

Zinc oxide and copper nanoparticles addition in universal adhesive systems improve interface stability on caries-affected dentin

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This study evaluated the MMP inhibition of the zinc oxide and copper nanoparticles (ZnO/CuNp), and the effects of their addition into adhesives on antimicrobial activity (AMA), ultimate tensile strength (UTS), in vitro degree of conversion (in vitro-DC), as well as, resin-dentin bond strength (μ TBS), nanoleakage (NL) and in situ-DC on caries-affected dentin. Anti-MMP activity was evaluated for several MMPs. ZnO/CuNp (0% [control]; 5/0.1 and 5/0.2 wt%) were added into Prime&Bond Active (PBA) and Ambar Universal (AMB). The AMA was evaluated against *Streptococcus mutans*. UTS were tested after 24 h and 28d. After induced caries, adhesives and composite were applied to flat dentin surfaces, and specimens were sectioned to obtain resin-dentin sticks. μ TBS, NL, in vitro-DC and in situ-DC were evaluated after 24 h. ANOVA and Tukey's test were applied ($\alpha = 0.05$). ZnO/CuNp demonstrated anti-MMP activity ($p < 0.05$). The addition of ZnO/CuNp increased AMA and UTS (AMB; $p < 0.05$). UTS for PBA, in vitro-DC, in situ-DC and μ TBS for both adhesives were maintained with ZnO/CuNp ($p > 0.05$). However, lower NL was observed for ZnO/CuNp groups ($p < 0.05$). The addition of ZnO/CuNp in adhesives may be

an alternative to provide antimicrobial, anti-MMP activities and improves the integrity of the hybrid layer on caries-affected dentin. © 2019 Elsevier Ltd

Copper

Microtensile bond strength

Nanoleakage

Nanoparticles

Universal adhesive system

Zinc oxide

Bond strength (materials)

Copper

II-VI semiconductors

Metal nanoparticles

Microorganisms

Nanoparticles

Resins

Tensile strength

Zinc oxide

Anti-microbial activity

Degree of conversion

Interface stabilities

Micro-tensile bond strength

Nanoleakages

Streptococcus mutans

Ultimate tensile strength

Universal adhesives

Adhesives

adhesive agent

copper nanoparticle

zinc oxide nanoparticle

adult

antimicrobial activity

Article

confocal laser scanning microscopy

controlled study

dental caries

dentin

human

in vitro study

priority journal

Streptococcus mutans

tensile strength