

3M

Filtek™

One Bulk Fill Restorative



Overcoming the myths of bulk fill composite materials

Bulk fill composite materials were introduced for restorations more than a decade ago; however, many dentists were reluctant to try them due to the limitations and performance of earlier bulk filling materials.

In addition, most dentists were trained to use incremental filling materials that require a layering technique in order to minimize stress/shrinkage; achieve proper adaptation and eliminate voids; and achieve proper depth of cure. Because of this, many dentists find it difficult to trust or incorporate bulk fill materials that seemingly contradict their training.

Older composite resin chemistries feature monomers that need to be layered in 2 mm increments to minimize shrinkage. This traditional layering technique requires more steps and means dentists spend more time working in a patient's mouth.

Using a traditional layering technique requires multiple steps of packing, layering, and curing, which could increase the potential for voids and/or poor adaptation with each layer. The amount of time that this layering technique requires could also increase the potential to introduce contamination from blood or saliva.

“Since the introduction of bulk fill materials, a significant amount of technology has been dedicated to addressing shrinkage stress, but depth of cure issues persisted for some time,” says 3M Advanced Product Development Specialist Tim Dunbar, Ph.D. “Significant advances in materials science and chemistry in the past decade enable more translucent

composites that allow curing light to penetrate to a depth of 5 mm with low shrinkage stress.”

3M™ Filtek™ One Bulk Fill Restorative is designed for the posterior so dentists don't need to sacrifice wear resistance, strength and handling. It also has opacity equivalent to many typical universal composite materials used today, so dentists don't need to sacrifice esthetics while working quickly and efficiently.

Unfortunately, despite the great advances made over the last few years, myths about bulk fill materials continue to persist. Let's take a closer look at the science of Filtek One Bulk Fill Restorative – and break down the myths of bulk fills.

MYTH 1

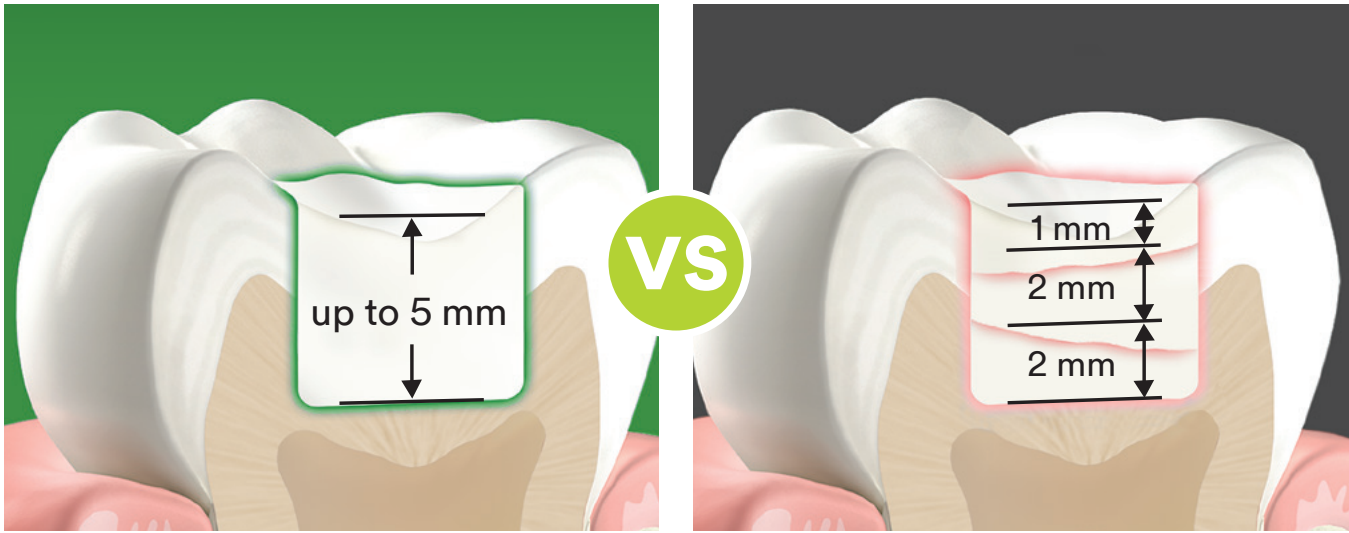
Bulk fill materials are not esthetic enough (too translucent).

