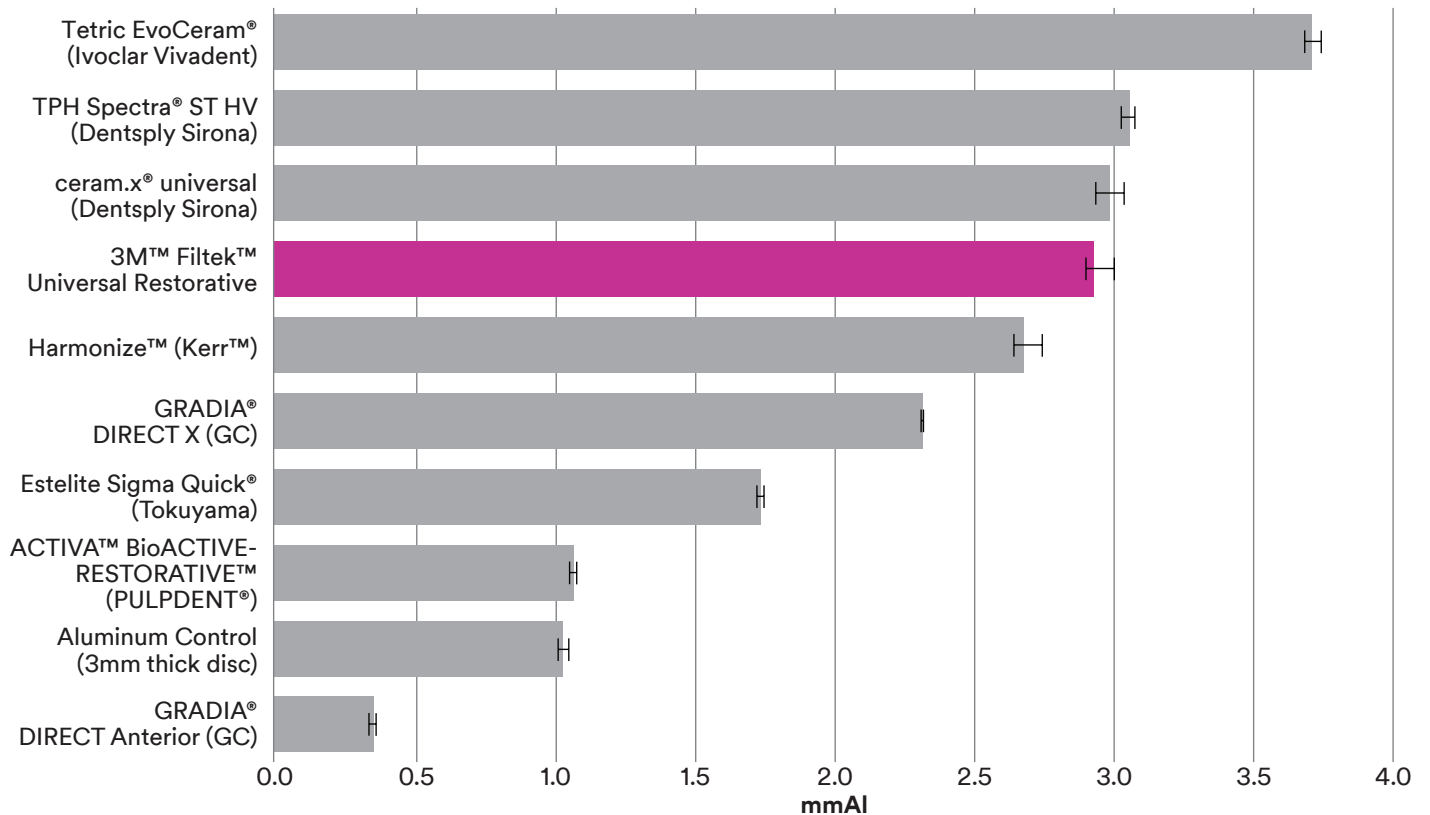


Radiopacity

Radiopacity plays an important factor during recalls with patients. Dentists would like to be able to see previous restorations better during clinical appointments, so that they can more easily differentiate between the natural dentition and composite restorations. To improve the radiopacity, Filtek Universal Restorative contains the same agglomerated particles of 100nm ytterbium trifluoride (YbF3) as 3M™ Filtek™ One Bulk Fill Restorative. This gives 3M™ Filtek™ Universal Restorative an increased radiopacity compared to other universal composites on the market.

