Shear bond strengths of pressed and layered veneering ceramics to high-noble alloy and zirconia cores

Motoaki Ishibe, DDS,[a] Ariel J. Raigrodski, DMD, MS,[b] Brian D. Flinn, PhD,[c] Kwok-Hung Chung, DDS, MS, PhD,[d] Charles Spiekerman, PhD,[e] and Robert R. Winter, DDS[f]
University of Washington, Seattle, Wash

Statement of problem. Heat-pressed ceramics to metal alloys and zirconia have been available for some time. However, information regarding their shear bond strengths is limited.

Purpose. The purpose of this study was to evaluate the shear bond strengths of heat-pressed and layered ceramics with regard to their corresponding high-noble alloy and zirconia cores.

Material and methods. Forty cylinders (approx. 5 mm in diameter) of high-noble alloy (Olympia) were cast and divided into 4 groups (n=10). Metal cylinders were veneered with ceramics to produce shear test specimens: Group PMI with IPS InLine POM; Group LMI with IPS InLine; Group PMC with Pulse press-to-metal; and Group LMC with Authentic Pulse Metal ceramic. Forty cylinders (approx. 5 mm in diameter) of zirconia (Lava) were obtained and divided into 4 groups (n=10). These cylinders were veneered with ceramics to produce shear test specimens: Group PZI with IPS e.max ZirPress; Group LZI with IPS e.max. Ceram; Group PZV with VITA PM9; and Group LZV with VITA VM9. The veneering ceramics, 3 mm in thickness, were either pressed or layered to their corresponding cylinders. Thermal cycling was performed at 5°C and 55°C for 20,000 cycles with a 20 second dwell time. Shear bond strength testing was conducted in a universal testing machine, and the failure strengths were recorded. Fracture surfaces were characterized visually, under a stereomicroscope, and with a scanning electron microscope (SEM). Data were analyzed using rank-based Kruskal-Wallis and Mann-Whitney tests with Bonferroni correction to adjust for multiple comparisons (α=.05).

Results. For metal ceramic specimens, the mean (SD) shear bond strengths ranged from 37.8 (20.6) MPa to 66.4 (22.1) MPa. There were significant differences between Groups PMI and PMC and between Groups LMI and PMC, in which Groups PMI and LMI had significantly higher strength values than Group PMC (P=.041). For zirconia ceramic specimens, the mean (SD) shear bond strengths ranged from 30.03 (9.49) MPa to 47.2 (13.0) MPa, with Group LZV having a significantly higher shear bond strength value than Group LZI (P=.012). Half of the Group PZV specimens failed during thermal cycling, and Group PZV was, therefore, excluded from statistical analysis. For all shear bond strength testing specimens, cohesive failures in the veneering ceramics were observed.

Conclusions. For shear bond strength of veneering ceramics to high-noble alloy, there was no significant difference between pressing and layering with the same manufacturer. For shear bond strength of veneering ceramics to zirconia, there was no significant difference between the pressed and layered groups. (J Prosthet Dent 2011;105:29-37)

Clinical Implications

The results of this in vitro study suggest that, for shear bond strength, clinicians and dental laboratory technicians should consider the use of pressed ceramics to high noble alloy and zirconia as an alternative to traditional layering procedures.

[a]Graduate student, Graduate Prosthodontics, Department of Restorative Dentistry, School of Dentistry.
[b]Professor and Director, Graduate Prosthodontics, Department of Restorative Dentistry, School of Dentistry.
[c]Research Associate Professor, Materials Science and Engineering.
[d]Professor, Department of Restorative Dentistry, School of Dentistry.
[e]Research Associate Professor, Department of Dental Public Health Sciences.
[f]Affiliate Professor, Graduate Prosthodontics, Department of Restorative Dentistry, School of Dentistry.