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# Biomaterials Research Report

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# Novel Universal Cement Bond Strength to Multiple Substrates

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## Introduction:

***G-CEM ONE*** is the latest in a series of universal cements which may be used with or without an additional primer to a variety of surfaces. In this case, it also includes an additional *Adhesive Enhancing Primer* with touch-curing technology which allows rapid curing of the cement at the critical tooth interface to prevent gap formation and provide early bond strength. This study used a modified ISO/TS 11405:2015 method for testing cement indirect bond strength by using a single sided PTFE tape to create a 3 mm interface and cement is bonded to an opaque metal disc to test the self-curing capabilities of the cement. We tested this cement system to human dentin and enamel, zirconia and a lithium disilicate glass ceramic at 10 minutes, 24 hours and after artificial aging of 10,000 thermocycles.

## Experimental Design:

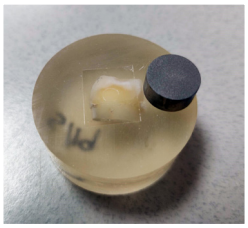
### MATERIALS:

***G-CEM ONE, G-CEM ONE Adhesive Enhancing Primer*** (AEP) and ***G-Multi Primer, RelyX Unicem 2 + RelyX Ceramic Primer, RelyX Ultimate + Scotchbond Universal*** (3M), ***Maxcem Elite + Silane Primer*** (KaVo Kerr), ***Panavia V5*** + ***Tooth Primer*** and ***Clearfil Ceramic Primer Plus*** (Kuraray)

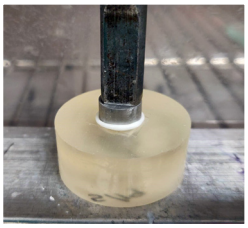
### TESTS:

**Substrates:** Human Dentin, Human Enamel, Initial LiSi Block and Initial Zirconia
**Storage Conditions:** immediate 10 minute test, 24 hours in water, 10,000 thermocycles

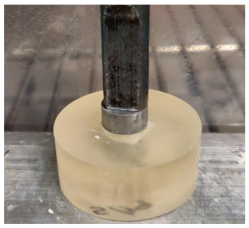
**Indirect Shear Bond Strength [n=8] to dentin, enamel, Initial LiSi Block and Initial Zirconia:** Molars, sterilized in a 1% chloramine solution, and stored in deionized water were embedded in acrylic resin discs and ground through 600-grit SiC paper to form bonding substrates of superficial dentin and ground enamel. *Initial Zirconia* and *Initial LiSi Block* plates were cut to be ~12 mm x 12 mm x 2-3 mm thick, processed according to manufacturer instruction, embedded in acrylic resin discs, finished through 600 grit diamond paper, and surfaces treated according to manufacturer instructions. The surface treatment was 9.6% hydrofluoric acid for 20 seconds to *Initial LiSi Block* and sandblasting with 4 bar (0.4 MPa) pressure and 50 µm particles to *Initial Zirconia*. Test groups for adhesive bonding had their surfaces treated. Specimens were then prepared in which single-sided adhesive PTFE tape, ~0.10 mm thick, with an approximately 3 mm diameter hole is placed over the bonding site and burnished into place. 10 mm diameter metal cylinders were ground with 60 grit SiC Paper, sandblasted, and primed to simulate an indirect restoration which should have a higher bond strength than the substrate being tested. A dab of the cement was placed in the center of the metal cylinder and the cylinder gently applied concentric with the hole with finger pressure before being placed in a loading jig where a 1 kg weight was applied at room temperature. The excess cement was removed by cotton without light and the load was removed then transferred to a 37°C, 100% R.H. oven carefully and dwelled for 10 minutes. One test group was then tested, one group was then transferred to a container with 37 °C water for 24 hours and one group was thermocycled for 10,000 cycles between 5 and 55°C water. The shear bond strength test was performed on a universal testing machine (Instron model 5866) at a crosshead speed of 1 mm/min. Means and standard deviations of bond strength were calculated and reported in the results section. Data were analyzed by ANOVA and Fisher's PLSD at the 0.05 level of significance.