Below you can see how Filtek Universal Restorative has better radiopacity than GC GRADIA® DIRECT, GC GRADIA® DIRECT X, Tokuyama Estelite Sigma Quick®, Kerr™ Harmonize™ and PULPDENT® ACTIVA™ BioACTIVE RESTORATIVE™. Filtek Universal Restorative has radiopacity comparable to Dentsply Sirona ceram.x® universal.

Radiopacity ISO 4049:2010



Source: 3M internal data

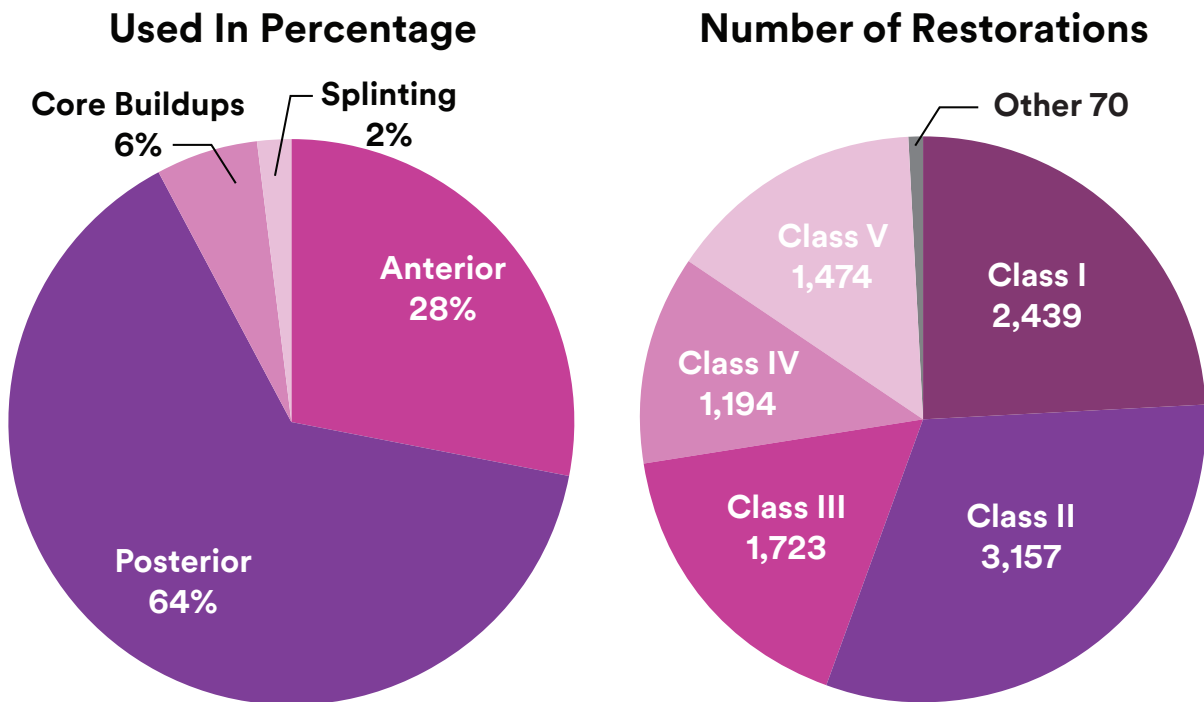
Field Evaluation

A field evaluation was conducted with 125 dentists in four countries (Germany, Italy, United Kingdom and the U.S.) to confirm the in vitro handling and assess the esthetic clinical performance of 3M™ Filtek™ Universal Restorative.

Recruited dentists were sent packages containing capsules of 3M™ Filtek™ Universal Restorative material. They were then asked to evaluate the material in combination with their current adhesive and finishing polishing system for a period of 2–3 weeks. After that time, they continued to evaluate the Filtek Universal Restorative material for another 2–3 weeks with a procedure kit that included 3M™ Scotchbond™ Universal Adhesive and 3M™ Sof-Lex™ Diamond Polishing System.

One-hundred seventeen dentists were currently using universal composites for their anterior and posterior restorations. Sixty-six were competitive universal composite users. Fifty-one currently use 3M universal composites.

