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CAD-CAM Resin-Based Crown Materials Bond Strength to Polyetheretherketone and Titanium

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Objectives To evaluate the effect of additively or subtractively manufactured restorative material type on the shear bond strength (SBS) to different abutment materials and failure modes.

Methods One hundred and ten disk-shaped specimens (Ø3 mm×3 mm) were fabricated by using 3 additively (AM_CT, AM_FP, and AM_VS) and 2 subtractively (SM_GC and SM_BC) manufactured resin-based materials. After allocating 2 specimens from each group for scanning electron microscope evaluation, the specimens were divided according to the abutment material (polyetheretherketone [PEEK] and titanium [Ti]) (n=10). All specimens were abraded with 50 µm aluminum oxide. After applying a resin primer to PEEK and an adhesive primer to Ti specimens, a self-adhesive resin cement was used for cementation. All specimens were stored in distilled water (24 hours, 37°C) and a universal testing device was used for the SBS test. SBS data were analyzed with 2-way analysis of variance and Tukey honestly significant difference tests were, while the homogeneity of failure modes was assessed with chi-square test. Pearson's correlation test was used to investigate the correlation between the SBS values and failure modes ($\alpha=.05$).

Results Material type, abutment type, and their interaction affected the SBS ($P<.001$). When PEEK was used, SM_GC and SM_BC had the lowest and AM_VS had the highest SBS ($P<.001$). When Ti was used, SM_GC had the lowest SBS followed by SM_BC ($P<.001$). AM_VS had higher SBS when cemented onto PEEK and SM_BC had higher SBS when cemented onto Ti ($P<.001$). There was a weak positive correlation ($r=.380$, $P<.001$) between the SBS values and failure modes, which were mostly adhesive.

Conclusions Regardless of the abutment material, additively manufactured specimens had higher bond strength and one of the subtractively manufactured materials (SM_GC) mostly had lower bond strength. The abutment material had a small effect on the bond strength. Adhesive failures were observed more frequently.