

Tokuyama Universal Bond Shear Bond Strength to Teeth and Zirconia

M. Cowen, J.M. Powers

Experimental Design:

Materials:

Bonding Agent: *Tokuyama Universal Bond* (Tokuyama Dental America, Inc.)

Composite: *Estelite Sigma Quick* (Tokuyama Dental America, Inc.)

Tests: direct shear bond strength tests

Substrates: Self-etched Superficial Dentin and total-etched Ground Enamel, IPS e.max ZirCad

Storage: 24 h in 37°C deionized water and 5000 thermocycles between 5-55 °C with a 20 s dwell time

Replications: Direct: n=8

Methods:

Pretreatment of Surfaces: Human, adult molars extracted within the last 2 months and sterilized in a 10% ethanol solution, were embedded in acrylic resin discs and ground through 600-grit SiC paper to form bonding substrates of superficial dentin and ground enamel. IPS e.max Zircad specimens were ground through 600 grit diamond abrasive, and air abraded with 50 µm alumina oxide at 30 psi pressure. Specimens were ultrasonically cleaned in deionized water for 5 minutes. Tooth specimens were preconditioned to 37 °C for at least 1 hour before use, and rinsed with 37 °C water after application of the 35% phosphoric acid etchant (3M) in the etched enamel group. *Tokuyama Universal Bond* was applied for 5 seconds with a micro-brush and immediately dried with mild air. *Estelite Sigma Quick* was then placed on top of the substrate utilizing the Ultradent Shear Test mold and jig according to ISO 29022 to produce a 2.38 mm diameter, 2 mm in height shear test cylinder. The cylinder was light cured for 20 seconds with an *Elipar Deep Cure-S* (3M) while in the mold. The specimens were then transferred to a 37°C water bath until testing or thermocycling and testing. Specimens were tested using an Instron 5866 universal tester with a 1 mm/min crosshead speed.

Results:

Tokuyama Universal Bond Shear Bond Strength, MPa		
Substrate	24 Hours	5000 Thermocycles
Self-Etched Dentin	28.9 (3.4)	36.0 (5.2)
Total-Etched Enamel	34.6 (3.0)	38.4 (4.7)
Zirconia	33.6 (4.3)	26.9 (1.7)

Means with Standard Deviations in Parentheses

Failure mode was adhesive to zirconia substrates. There were two dentin specimens in both 24 hour and thermocycling groups which had mixed failures through the dentin. Etched enamel specimens showed predominately adhesive failures with some stress lines evident on the enamel surfaces in specimens over 38 MPa, and 2 specimens with small edge failures (<20% area) through the composite-adhesive interface.

It was apparent that some voids were usually included in the adhesive layer for dentin specimens, but didn't appear to affect the resultant bond strength unless they were trapped at the substrate-adhesive interface. This may be due to the particularly quick drying effect that allowed the top surface to harden before solvent in dentin tubules was able to evaporate and escape the adhesive layer. An example of this appearance of bubbles is included in the appendix. Some voids were also included in the zirconia and enamel specimens, but were found to a much lesser degree and generally didn't affect the resultant bond strength. It is clear that the drying step is the most technique sensitive component of this bonding agent, particularly as it applies to dentin bonding. This bonding agent has exceptional wettability and can produce a glossy even surface after 3-5 seconds of mild air drying.

The information contained in this report is copyright protected by Dental Consultants, Inc., publisher of the DENTAL ADVISOR, and is intended for internal purposes only. Entitlement to use, reproduce or distribute this information is strictly prohibited without permission from Dental Consultants, Inc. Any use, reproduction or distribution without permission would be a copyright infringement. Copyright ©2018 - All rights reserved.

Conclusion:

The bond strength of **Tokuyama Universal Bond** to tooth structure after thermocycling was excellent. There may have been a small amount of continued polymerization after 24 h testing during the thermocycling process resulting in a higher bond strength to tooth structure. The bond strength to zirconia showed a moderate drop after thermocycling which similar to most other universal bonding agents. All average bond strengths were above 25 MPa and is comparable to other universal bonding agents on the market, but with a fast application time and no light curing needed.

Appendix:

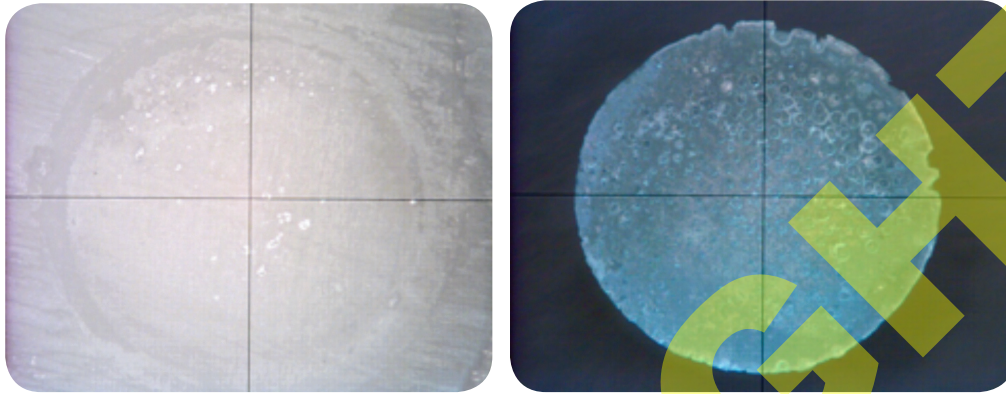


Fig. 1 - Debonded dentin surface and composite cylinder with transillumination which measured a 17MPa bond strength. This was the worst case seen and excluded from the results.



Fig.2: Example of a more typical result. Shown composite cylinder gave a 28 MPa bond strength to dentin after 24 hours. Some small bubbles are included in the adhesive but didn't have a large effect on the resultant strength.

.....
 The information contained in this report is copyright protected by Dental Consultants, Inc., publisher of the DENTAL ADVISOR, and is intended for internal purposes only. Entitlement to use, reproduce or distribute this information is strictly prohibited without permission from Dental Consultants, Inc. Any use, reproduction or distribution without permission would be a copyright infringement. Copyright ©2018 - All rights reserved.