

Veneer Cement Bond Strength Durability and Resistance to Toothbrush Abrasion

M. Cowen, J.M. Powers

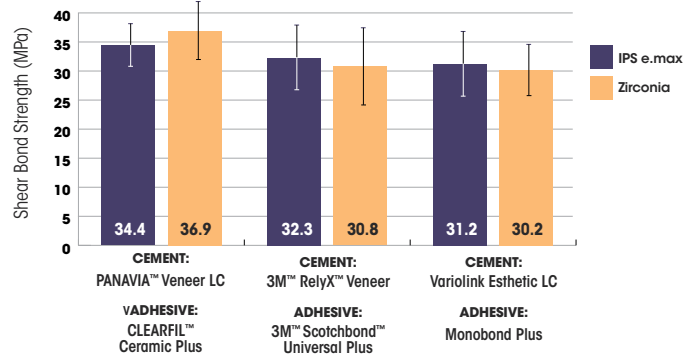
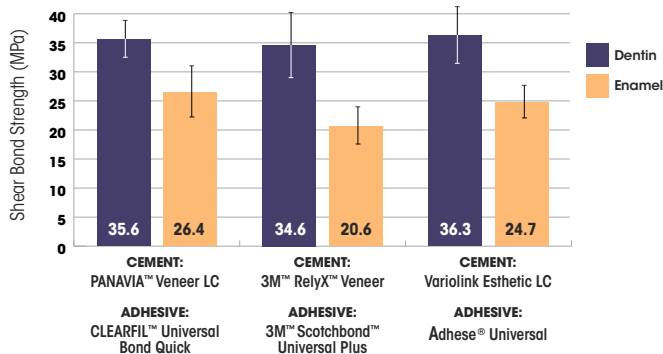
INTRODUCTION:

Veneer Cements are specialized cements for demanding esthetic cases in which any color change over time is the most apparent and mechanical retention and bonding surface area is at a minimum. Ideally, esthetic veneer cements should have a long working time, curing on demand, excellent color stability, and high strength. Veneer restorations, inlays and onlays differ from other indirect restorations in that there is a relatively larger margin exposed compared to the size of the restoration, while more margin is often directly exposed to toothbrush abrasion rather than being protected by gingiva. Over time, toothbrush abrasion and chemical attack may wear enough of the cement margin to allow increased staining to occur, bacteria to accumulate or present a change in gloss which can show an unsightly cement margin.

In this study, we compared the bond strength of three veneer cements after six months of artificial aging to Dentin, Enamel, **IPS e.max CAD** (Ivoclar Vivadent, Inc.) and **KATANA™ STML** (Kuraray Noritake Dental, Inc.) Zirconia. We also tested the resistance to toothbrush abrasion, simulating about 5.5 years of regular toothbrush use while measuring the depth of wear, change in surface roughness and gloss.



Bond Strength Results After Artificial Aging (5000 Thermocycles)



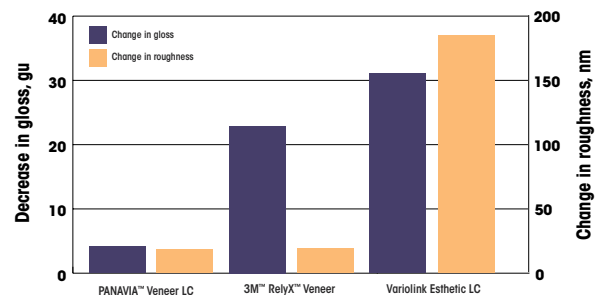
Panavia™ Veneer LC with **CLEARFIL Universal Bond Quick** and **CLEARFIL Ceramic Primer Plus** had equivalent or higher bond strength to the Dentin, Enamel and Lithium Disilicate substrates tested after six months of thermocycling simulated aging to the other two cement systems. **Panavia™ Veneer LC** with **CLEARFIL Ceramic Primer Plus** has the highest bond strength to zirconia (ANOVA and Tukey multiple comparison test, $p > 0.05$). All cement systems showed good adhesion after thermocycling, indicating sufficient curing light penetration through the zirconia disc used in this study.

PANAVIA™ Veneer LC had the best gloss retention of the three cements tested and a very even wear pattern. Having limited surface roughness after toothbrush abrasion can help lower staining and bacterial adhesion, with an average roughness of under 100 nm being ideal to prevent staining and bacterial adhesion. The final roughness after abrasion was under 50 nm for both **PANAVIA Veneer LC** and **3M™ RelyX™ Veneer**, while **Variolink Esthetic LC** had a roughness of over 200 nm. Variolink Esthetic LC had the presence of up to 3-micron diameter surface voids after toothbrush abrasion, likely due to larger filler clusters being removed.