In the past, bulk fill materials needed a relatively high amount of translucency (low opacity) in order to fully cure in a 4-5 mm increment. The concept is quite simple – if the composite needs to cure all the way through 4-5 mm of material, then it needs to allow the light to penetrate to a greater degree.

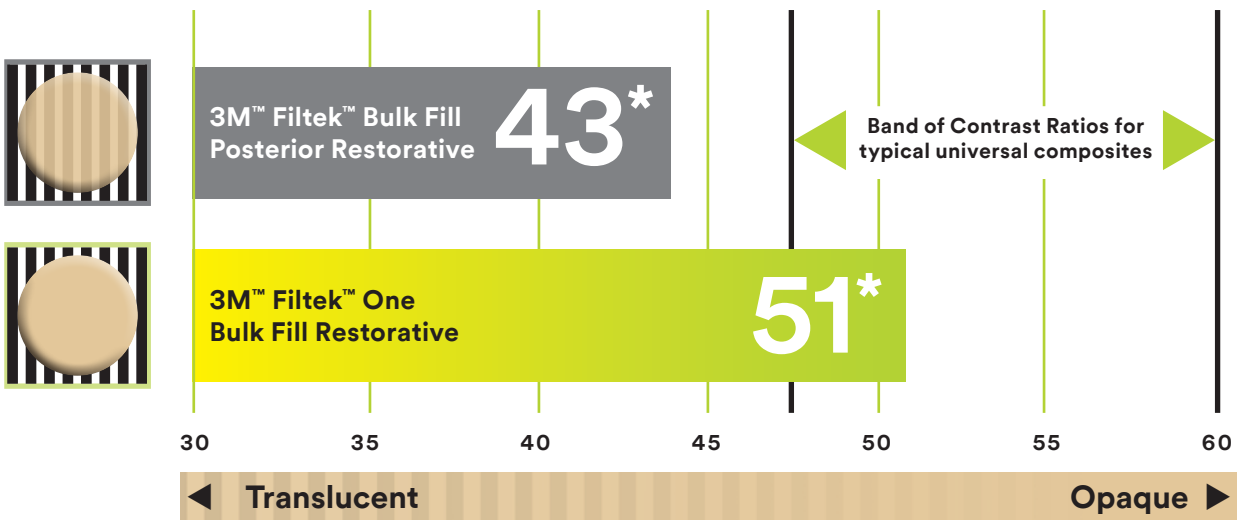
In the decade or so since the introduction of the first bulk fill composites, the field of materials science has exploded. Research and development efforts in the past 5-10 years have yielded bulk fill composites that no longer require a choice between fast and

effective depth-of-cure and esthetics. 3M designed Filtek One Bulk Fill Restorative with unique optical properties and improved opacity to provide the simplicity of one-step placement up to 5 mm, without compromising esthetic results.

3M leveraged its nanotechnology expertise to increase opacity without reducing depth of cure. In its cured state, Filtek One Bulk Fill Restorative has a higher opacity than other leading bulk fill restoratives, resulting in improved esthetics. 3M's nanofiller technology also provides superior wear resistance and excellent polish retention.



Contrast Ratio



*The contrast ratio is the average of all shades.

MYTH 2

It's necessary to layer bulk fill materials in order to minimize stress/shrinkage.

Stress is the amount of force exerted on a tooth due to polymerization shrinkage as it cures. This stress can break the adhesive bond, crack enamel and allow leakage at the margins. The amount of stress is determined by the shrinkage of the material and its stiffness.

3M™ Filtek™ One Bulk Fill Restorative exerts less or equivalent stress on a tooth than some common incrementally placed universal composites, because it uses two new resin components to reduce polymerization stress.

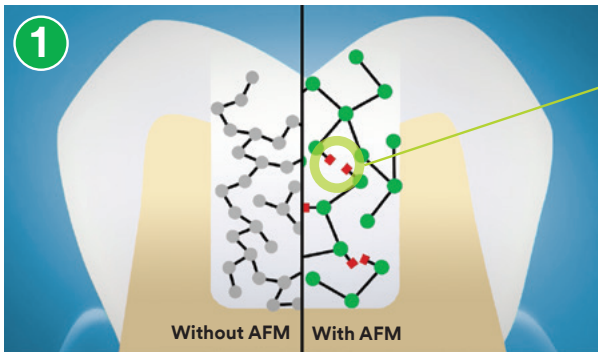
One resin component is an addition-fragmentation monomer (AFM). During polymerization, the central group can fragment to relieve stress and the fragments can then re-polymerize in a lower stress state.

