

Time	Surface	No Rinse	Rinse Etchant
Immediate	Dentin	33-36 mPa	34-36 mPa
Immediate	Enamel	25-28 mPa	32-34 mPa
24 hours	Dentin	53-55 mPa	53-56 mPa
24 hours	Enamel	40-44 mPa	44-46 mPa
6 month	Dentin	53 mPa	54-57 mPa
6 month	Enamel	44 mPa	44-46 mPa

For comparison purposes, tests were performed with OPTIBOND FL® (Kerr Corporation, Orange, California) and Z-100 as described above. This resin bonding system that has been commercially available for more than a decade. Dentin samples had immediate bond strengths of 32 mPa and 24 hour bond strength of 43 mPa. The samples were prepared using the manufacturer's standard method. These results demonstrate that the present invention is equivalent to or better than existing technology.

Although the present invention has been described with reference to preferred embodiments, persons skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention. All references cited throughout the specification, including those in the background, are incorporated herein in their entirety. Those skilled in the art will recognize, or be able to ascertain, using no more than routine experimentation, many equivalents to specific embodiments of the invention described specifically herein. Such equivalents are intended to be encompassed in the scope of the following claims.

I claim

1. A method for adhering a material to a dental substrate, comprising the steps of:

(a) applying to a dental substrate an effective amount of a dental etching solution, said etch solution comprising an inorganic acid, present in an amount of from about 1 to about 10 parts by weight; an organic acid, present in amount from about 0.1 to about 10 parts by weight; a solvent present in an amount from 0 to about 65 parts by weight; an ethylenically unsaturated functional monomer, present in an amount from about 0.1 to about 10 parts by weight and water, present in an amount from 0 to about 50 parts by weight, all components in an amount to equal a total of 100 parts by weight;

(b) applying a second preparative solution to the dental substrate treated in step (a), said preparative solution comprising an ethylenically unsaturated functional monomer, present in an amount of from about 5 to about 25 parts by weight; a polyethylenically unsaturated functional crosslinking monomer, present in an amount of from about 10 to about 40 parts by weight; a solvent present in an amount from 0 to about 65 parts by weight; and water, present in an amount from 0 to about 50 parts by weight, all components in an amount to equal a total of 100 parts by weight;

(c) applying a curable composite to the dental substrate treated in step (b), said curable composite comprising an ethylenically unsaturated functional monomer, present in an amount of from about 10 to about 30 parts by weight; a polyethylenically unsaturated functional crosslinking monomer, present in an amount of from about 50 to about 90 parts by weight; a solvent present in an amount from 0 to about 15 parts by weight; and water,

present in an amount from 0 to about 15 parts by weight, all components in an amount to equal a total of 100 parts by weight; and

(d) exposing the treated dental surface to a light source that emits an effective amount of energy to cure the composite.

2. The method of claim 1, wherein the inorganic acid of step (a) is selected from the group consisting of nitric acid, sulfuric acid, hydrochloric acid and phosphoric acid.

3. The method of claim 1, wherein the inorganic acid of step (a) is nitric acid.

4. The method of claim 1, wherein the organic acid of step (a) is selected from the group consisting of lactic acid, pyruvic acid, glycolic acid, chloroacetic acid, dichloroacetic acid, trichloroacetic acid, cyanoacetic acid, tartaric acid, succinic acid, glutaric acid, maleic acid, fumaric acid, malonic acid, citraconic acid, ortho-phthalic acid, meta-phthalic acid, para-phthalic acid, citric acid, tricarballic acid, 1,3,5-pentanetricarboxylic acid and trimellitic acid.

5. The method of claim 1, wherein the organic acid of step (a) is succinic acid.

6. The method of claim 1, wherein the ethylenically unsaturated functional monomer of step (a) is methacrylic acid.

7. The method of claim 1, wherein the ethylenically unsaturated functional monomer or step (b) is hydroxyethylmethacrylate.

8. The method of claim 1, wherein the polyethylenically unsaturated functional crosslinking agent of step (b) comprises two polyethylenically unsaturated functional crosslinking agents.

9. The method of claim 8, wherein the polyethylenically unsaturated functional crosslinking agents are: the reaction product of pyromellitic dianhydride with glycerol dimethacrylate (PMGDM); and 2,2'-bis[4-(3-methacryloxy-2-hydroxy propoxy)-phenyl ]-propane (bis-GMA).

10. The method of claim 1, wherein step (b) further comprises a photo initiator.

11. The method of claim 10, wherein the photo initiator is camphorquinone (CQ).

12. The method of claim 1, wherein the ethylenically unsaturated functional monomer of step (c) is hydroxymethylacrylate.

13. The method of claim 1, wherein the polyethylenically unsaturated functional crosslinking monomer of step (c) comprises two polyethylenically unsaturated functional crosslinking agents.

14. The method of claim 13, wherein the polyethylenically unsaturated functional crosslinking agents are: the reaction product of pyromellitic dianhydride with glycerol dimethacrylate (PMGDM); and 2,2'-bis[4-(3-methacryloxy-2-hydroxy propoxy)-phenyl ]-propane (bis-GMA).

15. The method of claim 1, wherein step (c) further comprises a photo initiator system.

16. The method of claim 15, wherein the photo initiator system comprises a light-sensitive initiator and a polymerization accelerator.

17. The method of claim 16, wherein the light sensitive initiator is camphorquinone (CQ) and the polymerization accelerator is ethyl N,N-dimethyl-4-aminobenzoic acid (EDMAB).

\* \* \* \* \*