



CLINICAL CASE



Clinical case: Stick to innovation: Five benefits of modern dental universal adhesives

Keyword(s): Dental Adhesives, Universal adhesives, bond strength

From demographics and patient demands, to technique and philosophy, and even our overall understanding of oral health – dentistry is constantly evolving. And these changes need new and innovative dental materials, including adhesives.

Manufacturers continue to make improvements to dental adhesives to meet clinicians' modern needs. Universal adhesives in particular offer important advantages in performance and ease of use. A good universal adhesive should include the following characteristics:

- High bond strength
- Compatibility with your preferred etching technique
- Suitability for direct and indirect restorations
- Ability to bond to restoration materials like glass ceramic, zirconia, metals, and composite without extra primer

Universal adhesives are compelling for these reasons alone, but there are actually five more performance benefits you may not have considered:

1. Radiopacity: Distinguish adhesive layers from gaps, voids and caries

Most universal adhesives are radiolucent. On an x-ray, it can be difficult to differentiate between adhesive pooling, secondary caries, marginal gaps, and voids beneath the restoration, particularly in hard-to-inspect areas. Radiolucency under an existing restoration can lead to misdiagnosis – and potentially invasive overtreatment. To remedy this issue, some manufacturers add inorganic radiopaque fillers to increase the adhesive's radiopacity. However, inorganic fillers can increase the viscosity and affect the material's application properties, making handling more challenging. Plus, fillers tend to settle over time, which can negatively impact the quality of the product if the bottle is not shaken thoroughly before use.



Intentional adhesive pooling under Class I restorations – X-rays of extracted human molars. The first three molars to the left were treated with different non-radiopaque universal adhesives, while the rightmost molar was treated with 3M™ Scotchbond™ Universal Plus Adhesive.

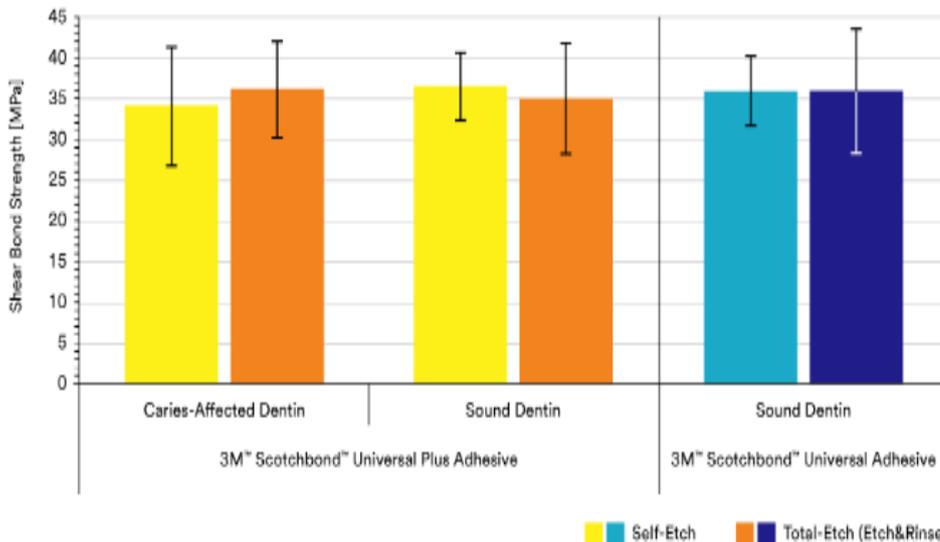
To avoid potential problems, look for a universal adhesive formulated to achieve dentin-like radiopacity without the addition of radiopaque fillers. 3M™ Scotchbond™ Universal Plus Adhesive, for example, uses a newly developed radiopaque monomer that remains homogeneously distributed in the adhesive and ensures low viscosity.

2. Adhesion to caries-affected dentin: Support minimally invasive procedures

More and more dentists are utilizing minimally invasive approaches and are looking for ways to preserve as much natural tooth structure as possible when removing caries. In most cases, this means leaving caries-affected, but firm, dentin in place on the cavity floor. And in deep cavities, even the soft dentin close to the pulp can be left near the pulp. However, to make this approach successful, there needs to be a tight seal

around the carious tissue. The seal cuts off the remaining bacteria from their nutrient supply and stops tooth decay from progressing.

Thankfully, you can maintain your commitment to minimally invasive restorations and still use a universal adhesive. 3M™ Scotchbond™ Universal Plus Adhesive, for example, has been formulated for a strong bond to both sound and caries-affected dentin, as well as seal caries-affected dentin by forming a clearly defined continuous hybrid layer. This means clinicians can take advantage of the universal adhesive's physical properties and workflow benefits while preventing secondary decay.



Shear bond strength of 3M™ Scotchbond™ Universal Plus Adhesive to caries affected dentin compared to sound dentin.

