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Laboratory Evaluation of OptiBond™ Universal 360

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INTRODUCTION:

OptiBond™ Universal 360 is the next generation of universal adhesive from Kerr which combines a ternary solvent system with their patented GPDM monomer and a new addition of the MDP monomer. The ternary solvent includes water, ethanol and acetone in order to lower sensitivity, rewet dry dentin to lower technique sensitivity, and make it more compatible with dual- and self-curing cements to create a truly universal adhesive. MDP and GPDM are both in the same class of monomer known as functional phosphate ester monomer, but they have different strengths. MDP has more active chemical bonding sites meaning for each monomer it can create a slightly stronger chemical bond, while GPDM is more efficient at etching tooth structure for better performance without using a phosphoric etching treatment. Combined they may produce a stronger, more durable bond to tooth structure.

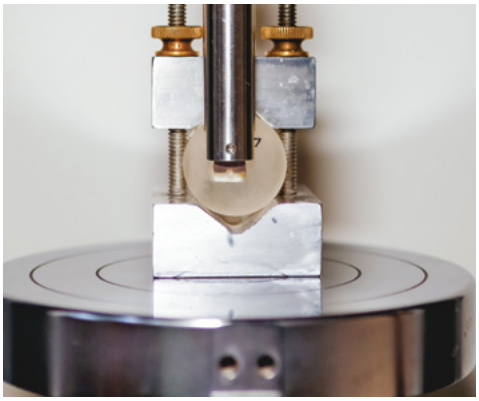
With the addition of MDP adhesive monomer technology to this product line, the bond performance of ***OptiBond Universal 360*** with artificial aging to the challenging substrates of dentin and zirconia were compared to competitive universal adhesives on the market. The main clinically relevant outcomes for bond studies of this nature are the measurements of the initial bond strength compared to the results after accelerated aging to get an idea of the bond durability over a period of time. This is an important screening test to make sure all of the components of these universal adhesives work in harmony as intended.

RESULTS SUMMARY:

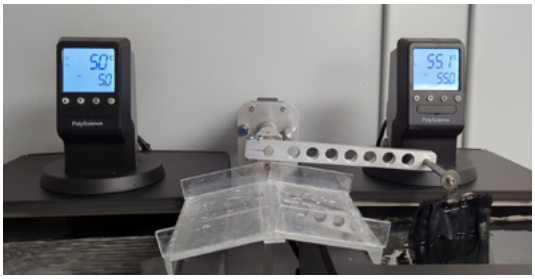
- **There was no drop in bond strength after artificial aging to dentin or zirconia with *OptiBond Universal 360*.**
- **High bond strengths were achieved to dentin and zirconia with *OptiBond Universal 360*.**

STUDY DESIGN:

Test methods for ISO 29022 also known as the Ultradent method were followed where a 2.38 mm cylinder of composite is placed on the treated surface. This creates a simple interface for evaluation where we create a defined area of bonding, and when the composite cylinder is debonded with a universal testing machine, we can measure the force divided by the surface area (N/mm^2) to define the bond strength in terms of MPa.



We used the same composite, ***Herculite™ XRV*** as a control for each, as different strengths and modulus of composite can impact the results when comparing different adhesives. Dentin and Zirconia surfaces are prepared by grinding up to 600-grit SiC paper until surfaces are flat to simulate the surface texture left by a fine rotary bur. The ***Katana™ Zirconia STML*** (Kuraray Noritake Dental, Inc.) was sandblasted with 3 bar (0.3 MPa) pressure and 50 µm particles as one of the most common surface treatments for zirconia. The dentin in this case was not etched with phosphoric acid so it is considered to be the self-etched mode for the adhesive. Testing these adhesives in the self-etch mode to dentin is important to evaluate the ability to penetrate the smear layer after preparation and create a stable adhesive interface.