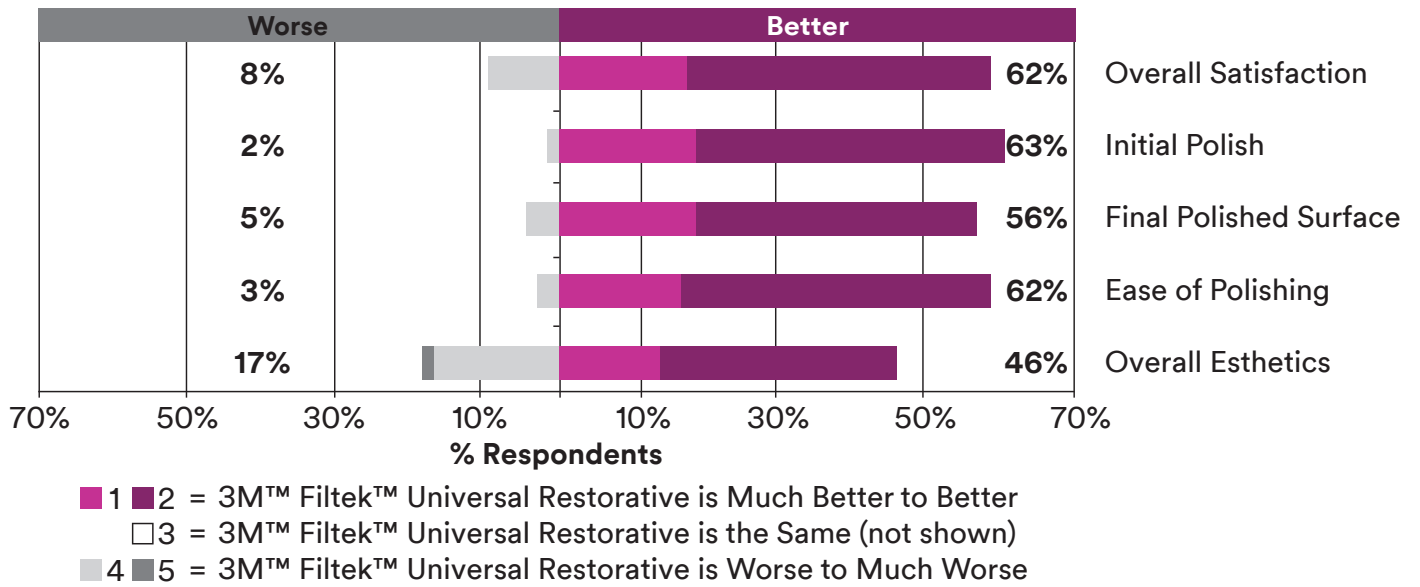
There were 10,057 restorations placed during the 5-week evaluation: 2,816 in the anterior, 6,437 in the posterior, 603 core buildups and 201 splintings.



Simplified Esthetics

One focus of 3M™ Filtek™ Universal Restorative is simplified esthetics. Dentists were asked to specifically compare Filtek Universal Restorative to their current product on a scale of 1 to 5. A rating of 1 to 2 indicated Filtek Universal Restorative was Much Better or Better than their current product. Ratings of 4 to 5 indicated Filtek Universal Restorative was Worse or Much Worse than their current product. A rating of 3 indicated Filtek Universal Restorative was performing similarly to their current product. (For the purpose of this report, the rating of 3 is not shown. It can be calculated by subtracting the Worse and Better % Respondents from 100.)

