0253 Effect of cavity-configuration and thermo-cycling on adhesion of low-shrinking composite

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Objectives: Polymerization shrinkage stress can impair bonding effectiveness, especially at the bottom of a high C-factor occlusal class-I cavity. The purpose of this study was 1) to evaluate the effect of a low-shrinking composite on the bonding effectiveness in a high polymerization shrinkage stress environment and 2) to evaluate the effect of thermo-cycling on these pre-stressed interfaces.

Methods: A new low-shrinking composite (els, Saremco) was bonded into standardized occlusal class-I cavities (4.5x4.5x2.5 mm) using a 3-step etch-and-rinse adhesive (cmf, Saremco). A 2-step etch-and-rinse adhesive (XP Bond, Dentsply) and a conventional composite (Z100, 3M ESPE) served as control. The restored teeth were subjected to 20,000 thermo-cycles or 3 weeks of water storage. Then, the teeth were sectioned to 1x1 mm sticks by an automated, water-cooled diamond saw (Accutom, Struers), of which the 4 central sticks were further processed for micro-tensile bond strength (μTBS) testing (5 teeth per group were used).

Results: 3-way ANOVA revealed a significant effect for the adhesive and composite (both $p<0.0001$), but no effect for thermo-cycling ($p=0.994$).

mean ± SD (ptf/n)	control	20,000 thermo-cycles
cmf/els	26.2 ± 9.2 MPa^{a,b} (0/20)	27.5 ± 9.2 MPa^{a} (0/20)
cmf/Z100	16.3 ± 16.9 MPa^{b,c,d} (7/20)	20.3 ± 13.6 MPa^{a,b,c} (1/20)
XP Bond/els	13.7 ± 12.1 MPa^{c,d} (3/20)	8.3± 10.5 MPa^{d,e} (9/20)
XP Bond/Z100	0.0 ± 0.0 MPa^{e} (20/20)	0.1± 0.4 MPa^{e} (19/20)

ptf = pre-testing failure = 0 MPa. Means with the same superscript are not statistically different (Turkey multiple comparisons, $p<0.05$).

Conclusion: The low-shrinking composite in combination with the 3-step etch-and-rinse adhesive provided the best bonding performance, even after thermo-cycling. The 2-step etch-and-rinse adhesive suffered strongly from polymerization shrinkage stress, which could be partially restored by using the low-shrinking composite.

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