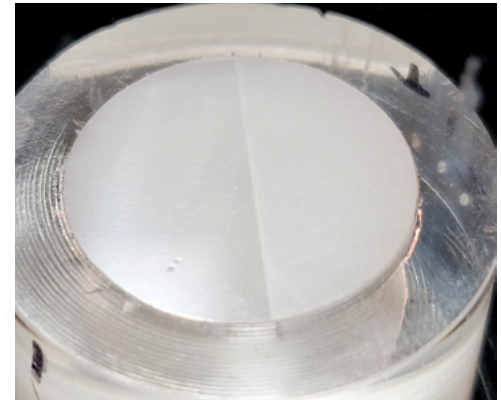
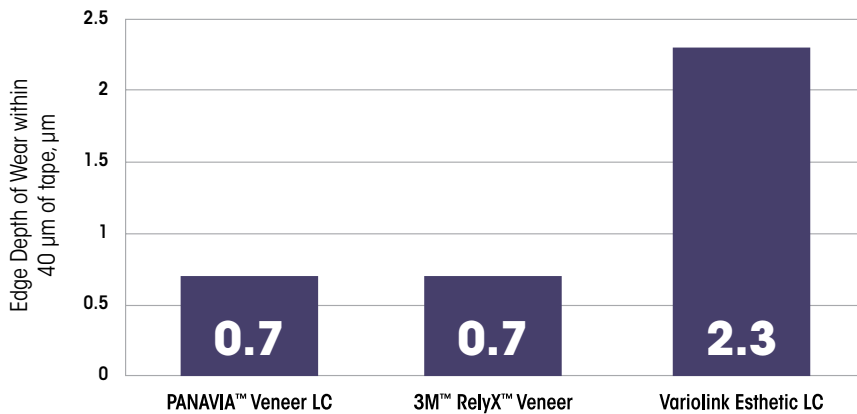
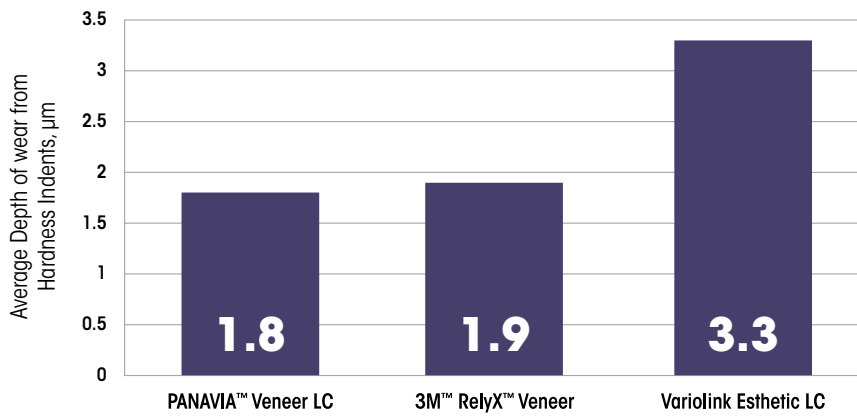
CONCLUSION:

PANAVIA™ Veneer LC cement system showed excellent adhesion properties and exceptional gloss retention and wear resistance. Due to its excellent properties, **PANAVIA™ Veneer LC Paste** can meet the most challenging esthetic conditions of veneer cementation.

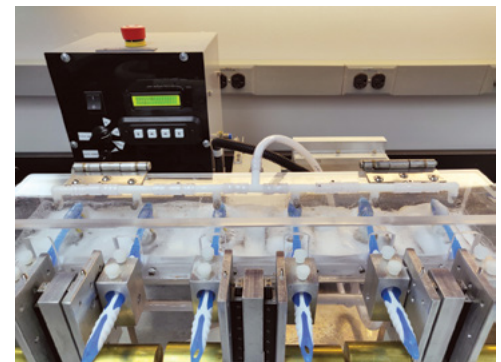
Change in Gloss and Roughness after Toothbrush Abrasion



Depth of Wear and Hardness

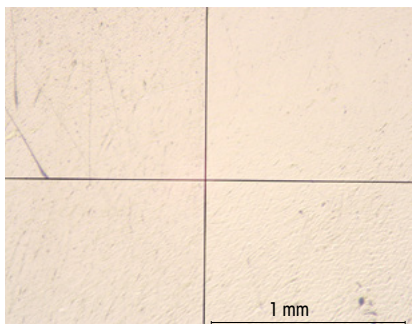


Example of a cement specimen after toothbrush abrasion, with the polished surface (~86 gu) on the left, and abraded surface (~63 gu) on the right.

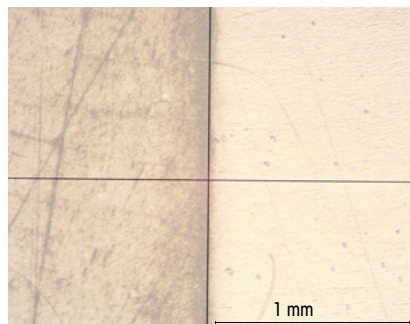


Proto-tech Advanced Toothbrush Simulator
The specimens were subjected to the equivalent of over 5 years of toothbrush abrasion in a figure-8 pattern.

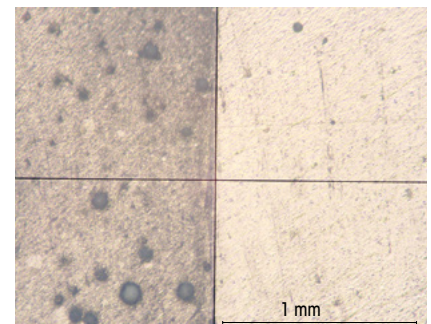
PANAVIA™ Veneer LC



3M™ RelyX™ Veneer



Variolink Esthetic LC



Appearance of surface gloss at 10X magnification after toothbrush abrasion (initial right, final left) **PANAVIA™ Veneer LC** has almost indistinguishable gloss difference after tooth brush abrasion.

Research supported by Kuraray Nortitake Dental, Inc. Special thanks to the University of Michigan College of Engineering and the Michigan Center for Materials Characterization for use of the instruments and staff assistance.