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Commentary

Role of Hydroxyethyl Methacrylate and 10-Methacryloyloxydecyl Dihydrogen Phosphate Monomers in Dentin Adhesive Primers

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DESCRIPTION

Functional monomers are considered significant parts of dentin adhesives, as they control the interaction of the adhesive interface among dentin and dental enamel. Two-Hydroxyethyl Methacrylate (HEMA) seems to be the most involved monomer in dentin adhesive primers. Because of its low molecular weight, it was presented fully as developing wettability and diffusion in the dentin structure. It is highly hydrophilic and promotes the adhesion and penetration of different monomers. Ten-Methacryloyloxydecyl Dihydrogen Phosphate (10-MDP) can connect chemical adhesion with micromechanical adhesion, through binding enamel and dentin with hydroxyapatite, forming MDP-Ca salts. These salts have extraordinary solidness, resistance from hydrolysis, and high longevity, giving protection from the binding interface and stability in a watery medium. Subsequently, it was integrated into the adhesive resin as a binding agent and as a diffusion trigger of the adhesive. HEMA and 10-MDP are functional monomers significant for the adhesive interaction. However, the adhesive systems are made up of a combination of various monomers (containing or not HEMA and 10-MDP), solvents, initiators, and nanoparticles used to advance the whole adhesive process.

The parts of adhesive systems can essentially impact their interaction with the tooth structure and, thus, significantly affect adhesion. The chemical and morphological characteristics of the tooth-adhesive interface and the nature of the hybrid layer are firmly connected with the association between functional monomers and dental substrates. The hydrophilic property of these monomers, like HEMA, contributes to expand the bond strength of adhesives to dentin, and a few functional monomers can chemically bond to calcium, like, 10-MDP. The formulation utilized in G1 contained other functional monomers that played a significant part in the adhesion process. The functional monomers PENTA and methacrylate dihydrogen phosphate are acidic, with mild pH, demineralization, sufficient wettability, and diffusion of adhesive monomers for micromechanical maintenance, showing comparative execution to those of G3 and G2 as for adhesive strength.

G2 had the lowest average bond strength (11.2180 MPa), being measurably different from that of G3 and like the bond strength of G1. The functional group of this monomer displays hydrophilic properties, aiming to develop dentin wetting and demineralization, being considered as an adhesion promoter since it adds to the increase in the bond strength of adhesives to dentin. Then again, the high hydrophilicity of this monomer develops water retention and, thus, hydrolysis in the adhesive interface, mostly influencing the bond strength. Subsequently, high concentrations of HEMA in an adhesive can have disintegrating consequences for the mechanical properties of the polymer.

G3 had the highest average bond strength (15.6080 MPa), which can be explained by being an adhesive with pH, however essentially by the presence of the functional monomer 10-MDP. Adhesives based on 10-MDP chemically bond to dentin hydroxyapatite crystals through the electrostatic collaborations of ionic bonds formed with calcium particles, and this bond results in an insoluble MDP-Ca salt. Moreover, the phosphate group of 10-MDP form covalent bonds with the phosphate group of the hydroxyapatite crystals to likewise frame insoluble salts. The unique compound structure of 10-MDP and the resulting intense and stable adhesion to calcium in hydroxyapatite has been appear to add to bond strength, consequently upgrading the adhesive execution of self-etching systems. Monomer 10-MDP seems to be promising for bond stability, while HEMA may compromise bond strength. Thus, adhesive systems are comprised of combination of monomers, solvents, initiators, and nanoparticles to advance the adhesive process, making it challenging to consider a single component responsible for successful adhesion.

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