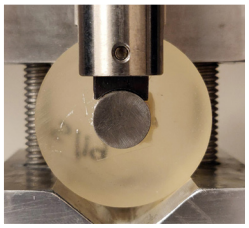
**After surface treatment, tape with 3 mm hole is applied, and cement is applied to disc and placed over the hole.**



**Disc is loaded with 1 kg load.**



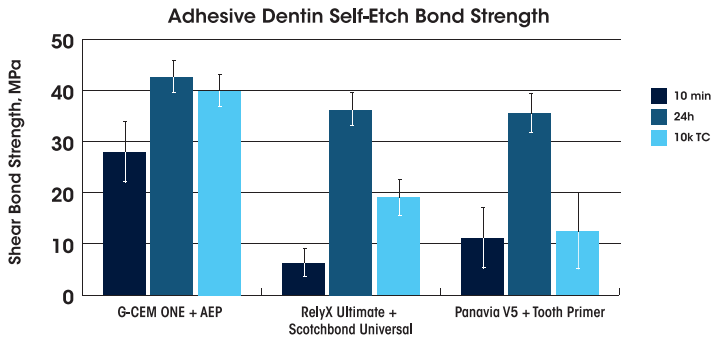
**Cement is removed under load before continuing to cure in ~99% R.H. chamber for 10 minutes before testing or placed in water.**

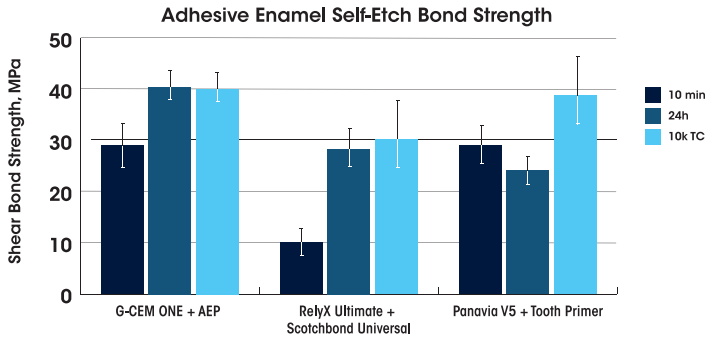


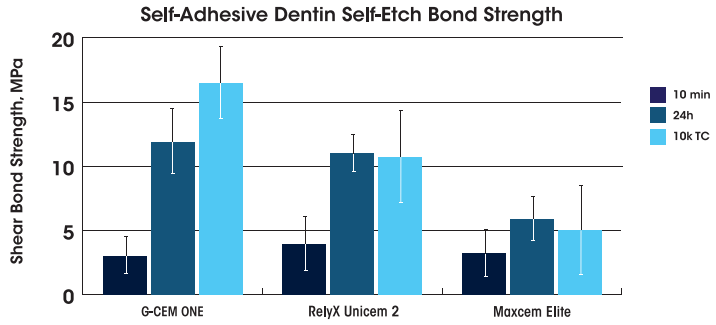
**Shear bond test is conducted with 1 mm/min crosshead speed using an Instron model 5866.**

