

Cement Composition Effects on Enamel Demineralization Adjacent to Orthodontic Brackets: an In Vitro Study Using the Canary System

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Abstract:

Incipient caries lesions or white spot lesions are one of the most common clinical problems resulting from orthodontic treatment with fixed appliances. Literature has shown that infrared photothermal radiometry and modulated luminescence (PTR-LUM), used by The Canary System for caries detection, is capable of monitoring artificially created carious lesions and their evolution during demineralization. Recently, a water-based calcium aluminate glass ionomer luting cement, Ceramir, has shown bioactive surface apatite formation that may influence local remineralization. This in vitro study's objective was to evaluate effects of bioactive cement on enamel demineralization around orthodontic brackets compared to composite resin cement. A sample of 32 caries-free extracted human teeth was collected under an IRB-exempt protocol. Orthodontic brackets were cemented to each tooth with either Transbond XT or Ceramir. A 3x3 mm window adjacent to the bracket was created with acid-resistant varnish for an area to measure. Acetic acid (pH=3) was used as a demineralizing solution and distilled water (pH 5.15) as a control. The sample was randomized into 4 groups (n=8 per group): Transbond XT in acetic acid, Ceramir in acetic acid, Transbond XT in distilled water, Ceramir in distilled water. Five (5) Canary scores (0-100, higher values indicating increased demineralization), were obtained at baseline (T=0), 2 days (T=1), 7 days (T=2), and 14 days (T=3). Photomicrographs (50X) were taken after completion of the study to examine the demineralization and surface changes. ANOVA and pair-wise post-hoc tests were used to analyze the data. Transbond XT (p=.0003) and Ceramir (p = .0001) showed significant demineralization around orthodontic brackets compared to the controls. The mean change in Canary score from T0-T3 for Transbond XT was 24.5±10.5, while Ceramir was 21.2±12.5, and this difference was not significant (p=.438). Photomicrographs, however, displayed a potential "protective" effect immediately adjacent to the Ceramir cement and the demineralized white area appears less opaque and with less surface change than the resin cement. In conclusion, this in vitro study demonstrated no significant difference in demineralization inhibition between the cements tested. Ceramir, however, displayed a potential "protective" effect and different microscopic appearance of the demineralized area that warrants further investigation. **The study also demonstrated the ability of the Canary System, using PTR-LUM to monitor progressive enamel demineralization, in vitro, around orthodontic brackets.**

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