



Received: August 5, 2025
Revised: September 9, 2025
Accepted: September 22, 2025

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Shear Bond Strength of Composite Resin Attachments in Clear Aligner Orthodontic Appliances with Different Adhesive Systems

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Abstract

Objectives: Orthodontic treatments with clear aligners are popular. Loss of composite resin attachments during treatment remains a concern. Self-adhesive composite resins were introduced to simplify bonding. This study compared the shear bond strength (SBS) and evaluated the failure modes of self-adhesive and conventional composite resin.

Methods: Eighty-four intact upper first premolars were used, 80 were randomly allocated into five groups with different bonding protocols: Group 1 (etch and rinse + conventional flowable composite resin), Group 2 (self-etching + conventional flowable composite resin), Group 3 (self-adhesive composite resin), Group 4 (etching + self-adhesive composite resin), and Group 5 (self-etching + self-adhesive composite resin). After thermocycling, the SBS was tested using a universal testing machine and analyzed with one-way ANOVA ($p < 0.05$). Failure modes were determined under a stereomicroscope. The enamel surface of four unallocated teeth with different preparations were assessed by a scanning electron microscope.

Results: 62.5% of attachments in Group 3 dislodged after thermocycling. The mean SBS (MPa) was significantly higher in Group 1 (17.72 ± 5.37), Group 2 (19.13 ± 5.37), Group 4 (19.03 ± 6.91), and Group 5 (13.21 ± 4.87) than in Group 3 (3.69 ± 1.30); ($p < 0.05$). Most failures in Groups 1, 2, 4, and 5 were mixed, while Group 3 exhibited only adhesive failure.

Conclusions: Self-adhesive composite resin alone had the lowest SBS. Pretreatment with 37% phosphoric acid or a self-etching primer significantly improved the SBS.

Keywords: attachment of clear aligner, intact enamel surface, self-adhesive composite resin, shear bond strength