The other resin component is aromatic urethane dimethacrylate (AUDMA). Because this is a larger monomer than found in traditional dimethacrylates, it limits the number of shrinkage zones. This helps reduce the amount of shrinkage and stress that occurs during polymerization.

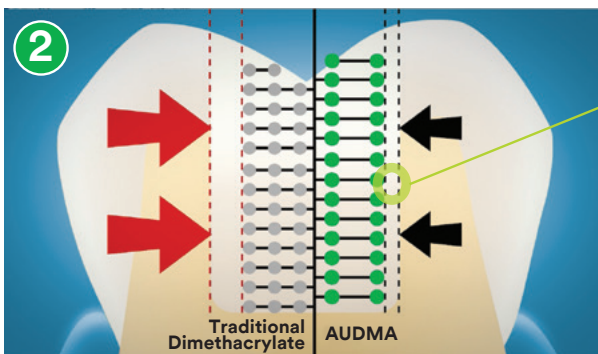
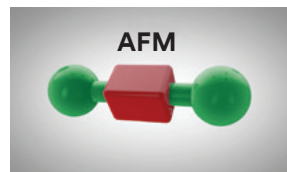
MYTH 3

It's necessary to layer filling materials in order to achieve proper adaptation and eliminate voids.

Here's how it works.



The innovative component of the first resin is an addition-fragmentation monomer (AFM). The unique feature of this resin is that, during polymerization, the central group **can fragment to relieve stress**. The fragments can then re-polymerize in a lower stress state.



The other resin component is aromatic urethane dimethacrylate (AUDMA). Because it's a larger monomer than found in traditional dimethacrylates, it limits the number of shrinkage zones. That helps **reduce the amount of shrinkage and stress** that occurs during polymerization.



For many decades, the incremental placement of composite has been the prevailing technique, in part because this was thought to minimize the potential for introducing voids. However, studies have shown that the opposite is true when compared to using an effective bulk fill composite.

Extruding 3M™ Filtek™ One Bulk Fill Restorative material out of its newly designed unit dose capsule creates the necessary conditions for shear thinning.

This means the viscosity of the material temporarily decreases and the material flows into the cavity prep, resulting in excellent adaptation, as well as fewer defects (voids).

In an in-vitro simulated operatory test with 79 dentists, restorations placed with Filtek One Bulk Fill Restorative in 5 mm deep class II cavities had fewer defects compared to restorations made using incrementally placed composites.

MYTH 4

A bulk fill placed in a 5 mm increment won't achieve the proper depth of cure.

Methacrylate-based dental composites have the ability to achieve a very high depth-of-cure, but this has often come at the price of lowered opacity/esthetics (see myth 1). In order to achieve a high depth-of-cure while maintaining a tooth-like opacity, we must look at the interaction of light between the filler particles and the matrix.

If the optical properties (refractive index) of the filler and matrix do not match closely, light is scattered within the composite resulting in higher opacity. This will limit the depth of penetration of the curing light to effectively enable bulk curing. If the optical properties match closely, light penetrates more effectively without the scattering resulting in more translucency. This will allow for greater penetration of the curing light and allow for bulk curing. Traditionally, this resulted in more translucent restorations.

By manipulating the base chemistry that controls this behavior, we can control the stages at which the material looks

opaque and translucent. The end result is a composite with the depth-of-cure required for bulk placement, and a final opacity that is closer to the natural tooth.

3M™ Filtek™ One Bulk Fill Restorative utilizes the science described above to achieve a uniform cure even at the bottom of 5 mm cavity, without sacrificing esthetics.

“We have data and peer-reviewed literature that indicate 3M’s bulk fill materials work as intended,” says Senior Technical Service Engineer Joe Edgington. “Bulk fills have been around for 10 years and many concerns and challenges have been worked out thanks to advances in materials science and chemistry.”

