bond strengths that were significantly higher than those with grinding and sandblasting. Gel-type acid etchants are simple to use without the risk of damaging delicate marginal areas of silica-based ceramic restorations. The authors suggest etching and silanating the ceramic surface after try-in procedures to avoid contamination. Various ceramic-silane combinations revealed differences in their susceptibility to hydrolytic degradation. These findings emphasize the need for proper material selection and combination to obtain long-term durable resin bonds. The large number of variables and influential parameters applied in this study limits detailed rankings of specific materials and methods.

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SHEAR BOND STRENGTH TO FELDSPATHIC PORCELAIN OF TWO LUTING CEMENTS IN COMBINATION WITH THREE SURFACE TREATMENTS

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ABSTRACT

Objective: This in vitro study evaluated bond strength and durability of various ceramic bonding systems bonded to feldspathic porcelain.

Materials and Methods: Eighty pairs of feldspathic porcelain disks (VMK 68®, Vita Zahnfabrik, Bad Säckingen, Germany) were used as substrate material. They were wet ground with SiC paper, air abraded for 10 seconds with 50 µm aluminum oxide particles, and etched for 5 seconds with 40% phosphoric acid gel. Clapearl Bonding Agent®, Clearfil Porcelain Bond®, and Panavia Ceramic Primer® (all Kuraray Co. Ltd., Tokyo, Japan) were applied to the prepared surfaces. The remaining 20 pairs of specimens were used as controls, receiving no primer treatment. Half the specimens in each group were luted with the autopolymerizing resin cement Panavia 21® (Kuraray) and the other half with the dual-polymerizing resin cement Clapearl DC® (Kuraray). Five specimens per group were stored in water for 24 hours, and the other five specimens were subject to thermocycling for 20,000 cycles before shear bond strength testing.

Results: Before thermocycling, bond strengths of all cement systems using Clapearl DC luting agent were comparable, whereas bond strengths of the groups using Panavia 21 revealed significant differences. After thermocycling, Clapearl DC cement exhibited a greater bond strength than did Panavia 21 when the primer was the same. Bond strength with Clapearl DC was not affected by the priming agent used. The bond strengths were extremely low in both control groups. Failure modes were significantly affected by the combination of priming agent, luting cements, and thermocycling.

Conclusion: The results of this study suggest that bond strength of ceramic bonding systems is poor in the absence of a priming agent. The dual-polymerizing resin cement Clapearl DC was significantly stronger and more durable than was Panavia 21, regardless of the primer used, before and after thermocycling. Thermocycling had mixed effects on the priming/luting agents used.

COMMENTARY

This study indicates the necessity for silane coupling and bonding agents to provide strong and durable bonds of composite resin cements to pretreated feldspathic ceramic surfaces.

Silane coupling agents provide covalent chemical bonds to silica-based ceramics and have a wetting effect on roughened ceramic surfaces, facilitating the use of a bonding agent/unfilled resin. The autopolymerizing resin cement had significantly lower bond strengths than did the dual-cure resin cement. However, it could not be determined whether this was due to their specific compositions and/or curing modes. The proper combination of the components of a bonding/luting system seems to be key for predictable results. Components of different ceramic bonding systems might not be compatible and should therefore not be interchanged. The varying effects of thermocycling on the performance of the different material combinations demonstrate the necessity for such parameters to simulate intraoral conditions and to evaluate the durability of resin bonds.

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BOND DURABILITY OF THE RESIN-BONDED AND SILANE-TREATED CERAMIC SURFACE

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ABSTRACT

Objective: This study evaluated methods to improve the bond strength of silanes to silica-based ceramics to eliminate the hazardous process of hydrofluoric acid application.

Materials and Methods: A leucite-reinforced feldspathic ceramic was fired onto NiCr alloy rods. The ceramic surfaces were uniformly wet ground, polished, and ultrasonically cleaned in acetone. Two hundred ten specimens were divided into seven groups of different silane-solution application methods:

1. Ceramic immersed in silane for 1 minute and dried at room temperature with compressed air for 15 seconds
2. Ceramic immersed in silane for 1 minute and dried at 100°C in a furnace for 2 minutes
3. Silane applied for 60 seconds with a brush and dried at room temperature with compressed air for 15 seconds
4. Same as group 3 but heated to 100°C for 2 minutes
5. Same as group 3 but hot-air dried at 50 ± 5°C for 15 seconds
6. Same as group 5, followed by rinsing of the specimens with boiled water at 80°C for 15 seconds and hot-air drying for 30 seconds
7. Same as group 6, with the additional application of a thin layer of unfilled resin by brush

Three additional groups of 30 specimens were fabricated for comparison with the results of the polished ceramic surfaces:

8. Same as group 7, then grit blasted with 50 μm aluminum oxide particles
9. Same as group 7, then etched with 10% hydrofluoric acid for 2 minutes
10. Same as group 7, then grit blasted and etched as with groups 8 and 9

All specimens were bonded with a dual-cured luting resin. The durability of the bond was evaluated by water storage at 37°C for up to 3 months, thermal cycling, and storage in 100°C water for 24 hours. Bond strengths were evaluated with a tensile testing device.

Results: Comparisons of the silane application procedures showed