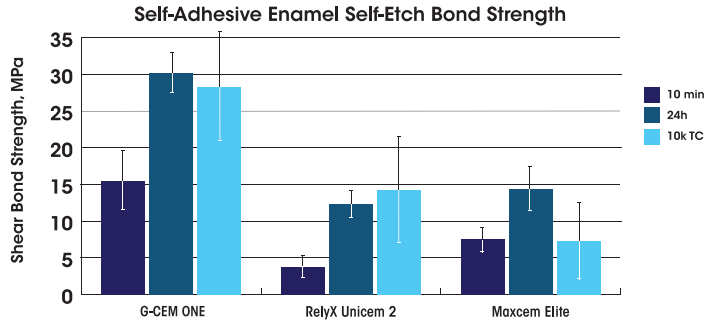
 

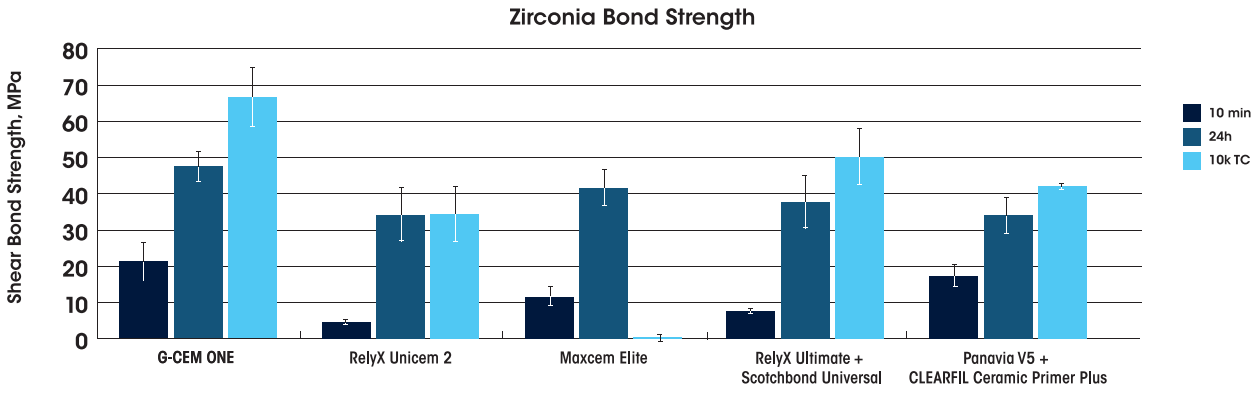
## Results:

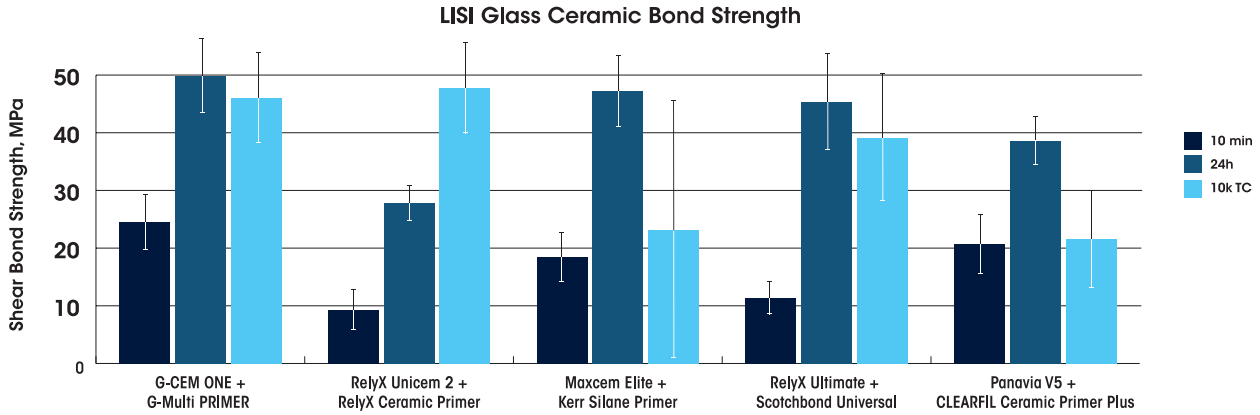



## Conclusion:

***G-CEM ONE*** has exceptional bond strength durability after thermocycling to all substrates tested, and high initial bond strength after limited curing time in combination with the *Adhesive Enhancing Primer* including touch curing technology.

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