Thermocycling:

Thermocycling of dental materials simulates the oral environment of the range of temperatures experienced when consuming hot and cold food and beverages. This also creates stress at the interface as the materials shrink and expand at different rates on either side of the interface creating cyclic fatigue over time. The 5,000 cycles in this study were performed over 2 weeks and simulate approximately 6 months of intraoral use. This is an important screening method to determine if there are any problems with the stability of the adhesive as the combination of hydrolytic degradation from water and stresses can accelerate debonding for some products.

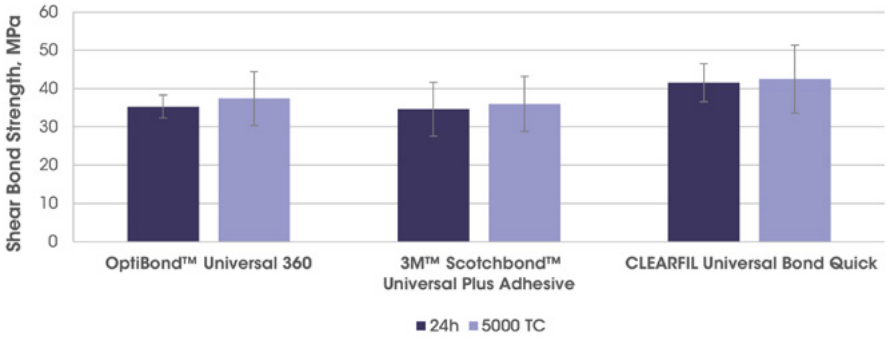
RESULTS:

Optibond Universal 360 **achieved over 30 MPa in bond strength to dentin and zirconia initially and with no decrease in bond strength after thermocycling. The goal for adhesive resin bonding is to have over 25 MPa for the most challenging indications which *Optibond Universal 360* surpassed.**

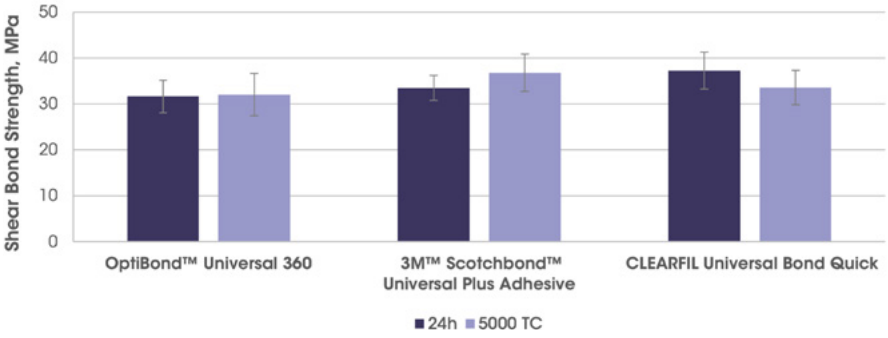
In comparison to the other universal adhesives on the market, there was no statistical difference between the different groups, meaning they all performed at a high level. In fact, after an analysis of what we call the failure mode to dentin of the adhesives shows that in many of these tests that a mixture of failures in either the dentin or composite occurred. This means that the adhesive strength at the interface created such a unified structure that the fracture during debonding took place somewhere other than the adhesive interface. **This indicates that the adhesive bond strength to dentin is near the maximum achievable in this test.**

Optibond Universal 360 now includes both MDP and GPDM monomers which can bond to both tooth structure and zirconia. The GPDM monomer itself has been shown to be more effective at etching tooth structure than MDP alone, while MDP has more active sites for enhanced chemical bonding. Together, they may prove to be more effective than either alone to effectively prepare the surface, seal, and bond to tooth structure.

Dentin:



Zirconia:



CONCLUSION:

OptiBond Universal 360 has excellent bond strength to dentin and zirconia, with no decrease in strength after thermocycling highlighting a durable bond. OptiBond Universal 360 performed as well as other competitive universal adhesives on the market to these substrates.

Research supported by Kerr Corporation.