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Research Report

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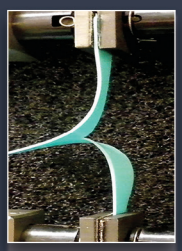

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Bond Strength Comparison of CLEARFIL Universal Bond Quick

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Purpose:

The purpose of this project was to compare the shear bond strength to ground dentin and enamel of a new bonding agent requiring a shorter application time with two other popular bonding agents.

Experimental Design:

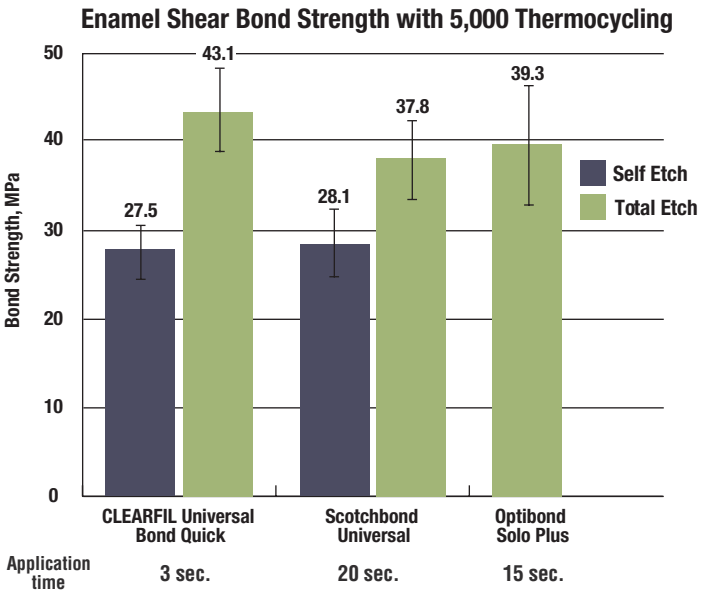
Materials and Conditions:

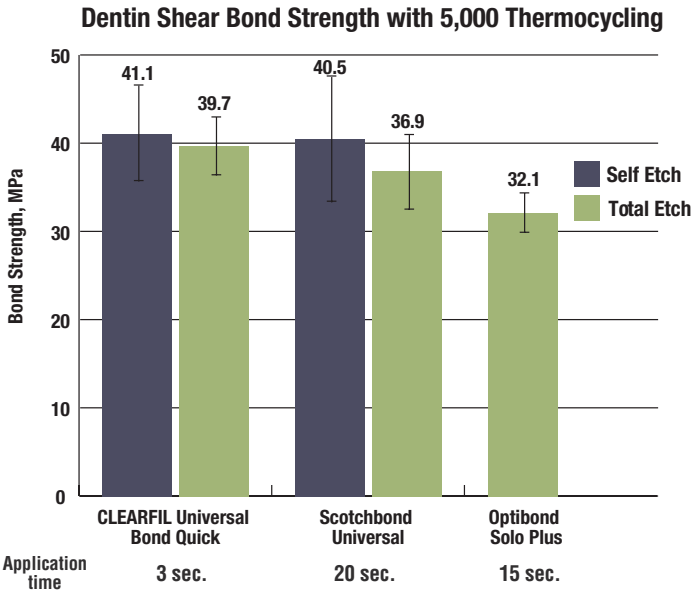
Product	Company	Lot	Etching Time	Application Time	Air Drying Time	Light Curing Time
CLEARFIL™ Universal Bond Quick	Kuraray Noritake Dental Inc.	T160128	10 s	**3 s**	5 s	10 s
K-ETCHANT Syringe, 35% Phosphoric Acid		1M0003				
OptiBond™ Solo Plus	Kerr Corp.	5738933	15 s	**15 s**	3 s	10 s
Kerr Gel Etchant, 37.5 % Phosphoric Acid		5702171				
Scotchbond™ Universal	3M Oral Care	618804	15 s	**20 s**	5 s	10 s
Scotchbond™ Universal Etchant 32 % Phosphoric Acid		621073				

Composite: ***TPH Spectra™ HV*** (DENTSPLY Caulk)
Light Curing Unit: ***Demi*** (Kerr Corp.), >1300 mW/cm²
Substrates: Ground adult human enamel and superficial dentin
Test: Ultradent Shear Bond Strength test (n = 5), 2.38 mm diameter cylinder
Storage Conditions: 24 h in 37 °C followed by 5000 thermal cycles, 5-55 °C in water
Etching Mode: ***CLEARFIL Universal Bond Quick*** (Kuraray Noritake Dental Inc.): Total-etch and Self-etch
OptiBond Solo Plus (Kerr Corp.): Total-etch
Scotchbond Universal (3M Oral Care): Total-etch and Self-etch

