



Received: September 4, 2024
Revised: November 26, 2024
Accepted: January 29, 2025

Corresponding Author:

Sitthikorn Kunawarote, Department of Restorative Dentistry and Periodontology, Faculty of Dentistry, Chiang Mai University, Chiang Mai 50200, Thailand.
E-mail: sitthikorn.k@cmu.ac.th

Ion-releasing Resin Composites as Clear Aligner Attachments: Comparison of Caries-inhibition Effect and Shear Bond Strength to Enamel

Pawee Petapa^{1,2}, Supassara Sirabanchongkran³, Montri Chantaramungkorn¹, Sitthikorn Kunawarote¹

¹Department of Restorative Dentistry and Periodontology, Faculty of Dentistry, Chiang Mai University

²Dental Department, Damnoen Saduak Hospital, Ratchaburi

³Department of Orthodontics and Pediatric Dentistry, Faculty of Dentistry, Chiang Mai University

Abstract

Objectives: To evaluate mineral loss and lesion depth of enamel adjacent to different ion-releasing resin composites in conjunction with artificial caries induction, and to evaluate shear bond strength to enamel.

Methods: Three ion-releasing resin composites (ACTIVA™ BioACTIVE-RESTORATIVE™, BEAUTIFIL Injectable X_{SL} and Cention® N) with or without adhesive system were investigated in comparison with a conventional resin composite (Filtek™ Z350 XT). Effect of Caries Inhibition in Adjacent Enamel – 36 human premolars with cylindrical cavities and filled with restorative materials underwent 14 days of artificial caries induction and were sectioned into two cross-sectional specimens (n=12). Mineral loss and lesion depth were measured at 10, 260, 510, and 760 μm from the tooth-restoration interface and analyzed using repeated measures ANOVA and pairwise comparison for within group comparisons ($p<0.05$) and One-way ANOVA with Tukey's post hoc test for comparisons among groups ($p<0.05$). Shear bond strength test – 108 human premolars were embedded in self-curing acrylic resin. A polyethylene tube was placed on each surface and filled with restorative materials. Each group was divided into 2 subgroups (n=9) whether the specimens were thermocycled or not. Shear bond strength was tested with the Instron® 5566 universal testing machine. Failure analysis was conducted using a stereomicroscope. Shear bond strength was analyzed using two-way ANOVA and Tukey's multiple comparison test ($p<0.05$).

Results: At 14 days post-caries simulation, ACTIVA™ BioACTIVE-RESTORATIVE™ and Cention® N with and without adhesive demonstrated an ability to inhibit caries formation at 10 μm from the restoration-enamel interface. Shear bond strength to enamel of Cention® N with adhesive had the highest values for both non-thermocycling (21.68±1.86 MPa) and thermocycling (21.17±2.4 MPa) condition, being significantly higher than other groups except for the conventional resin composite (20.3±1.85 MPa for non-thermocycling and 19.16±2.29) MPa for thermocycling condition.

Conclusions: The use of Cention® N with adhesive provides the optimal combination of shear bond strength and caries inhibition effect, which is potentially a superior candidate for clear aligner attachments.

Keywords: caries inhibition, clear aligner attachment, ion-releasing resin composite, shear bond strength