



Title	A Novel Silane Primer System Approach for Resin Zirconia Bonding
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A NOVEL SILANE PRIMER SYSTEM APPROACH FOR RESIN ZIRCONIA BONDING

OBJECTIVE: To investigate the effect of two cross-linking silanes blended with 3-acryloxypropyltrimethoxysilane on the shear bond strength between resin cement and silica-coated zirconia.

MATERIALS AND METHODS: 90 specimens of zirconia (Nobel Biocare) were subjected to silica-coating by Rocatec Plus (3M ESPE, 110 μm) sand at an operation pressure of 280 kPa, for 30 s/cm². 3M ESPE Sil-silane (3M ESPE) was used as a control. Primers of 1.0 vol% of 3-acryloxypropyltrimethoxysilane (ACPS), with 0.5 vol% cross-linking silanes bis-1,2-(triethoxysilyl) ethane (BTSE; Gelest) and bis[3-(trimethoxysilyl)propyl] amine (BTMA; ABCR) were prepared in a 95% ethanol and 5% deionised-water solvent mixture. The solutions were applied onto silica-coated zirconia surfaces and allowed to react for 5 min. RelyX resin cement (3M ESPE) was introduced into cylindrical stubs onto the zirconia surface and light-cured for 40 s twice. Half of the specimens were subjected to shear bond strength testing after dry storage and the other half after thermo-cycling for 6000 cycles, in an Instron machine. The silanized surfaces were analyzed with X-ray photoelectron spectroscopy. Data were compared with one-way ANOVA (significance level $\alpha=0.05$).

RESULT: There was no significant difference in mean shear bond strengths between control silane and ACPS blended with either of the two cross-linking silanes after dry storage ($p>0.13$). However, there was a significant difference in shear bond strengths after thermo-cycling ($p<3.8\times 10^{-8}$); ACPS+BTMA exhibited the highest shear bond strength (Table 1). Failure mode analysis suggested predominantly adhesive failure.

Silane	Mean shear bond strength \pm SD / MPa					
	Dry	Thermocycling (6000 cycles)	Debonding /%	Adhesive /%	Mixed %	Cohesive /%
Control	10.3 \pm 1.7	10.5 \pm 2.4	0	93.3	6.7	0
ACPS+BTSE	11.8 \pm 3.5	5.8 \pm 2.2	0	53.3	6.7	40.0
ACPS+BTMA	9.8 \pm 2.8	13.9 \pm 4.2	0	93.3	6.7	0

CONCLUSION: An experimental primer of a combination of an organofunctional silane and a cross-linking-silane may promote superior bonding than the control silane product.