Short Communication

Shear Bond Strength of a New Resin Bonding System to Different Ceramic Restorations

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This study evaluated the shear bond strength of a newly developed resin bonding system, including single-liquid ceramic primer and dual-cured resin luting agent, to 5 ceramic materials (feldspathic porcelain, machinable ceramic, In-Ceram Alumina, Procera AllCeram alumina, and Cercon). Ceramic specimens were cleaned with phosphoric acid, treated with primer, and bonded with a resin luting agent. Shear bond strength was determined after 24 hours of immersion in water and/or 10,000 thermocycles. There were no significant differences in bond strength before and after thermocycling for the 5 ceramic materials ($P > .05$). The findings indicate that the resin bonding system may offer an acceptable performance in terms of clinical success for the 5 ceramic restorations. *Int J Prosthodont 2007;20:417–418.*

Recent progress in technology and research related to new dental materials has resulted in an increased number of materials commercially available for esthetic restorations. Further, there is an ever-increasing demand for metal-free restorations.[1] Ceramics have the capacity to replicate the esthetically pleasing characteristics and vitality of natural teeth. In addition to feldspathic porcelain for laminate veneers and ceramic inlays/onlays, machinable glass ceramic, glass-infiltrated alumina ceramic, densely sintered high-purity alumina ceramic, and zirconia ceramic are widely used in clinical practice. Dual-cured resin luting agents are characterized by high mechanical strength and excellent esthetic properties.[2] The long-term prognosis for prosthetic metal-free ceramic restorations is largely a function of the choice of ceramic primer and cementing agent, durability, and content of the adhesive bond.[3] Recently, a new resin bonding system that includes single-liquid ceramic primer and a dual-cured resin luting agent for cementing all types of ceramics has been developed. This study evaluated shear bond strength and bonding durability of this system to 5 ceramic materials.

Materials and Methods

Five ceramic materials were examined: feldspathic porcelain (Vintage, Shofu); machinable ceramic (Cerec Vitablocs Mark II, Vita); In-Ceram Alumina (Vita), Procera AllCeram alumina (Nobel Biocare); and Cercon (DeguDent). Two ceramic disks of different sizes (diameters of 10 mm and 8 mm and thickness of 2.0 mm) were fabricated according to the manufacturer's instructions. The ceramic specimen surfaces were ground with no. 1,200 carbide paper, treated with 40% phosphoric acid gel (Kuraray) for 10 seconds, and air dried for 5 seconds. A piece of polyethylene tape with a circular hole 4 mm in diameter was positioned on the surface of the 10-mm-diameter ceramic specimen to control the bonding area. The surfaces of both specimens were treated with single-liquid ceramic primer (Clearfil Ceramic Primer, Kuraray), and then automix dual-cured resin luting agent paste (Clearfil Esthetic Cement, Kuraray) was placed within the circle on the 10-mm-diameter ceramic surface. Subsequently, the 8-mm-diameter ceramic specimen was placed on the resin paste to control the cement film thickness to approximately 50 μm. The resin luting agent was irradiated from 4 directions for 20 seconds, for a total exposure time of 80 seconds, using a visible light–curing unit (Candelux VL-5, Morita).

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Table 1 Shear Bond Strength of the Newly Developed Resin Bonding System to 5 Ceramic Materials*

	Mean shear bond strength ± SD (MPa)	
Ceramic material	Thermal cycle 0	Thermal cycle 10,000
Vintage	35.1 ± 9.0	34.1 ± 2.9
Vitablocs Mark II	41.7 ± 1.6	40.1 ± 2.0
In-Ceram Alumina	41.7 ± 5.0	37.4 ± 2.3
Procera AllCeram alumina	43.0 ± 2.6	38.6 ± 6.1
Cercon	45.5 ± 2.2	41.2 ± 5.1

*No significant differences were found between shear bond strength before and after thermocycling (Student *t* test, $P > .05$).

The specimens were allowed to stand for 30 minutes at room temperature. They were then assigned randomly to 2 subgroups of 7 specimens each: 24-hour immersion in water for the control group or followed by 10,000 thermal cycles between water baths held at 4°C and 60°C with a dwell time of 1 minute in each bath. Shear tests were performed with a universal testing machine at a crosshead speed of 0.5 mm/minute. Data were separately analyzed for each of the 5 ceramic materials using 1-way analysis of variance and the 2-group Student *t* test at a significance level of $P = .05$.

Results and Discussion

The shear bond strength of the developed resin luting agent to 5 ceramic materials treated with single-liquid ceramic primer was significantly higher than that previously reported,[4] and bonding durability after thermocycling was obtained for 5 ceramic materials. There were no significant differences between bond strength before and after thermocycling regardless of the ceramic materials (Table 1). Single-liquid ceramic primer contains γ-methacryloxypropyl-trimethoxy silane (γ-MPTS), 10-methacryloxydecyl dihydrogenphosphate (MDP), and ethanol, with no water. γ-MPTS was effective for bonding between resin luting agent and silica-based ceramics such as feldspathic porcelain, machinable glass ceramic, and glass-infiltrated alumina ceramic.[5] MDP may react on the surface of alumina and zirconia ceramics similarly to γ-MPTS. A dual-cured resin luting agent not containing adhesive monomer is preferable for ceramic restorations using a ceramic primer containing both γ-MPTS and MDP.

Conclusion

Within the limitations of this study, the newly developed single-liquid ceramic primer and dual-cured resin luting agent maintained good bond strength over 34 MPa after 10,000 thermocycles for 5 different ceramic restorations.

References

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