

CONTROL ID: 3223199

TITLE: Multi-parameter Evaluation of Acrylamide HEMA-alternative Monomers in 2-Step Adhesives.

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SCIENTIFIC GROUPS & NETWORKS: Dental Materials 4: Adhesion

KEYWORDS: Adhesive-Dentin interfaces, Linear Mixed-effects model, Durability, Bond strength.

ABSTRACT BODY:

Objectives: 2-hydroxyethyl methacrylate (HEMA) is frequently added to adhesives as co-solvent and to improve surface wetting. Nevertheless, HEMA promotes water sorption and thus hydrolysis at adhesive interfaces, thereby affecting bond durability to dentin. This study investigated if two acrylamide co-monomer alternatives could replace HEMA when 2-step adhesives were applied in etch-and-rinse (E&R) and self-etch (SE) bonding modes.

Methods: Bur-cut dentin was primed with the 10-MDP-based Clearfil SE Bond 2' primer ('C-SE2p'; Kuraray Noritake) prior to the application of three experimental adhesives, consisting of 50wt% BisGMA, 15wt% TEGDMA, and either 35wt% diethyl acrylamide ('DEAA'), hydroxyethyl acrylamide ('HEAA') or HEMA ('HEMA⁺'). A control HEMA-free bonding agent consisted of 60wt% BisGMA and 40wt% TEGDMA ('HEMA⁻'). The split-tooth design involved application in E&R mode on one tooth half versus SE mode on the corresponding half (8 teeth/group). Micro-tensile bond strength (μ TBS) of half of the micro-specimens was immediately measured upon 1-week (1w) distilled-water storage ('immediate μ TBS'), with the other half was measured after additional 6-month (6m) water storage ('aged μ TBS'). Statistics involved a linear mixed-effects model with specific contrasts ($p < .05$). Furthermore, contact angle (adhesive drop on primed dentin), viscosity, water sorption and 3-point bending (24h, 6m) were measured.

Results: Overall, LME values of the adhesives applied in E&R were significantly higher than when applied in SE mode, except for DEAA_1w, with the lowest μ TBSs recorded for HEAA and HEMA⁺ applied in SE mode. In E&R mode, 'aged' HEMA⁺ and HEMA⁻ revealed significantly lower LME values than their 'immediate' counterparts. Best wetting of the adhesive on primed dentin was recorded for HEMA⁻, significantly better than DEAA, and then HEAA and HEMA⁺, these inversely related to their viscosity. HEAA absorbed significantly more water than all other adhesive formulations. HEMA⁺>DEAA>HEAA>HEMA⁻ is the significant order for bending strength.

Conclusions: The acrylamide co-monomer DEAA could replace HEMA, while HEAA not.