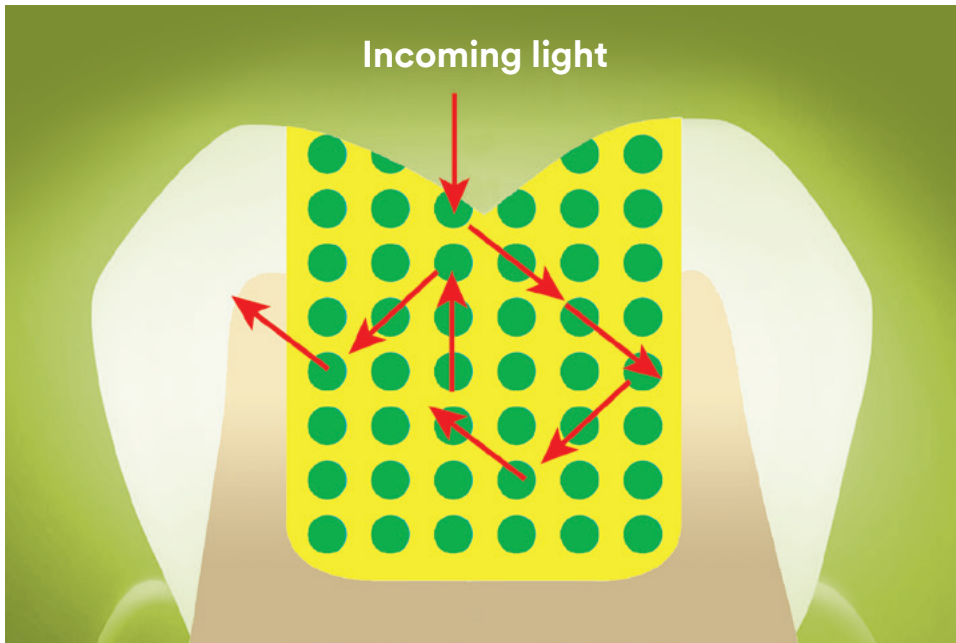
“With fewer defects, fewer voids, less chance of contamination, and less time than universal composites, dentists can make quality restorations with 3M’s bulk fill composites,” adds Dunbar.

For more information, contact your 3M Oral Care sales representative.

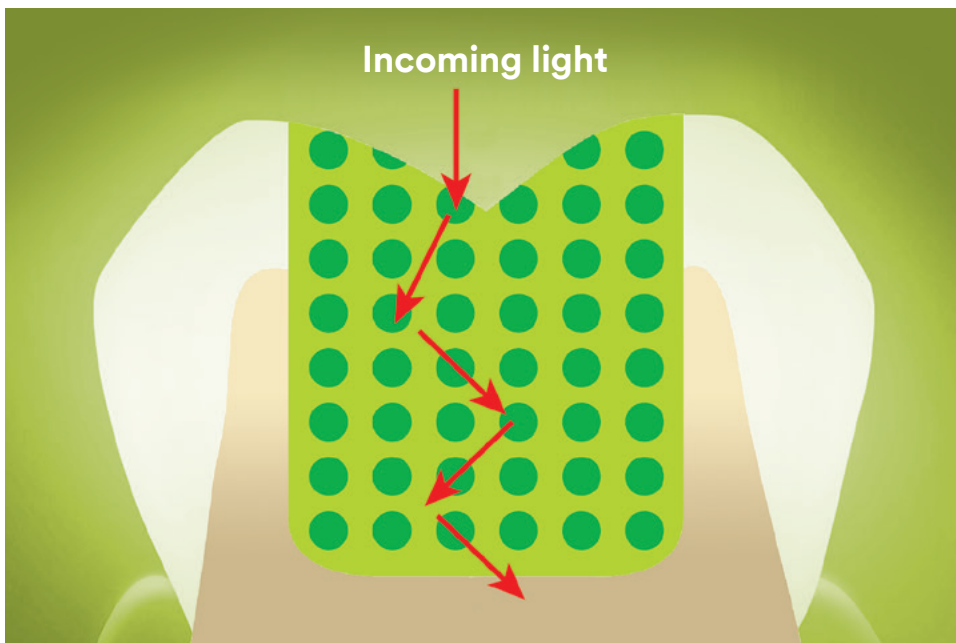
References

1. J. Dent. Res. 96 (Spec Iss A): 186, “Adaptation of Resin-based Composites in Class II Restorations”

Refractive index does not match



Refractive index does match



If the filler and the resin DO have matching optical properties (bottom diagram), as is the case with 3M™ Filtek™ One Bulk Fill Restorative, then the light will not be significantly bent, and the light will be successfully transmitted through the materials, which increases the material's depth of cure.



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