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.

By 3M Oral Care

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 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 OptiBond 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.

by 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 fill.

**MYTH 1**

Bulk fill materials are not aesthetic 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 composite, 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 OptiBond 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. Recall that OptiBond One Bulk Fill Restorative has a higher opacity than other leading bulk fill restoratives, resulting in improved esthetics. 3M’s nanotechnology also provides superior wear resistance and excellent polish retention.

By manipulating the base chemistry that resulted in more translucent restorations.

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 in a 5 mm deep cavity will not cause the composite to deaminate because 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 offers less or equivalent stress on a tooth than some common incrementally placed universal composites, because it uses two new resins 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.

If the fill 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.

**MYTH 4**

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

Metachromatic-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, resulting in more translucency. This will allow for greater penetration of the curing light and allow for better 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 or translucent. The 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 3M Advanced Product Development Specialist Tim Dunbar. “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.”

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