Esthetics—Competitive Product Users

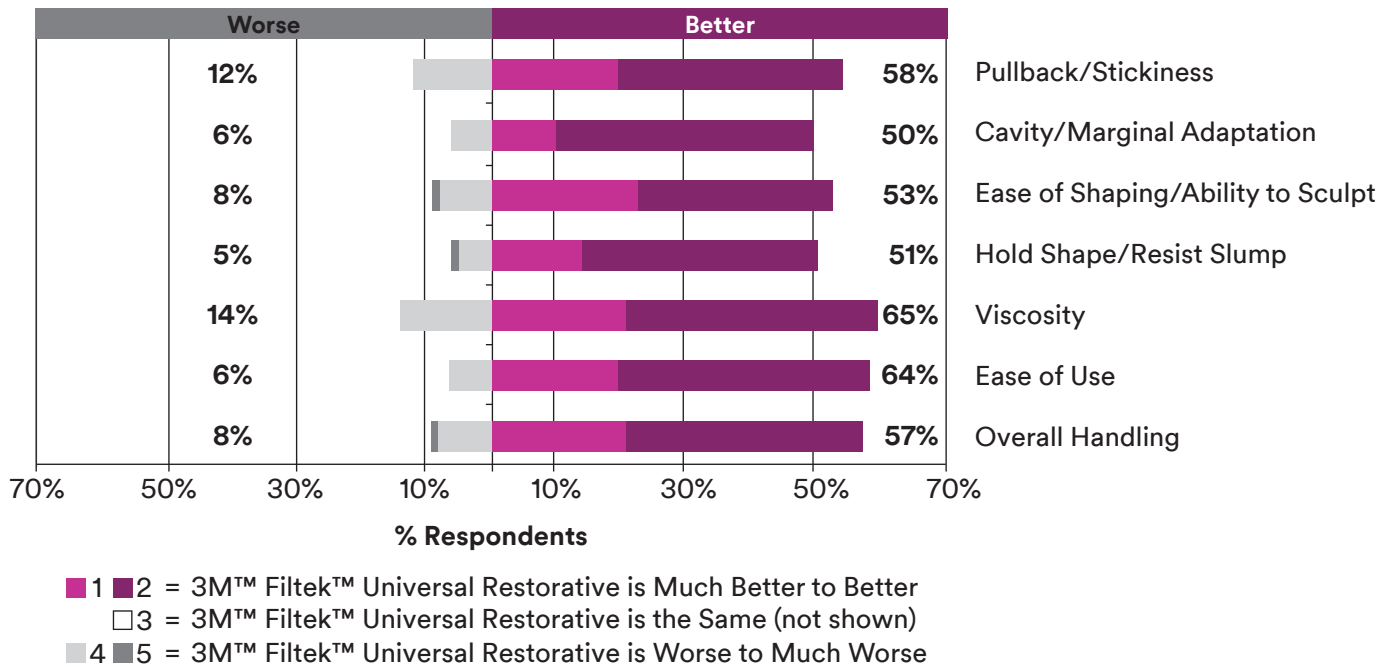


Handling Acceptability

The handling ratings of 3M™ Filtek™ Universal Restorative were compared to the handling ratings of their most frequently used composite.

Dentists were asked to rate handling attributes. A rating of 1 to 2 indicated Filtek Universal Restorative was Much Better or Better than their current product. Ratings of 4 to 5 indicated Filtek Universal Restorative was Worse or Much Worse than their current product. A rating of 3 indicated Filtek Universal Restorative was performing similarly to their current product. (For the purpose of this report, the rating of 3 is not shown. It can be calculated by subtracting the Worse and Better % Respondents from 100.)

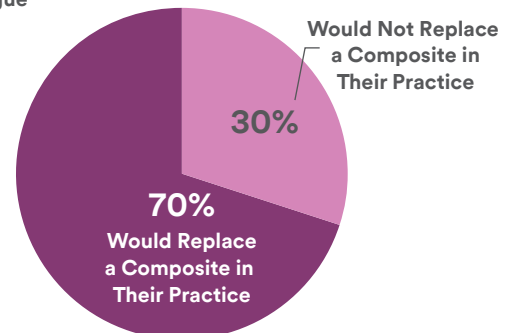
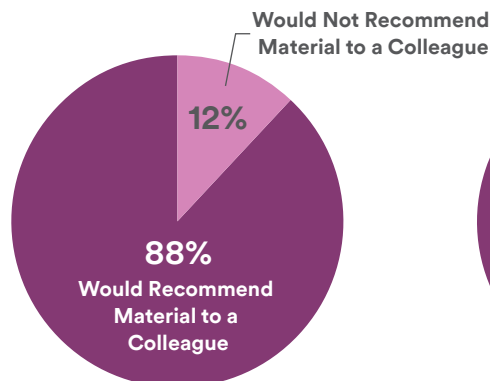
Handling—Competitive Product Users



Source: 3M internal data

A majority of clinicians surveyed said they would use 3M™ Filtek™ Universal Restorative in their practice.