3. BPA derivative-free formulation: Alleviate patient concerns

Spurred by the increasing discussion around Bisphenol A in various media, patients and dentists are looking for treatment options that do not involve formulations based on BPA derivatives, like BisGMA. To give your patients maximum confidence in the materials you use, seek out universal adhesives with a BPA derivative-free formulation such as Scotchbond Universal Plus Adhesive.

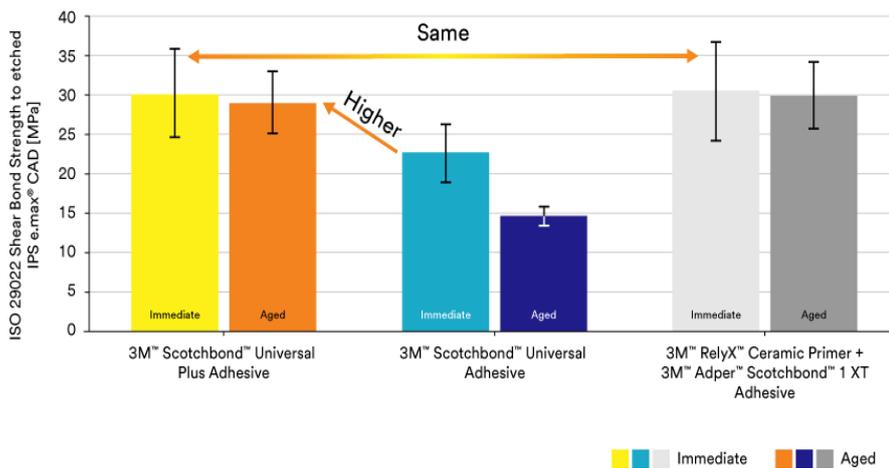
4. Function as a primer for indirect restorations: Improve durability, streamline procedure and reduce inventory

Most dental professionals are used to applying a primer (e.g., a silane) when bonding to indirect restoration materials. However, this step can actually be eliminated while improving bond strength – with the right adhesive.

Usually, dental primers contain a coupling agent like silane, diluted with solvent. Silanes contain reactive groups that help promote a bond between organic and inorganic materials, i.e., the tooth structure and the restoration material. Silanes can be further enhanced by being paired with a variety of functional groups that improve compatibility with different polymers.

For example, Scotchbond Universal Plus Adhesive contains an optimized mixture of silanes that enable it to function as both a primer and adhesive. In addition to the methacrylate-functional silanes present in its predecessor, 3M™ Scotchbond™ Universal Adhesive, the new formulation also contains aminofunctional silane. This combination provides gold standard bond strength to etched glass ceramic.

In fact, several in-vitro studies showed that the bond strength of Scotchbond Universal Plus Adhesive to etched glass ceramic is comparable to that of adhesives with a separate silane.



Shear bond strength of 3M™ Scotchbond™ Universal Plus Adhesive to lithium disilicate.

5. Self-cure and dual-cure: Streamline procedure, reduce inventory and improve confidence

Acidic adhesive formulations like modern universal adhesives are often incompatible with the peroxide/amine initiators used in self-cure and dual-cure products such as resin cements or core build-up materials, because the acidity can inhibit the cure at the interface to the adhesive. To overcome this incompatibility, typically a so-called self-cure activator or dual-cure activator needs to be mixed with the adhesive as an extra step before application. Scotchbond Universal Plus Adhesive contains a small amount of transition metal salt which provides peroxide/amine initiator compatibility and eliminates the need for a separate activator. However, the adhesive still needs to be polymerized with a curing light, in order to ensure maximum performance.

Scotchbond Universal Plus Adhesive has an additional benefit when used in combination with 3M™ RelyX™ Universal Resin Cement: the adhesive doesn't need to be light cured because the self-curing mechanism of the resin cement also cures the adhesive layer. This means the adhesive can be optimally distributed by the pressure of restorative material placement – thereby avoiding any potential fit issues caused by pooled adhesive cured before placement of the restoration.

Conclusion: Universal adhesives offer many advantages and some materials have evolved well beyond a strong bond. These next-generation materials are formulated to address specific dentist needs, such as radiolucency or support for minimally invasive dentistry. For these reasons, it's worth taking a fresh look at universal adhesives – and how the latest advancements could help you achieve your goals.

Recommended products:

- 3M™ Scotchbond™ Universal Plus Adhesive (Basiq Dental Article No. 276858)
- 3M™ RelyX™ Universal Resin Cement (Basiq Dental Article No. 214504)

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About Dr. Christoph Thalacker

Dr. Christoph Thalacker has been part of 3M ESPE/3M Oral Care since August 2001. As the Head of Adhesives R&D, his focus is on adhesives and filling composites.

The former student at Ulm University has published 19 publications in peer-reviewed journals, 26 patent families and over 30 presentations at international conferences to date.

In his spare time he likes hiking, cycling, skiing, languages, cooking, home improvement, gardening.