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Ability of Direct Restoratives to Withstand Contamination and Dentin Alteration

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Objectives The aim of this study was to monitor the ability of different categories of direct restorative materials to adapt to clinically relevant conditions such as contamination or dentin alteration.

Methods Bonding to saliva contaminated, decontaminated and altered tooth substrates (artificially hypermineralized, demineralized) were investigated and compared with clinically ideal conditions of sound, non-contaminated dentin substrates. A total of 300 human dentin specimens were randomly allocated into 15 groups (n=20) and restored with: 1) self-adhesive resin-based composite (Cention Forte/CF), 2) resin-modified glass ionomer cement (Fuji II LC/FJLC) or 3) an experimental conventional glass ionomer cement (EXP). Decontamination was implemented by rinsing followed by reapplication of cavity conditioner/primer. Shear bond strength (SBS) was performed after 1 week of storage in distilled water at 37°C and followed by fractographic and reliability analysis. Statistical analysis was performed by one- and two-way analysis of variance, Games-Howell post-hoc test ($\alpha=0.05$) and Weibull analysis.

Results Categories of contamination and dentin alteration were separately evaluated in comparison to sound dentin. (Table) The univariate analysis confirmed a significant influence ($p<0.001$) of the analyzed parameters: contamination ($\eta_p^2=0.085$), dentin alteration ($\eta_p^2=0.553$), and material ($\eta_p^2=0.675$; $\eta_p^2=0.656$). Post-hoc analysis identified no significant difference in SBS of each material with contamination, however significant reduction with demineralization. SBS of FJLC and EXP were only affected by demineralized substrate ($p<0.001$; $p=0.004$). CF exhibited significant increase with hypermineralization and decontamination ($p=0.008$; $p=0.026$). Bond reliability decreased in demineralized substrate groups for all materials. Predominant failure of CF was adhesive, while mixed failures were also observed for EXP and FJLC.

Conclusions CF performed better under all tested conditions compared to FJLC and EXP. Demineralization of the dentin substrate had a highly detrimental effect, although saliva contamination was tolerable for all materials.