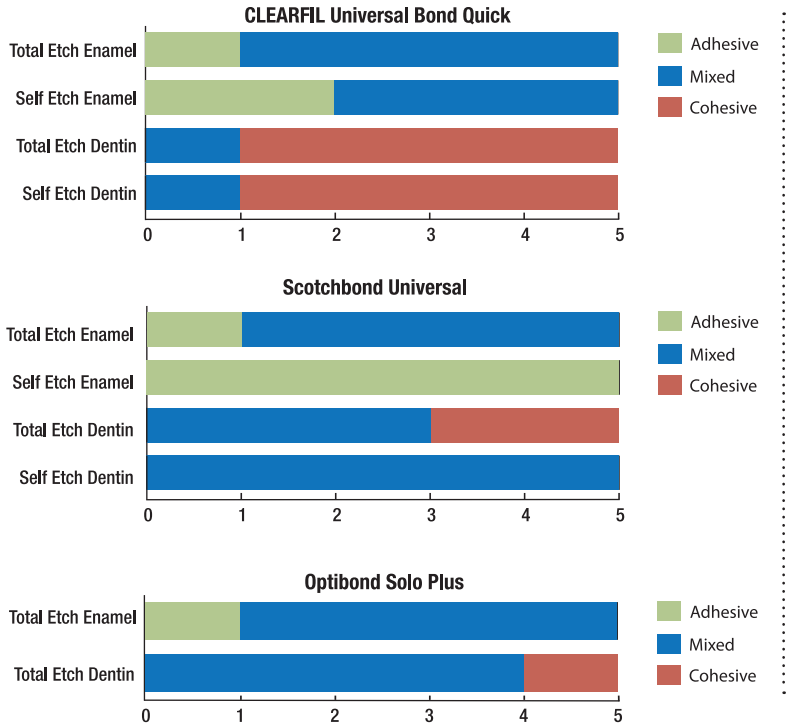
Methods:

Human third molars extracted within 3 months of testing, previously stored in sodium azide solution, then in saline and then in water, were embedded in resin and abraded on the facial surface through 600-grit (***Carbimet,*** Buehler, ~15 µm) SiC paper to form a bonding substrate of ground superficial dentin and ground enamel. Each specimen was then ultrasonically cleaned in deionized water for 5 minutes. Each specimen was prepared with the selected etching mode and bonding agent according to manufacturer's instructions, followed by direct placement of the composite material utilizing the Teflon Ultradent shear test mold and set-up jig. The specimens were stored for 24 h in 37 °C water and thermocycled between 5 and 55 °C water with a 20 second dwell time for 5000 cycles. The test specimens were debonded in shear on a universal testing machine (Model 5866 Instron) at a crosshead speed of 1.0 mm/min. Failure mode was determined with a 40x stereomicroscope by classification into categories of adhesive, mixed or cohesive failure. Adhesive failure occurs when greater than 95% of the substrate surface is clear of adhesive, cohesive failure in which there is no debonding and the failure was due to fracturing of the resin or substrate, and mixed failure in which both failure modes are apparent. Shear bond strength means and standard deviations and failure mode are reported.





5000 TC Failure mode



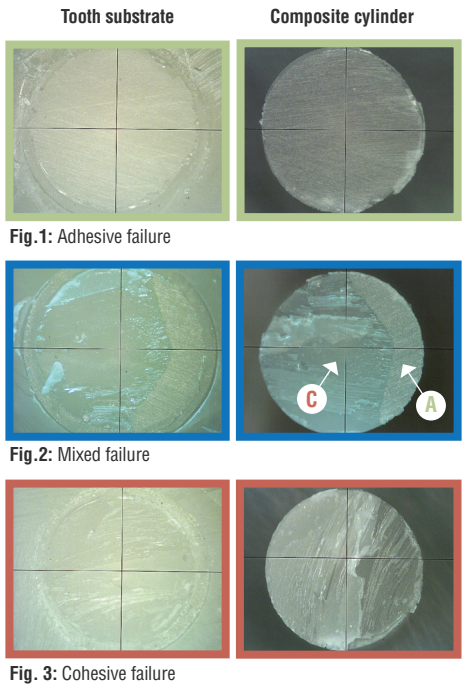


Fig.1: Adhesive failure

Fig.2: Mixed failure

Fig. 3: Cohesive failure

Adhesive failure (green above) indicates the failure occurred due to the bond strength of the bonding agent to the tooth. A cohesive failure (red above) on the other hand, indicates the bond strength was greater than the strength of materials used. A mixed failure (blue above) generally indicates the strength of the bonding agent and supporting materials were close enough to each other to exhibit both failure modes. Cohesive failure generally means the value reported for the bond strength is greater than measured due to early failure of the materials. The large number of cohesive failures in the dentin group for Clearfil Universal Bond Quick indicates the bond strength to dentin is even higher than reported.

Conclusion:

CLEARFIL Universal Bond Quick with a reduced application time of 3 seconds showed equivalent, or superior shear bond strengths compared to ***Scotchbond Universal*** and ***OptiBond Solo Plus*** after 5000 thermocycles.

