Bond Strength of Resin Cements to Zirconia after Surface Treatments

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INTRODUCTION

Air-abrasion with glass beads may reportedly be less likely to weaken cubic-containing zirconia compared to aluminum oxide. However, the effect of air-abrasion with glass beads on the bond strength of resin cement to cubic-containing zirconia is less known.

OBJECTIVE

The purpose of this study was to evaluate the effects air abrasion on the shear bond strength of resin cement to three types of zirconia: 5Y-PSZ, Katana UTML, Shade A2, Noritake; 4Y-PSZ, Katana STML, Shade A2; and 3Y-TZP, Katana ML, Shade 1.5-2.

MATERIALS and METHODS

Thirty block specimens (8x8x3.5mm) were milled out of each zirconia material and mounted in plastic pipe. Ten specimens of each of the zirconia materials were air-abraded (Basic Quattro IS, Renfert) using 50µm aluminum-oxide particles (Ney, Dentsply Ceramco) at 2.0 bar for 10 seconds; ten specimens were abraded using 80µm glass beads (Williams Glass Beads, Ivoclar Vivadent); and ten specimens served as a control and received no surface treatment. A 10-MDP primer (Z-Prime Plus, Bisco) was applied to the top surface of the zirconia specimens. Composite discs (Z250, 3M ESPE) were bonded using a resin cement (NX3, Kerr) and light cured. The specimens were stored in 37° C distilled water for 24 hours and then thermocycled for 2,500 cycles at 5° C and 55° C (Sabri Dental Enterprise). The specimens were loaded in shear on a universal testing machine (Instron). Data were analyzed with a two-way ANOVA/Tukey post hoc test (alpha = 0.05).

MATERIALS and METHODS (cont.)

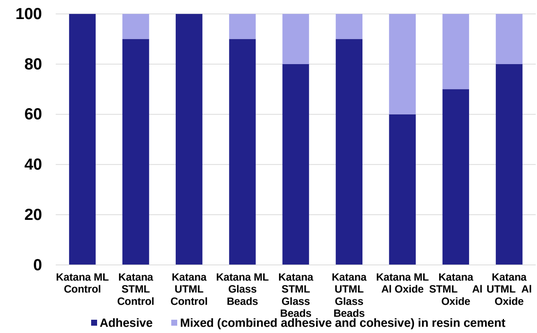
Specimens were examined using a 10X stereomicroscope to determine failure mode as either: 1) adhesive fracture at the resin cement/zirconia interface, 2) cohesive fracture in resin cement, or 3) mixed (combined adhesive and cohesive) in resin cement.

RESULTS

A significant difference in shear bond strength was found based on surface treatment ($p<0.001$), but not on zirconia type ($p=0.132$), with no significant interaction ($p=0.98$). See table. More mixed failures were observed with aluminum oxide air-abrasion. See bar graph.

Surface Treatment	Shear Bond Strength MPa (st dev)		
	Katana ML	Katana STML	Katana UTML
Control	6.0 (1.5) Aa	5.1 (1.3) Aa	6.4 (1.4) Aa
Al Oxide	13.4 (3.8) Aa	11.8 (4.1) Aa	12.9 (3.4) Aa
Glass Beads	5.9 (1.7) Ab	4.8 (1.0) Ab	5.6 (1.1) Ab

Groups with the same upper case letter per row or lower case letter per column are not significantly different (p>0.05)



Failure Modes

CONCLUSIONS

Air-abrasion with glass beads or no surface treatment resulted in significantly lower bond strengths of the resin cement to all three zirconia types compared to air-abrasion with aluminum oxide.