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Ultrastructure and bonding of high strength GIC to dentin. *SHY Wei[1], FR Tay[1], H Ngo[2], RJ Smales[2], DH Pashley[3] ([1]The University of Hong Kong; [2]The University of Adelaide, Australia; [3]Medical College of Georgia, USA)

This study examined the microtensile bond strength (μTBS) and ultrastructure of ChemFlex (Dentsply DeTrey, Konstanz, Germany), a highly viscous restorative glass ionomer cement (GIC), to sound dentin that was conditioned with various techniques. Mesial and distal enamel of extracted, human third molars were removed. Dentin surfaces were abraded with 180-grit SiC paper to create standardized smear layers for placement of the GIC. Three teeth were prepared for each conditioning protocol: [**C**] - no polyacrylic acid (PAA) treatment (control); II. [**P**] - 10% PAA for 10s, no rinsing; [**R**] - 10% PAA for 10s, rinsed; [**K**] - 25% PAA for 25s, rinsed; and [**H**] - 10% phosphoric acid for 15s, rinsed. A 0.5mm layer of a less viscous GIC mixture was initially used to enable better adapation to the moist, etched dentin. This was followed by GIC buildups using the recommended liquid-powder ratio. After being stored at 100% humidity for 24h, the teeth were vertically sectioned into 0.9 x 0.9mm beams for μTBS evaluation, using the "non-trimming" technique. Beams stressed to failure were examined with SEM. Additional untested beams from each group were prepared for TEM examination. Both demineralized and undemineralized specimens were examined. Results of μTBS evaluation: [**C**] 7.2"1.7 MPa, [**P**] 14.0"3.7 MPa, [**R**] 14.0"3.4 MPa, [**K**] 15.0"2.4 MPa, [**H**] 15.3"3.2 MPa. Kruskal-Wallis ANOVA and Dunn's multiple comparison tests showed that [**C**] has a statistically lower μTBS ($p<0.05$). SEM fractographic analysis revealed exclusive adhesive failures along the surface of dentin in [**C**]. Apparent adhesive failures in the other groups were actually mixed failures. TEM examination revealed the presence of interaction layers (IL) in all groups. In [**C**], the IL was restricted to the smear layer. In the other groups, IL of varying thickness could be seen in the intertubular dentin. GIC particles could be seen within dentinal tubules in [**K**] and [**P**]. It is concluded that the low μTBS observed in [**C**] reflects the weakness of the smear layer attachment to dentin. Similar μTBS seen in the other groups suggests that such values represent more of the cohesive strength of GIC under tension, rather than true adhesive strength to dentin.

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