

DENTAL COMPOSITE FORMULATION FROM ACRYLATE MONOMER AND POLYTHIOL ACCELERATOR

FIELD OF THE INVENTION

The present invention relates to dentistry, especially two paste dental composite formulations, and to methods of preparing the same. More particularly, the invention relates to dental composite formulations comprising a polymerizable mixture including an initiator/accelerator system which is storage stable and which results in esthetic and color stable dental composites upon admixture of the two pastes in the absence of external heat.

BACKGROUND OF THE INVENTION

It is known that two paste dental composite formulations based on benzoyl peroxide as the polymerization initiator possess relatively poor storage stability at ambient temperatures. At temperatures higher than those usually found in clinical usage (e.g. in transport, warehouses, military or similar field situations), the relatively unstable benzoyl peroxide will decompose prematurely at a still faster rate.

Another disadvantage of the conventional two paste composites based on benzoyl peroxide is their use of the color-prone tertiary aromatic amines in the accelerator paste as the activator or promoter designed for the rapid, ambient decomposition of the benzoyl peroxide into initiating radicals.

SUMMARY OF THE INVENTION

In view of the above and other disadvantages associated with known two paste dental composite formulations, it is an object of the present invention to overcome deficiencies of the prior art, such as indicated above; to provide improvements in dentistry; and to provide a two paste composite formulation for dental restorations, fillings etc. of enhanced storage and color stability.

It is another object to provide a two paste dental composite formulation which can be polymerized at ambient temperatures so as not to lead to any inflammatory or other unfavorable responses in tissues contiguous with the composite during the polymerization thereof.

It is still another object to provide a two paste dental composite formulation which can be polymerized in a matter of a few minutes to produce a color stable polymeric composite which exhibits acceptably high tensile strength characteristics.

These and other objects and advantages are accomplished in accordance with the present invention by providing a two paste acrylate monomer-containing dental composite formulation wherein one paste includes a storage stable organic hydroperoxide initiator, and the other paste includes a polythiol material which accelerates the decomposition of the organic hydroperoxide material into initiating free radicals at ambient temperatures and which is resistant to discoloration during storage and use.

DETAILED DESCRIPTION OF EMBODIMENTS

The two paste acrylate monomer-containing dental composite formulations of the present invention may be characterized as comprising conventional polymerizable monomers, inhibitors, stabilizers, fillers and the

like, in conjunction with a unique storage and color stable initiator system. The two pastes or paste-like components normally comprise the same or similar materials, except that one paste includes an organic hydroperoxide initiator and no accelerator, whereas the other paste includes a polythiol accelerator and no initiator. If desired, the initiator-containing paste may contain different and/or additional conventional components from the accelerator-containing paste, and vice versa, so long as the initiator and accelerator are maintained in separate pastes prior to mixing to form the desired composite.

The polymerizable acrylate monomers that may be used in the initiator and/or accelerator pastes of the present invention are well known in the art. See, e.g. U.S. Pat. No. 4,383,826; U.S. Pat. No. 4,333,348; and U.S. Pat. No. 3,066,112, these patents being incorporated herein by reference. Thus, some non-limiting examples of the polymerizable acrylate monomers which may be used include acrylic acid, methacrylic acid; typical alkyl methacrylates (e.g. methyl methacrylate, butyl methacrylate); cycloaliphatic methacrylates (e.g. cyclohexyl methacrylate; iso-bornyl methacrylate); aryl methacrylates (phenyl methacrylate; benzyl methacrylate; bisphenol dimethacrylates, etc.); functional methacrylates (such as 2-hydroxyethyl methacrylate; 4-methacryloxyethoxybenzaldehyde; 4-methacryloxyethoxybenzoic acid); ethylene glycol dimethacrylate; diethylene glycol dimethacrylate; triethylene glycol dimethacrylate; tetraethylene glycol dimethacrylate; polyethylene glycol and polypropylene glycol dimethacrylates; ethoxylated and propoxylated bisphenol dimethacrylates; neopentyl glycol dimethacrylate; trimethylolpropane trimethacrylate; 1,6-hexanediol-, 1,10-decanediol and 1,4-cyclohexanediol dimethacrylates; pentaerythritol tetramethacrylate; 1,10-decamethylene dimethacrylate; 1H, 1H-pentadecafluorooctyl methacrylate; 2,2-bis[p-(2'-hydroxy-3-methacryloxypropoxy)phenyl]propane, i.e. bis-GMA; and various nonhydroxylated homologs of bis-GMA e.g. 2,2-bis[p-(2'-methacryloxyethoxy)phenyl]propane; various diurethane dimethacrylates (e.g. the diadduct of 2-hydroxyethyl methacrylate and trimethylhexamethylene diisocyanate), oligomeric urethanes with multifunctional methacrylate groups (e.g. urethane derivatives of bis-GMA and aliphatic and cycloaliphatic diisocyanates), and other prepolymer types of monomers (e.g. siloxane multifunctional methacrylates; polyfluorinated oligomeric multifunctional methacrylates, etc.) and the like. Mixtures of the above and other acrylate monomers or other copolymerizable monomers (such as any vinyl monomer capable of free radical polymerization, e.g. styrene, α -methylstyrene, vinyl biphenyl, vinyl acetate, pentafluorostyrene, and similar olefinic monomers) also may be used in either or both of the paste components. However, bulky multifunctional acrylic monomers are preferred since they have relatively low exotherms and shrinkages on polymerization, and because of their crosslinking nature, yield materials with low water sorption, high strength and excellent dimensional stability. In addition such monomers are desirable because of their low volatility and minimum potential for tissue irritation.

Either or both of the initiator-containing and accelerator-containing pastes, and generally both of them, normally also will contain a small amount of an inhibitor, such as 2,6-di-tert-butyl-p-cresol (BHT), and a par-