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Composite-Cement, Abutment-Chimney-Height and Surface-Treatment Affect the Bond-Strength of the Polyetheretherketone-Abutment-Interface

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Objectives The aim of the present study was to investigate whether (i) the brand of composite-cement, (ii) the chimney height and (iii) different surface-treatments of the polyetheretherketone crowns affect the bond-strength of the polyetheretherketone crown-abutment interfaces.

Methods 480 screw-fixed polyetheretherketone (PEEK) crowns with different chimney heights (3.5 mm and 5.5 mm) were fabricated by CAD/CAM technology and attached to the titanium abutments with three composite-cement brands (DTK-adhesive/visio.link-Primer for PEEK, MKZ-Primer for abutment [DTK], Bredent; PanaviaV5/Clearfil-Ceramic-Primer-Plus [Panavia], Kuraray Dental; G-Cem-LinkForce/G-Multi Primer [G-Cem], GC). Surfaces of the PEEK crowns were pretreated with 4 different methods (1) aluminium oxide (250 μ , 4 bar) [Al₂O₃], (2) aluminium oxide (250 μ , 4 bar) and macro-retentions [Al₂O₃+MR], (3) aluminium oxide (250 μ , 4 bar) and Dialog bonding fluid (Schütz Dental) [Al₂O₃+DBF] instead of the primers belonging to the composite-cement brands or (4) Rocatec plus (110 μ , 2,5 bar) [ROC]. This resulted in a total of 24 groups of 20 test specimens each. Before measurements test specimens were stored in distilled water at 37°C for at least 24 hours. Bond strength (tensile test) was determined with a universal testing machine (Zwick/Roell). Data were analysed using ANOVA statistics.

Results The composite-cement brands had a significant effect on the bond-strength of the PEEK-abutment interface (DTK: 192 \pm 103 N; G-Cem: 166 \pm 90 N; Panavia: 75 \pm 72 N; p<0.001, Figure 1). The influence of the different chimney heights on the bond-strength (5.5mm: 168 \pm 111 N; 3.5mm: 122 \pm 86 N; p<0.001, Figure2) was also significant as well as the surface treatment (Al₂O₃+MR: 202 \pm 99 N; ROC: 149 \pm 118 N; Al₂O₃: 124 \pm 94 N; p<0.001, Figure 3). Al₂O₃+DBF was not significantly different from Al₂O₃ alone.

Conclusions Increasing the bonding area (i.e. increasing the chimney height from 3.5mm to 5.5mm) increased the bond strength of the PEEK crown-abutment interface. PEEK test specimens with macroretentions achieved the highest bond strengths in combination with the cements DTK followed by G-Cem.