- 88% of clinicians would recommend this material to their colleagues - (N = 125)
- 70% of clinicians would replace a composite in their practice with this material - (N = 125)



Placement Protocols

Class II Restorations



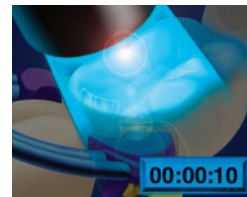
1



2



3



4



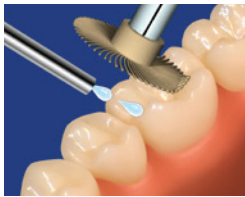
5



6



7



8



9

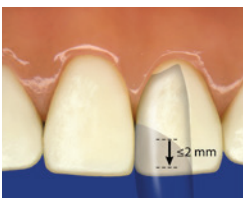
Class IV Restorations



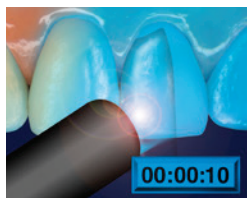
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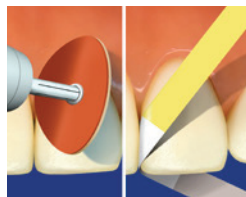
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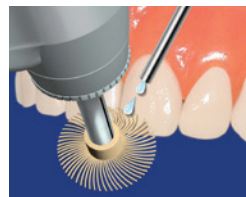
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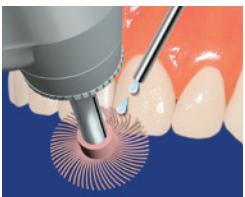
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5



6



7

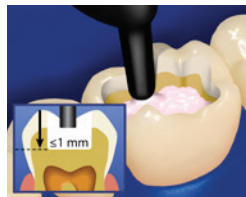
Pink Opaquer Placement



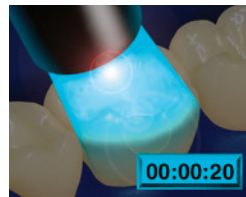
1



2



3



4

Restoration Type	Increment Depth	Halogen Lights (with output of 550-1000 mW/cm ²)	LED Lights (with output 1000-2000 mW/cm ²)
Class II	2.0 mm.	20 sec. Occlusal	10 sec. Occlusal
Class IV	2.0 mm.	20 sec. Incisal	10 sec. Incisal
Pink Opaquer	1.0 mm.	40 sec. Occlusal	20 sec. Occlusal

Physical Property Comparison

Competitors

Physical Property	Unit for Measure	3M™ Filtek™ Universal Restorative	Tokuyama Estelite Sigma Quick®	GC GRADIA® DIRECT	GC GRADIA® DIRECT X	Ivoclar Vivadent Tetric EvoCeram®	Kerr™ Harmonize™	Dentsply Sirona TPH Spectra® ST HV	Dentsply Sirona ceram.x® universal	PULPDENT® ACTIVA™ BioACTIVE-RESTORATIVE™
Radiopacity	mmAl	2.9	1.7	0.4	2.3	3.7	2.7	3.1	3.0	1.1
ACTA (3-Body Wear)	% to Z250	1.0	1.0	2.2	2.3	1.7	1.2	1.6	1.7	3.2
Fracture Toughness	MPa*m ^{1/2}	2.1	1.4	1.3	1.3	1.5	1.7	1.7	1.8	1.7
Cusp Deflection	µm	3.6	4.4	3.7	2.6	3.3	3.9	5.3	5.4	2.7
Polish Retention	gloss %	63.9	63.9	25.0	13.1	10.3	59.3	12.2	13.7	13.8
Compressive Strength	MPa	307.2	335.8	294.6	289.6	299.4	275.6	347.6	347.8	220.1
Flexural Strength	MPa	152.3	107.0	99.5	90.6	96.5	133.5	120.8	105.1	91.1
Diametral Tensile Strength	MPa	77.5	60.0	50.2	53.9	58.3	73.0	70.0	75.2	47.8
Watts Shrinkage	%	1.8	1.8	1.9	1.9	1.6	1.8	1.8	1.9	3.6

Source: 3M internal data

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