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 JM Oral Care

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 required 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, because this was thought to minimize the potential for introducing voids.

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. This 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 bulk fill composites, the field of materials science has exploded. Research and development efforts in the past 5 to 10 years have yielded bulk fill composites that no longer require a choice between fast and effective depth of cure and esthetics. Some bulk fill composites with unique optical properties and improved opacity to provide the simplicity of one-step placement up to 5 mm, without compromising esthetic results.

MYTH 2

It is 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 exhibits 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-fragment 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 bulk fill materials in order to achieve proper adaptation and eliminate voids.

For many decades, the incremental placement of composite has been the prevailing technique, in part because this was thought likely 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.

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 will penetrate more effectively without scattering resulting in more translucency. This will allow for greater penetration of the curing light and allow for bulk curing. Traditional fillings resulted in more translucence 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 that demonstrates an increased depth of cure 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. “3M has advanced products made using incrementally placed composites.”

For more information, contact your JM Oral Care sales representative.