the dentist working with the product. The material can be produced in a variety of shades to match the shade used to fabricate the overlying crown.

The materials have a high strength and toughness but are not as brittle as ceramics and they also tend to protect the root by failing at the gum line. Conventional metal posts and ceramic posts tend to cause a roof fracture when they break. The tooth then has to be extracted. If the material fails at the gum line, the root is spared and the tooth can be saved for retreatment.

There are many advantages to using this material for orthodontic brackets, specifically they can be highly translucent and thus almost transparent bracket. The bracket will tend to blend in with teeth and will be more aesthetic than current metal and ceramic brackets. The bracket has a greater toughness than existing materials and may be more resistant to failure than ceramic brackets. The ceramic brackets are used as an aesthetic alternative to metal but suffer from failure at the wings due to their brittle nature. The brackets also have less friction that ceramic brackets. One of the problems with the ceramic brackets is high friction with the wires thus prolonging treatment.

There are also many advantages of using the material for an implant abutment including the aesthetics, the ease of adjustment and decreased stress transfer. Conventional implant abutments must be custom made or custom adjusted in the laboratory. Also the prior metal abutments may transfer stress directly to the bone leading to accelerated bone resorption. The resin ceramic abutments may act as a shock absorber.

A direct filling material would be used by the dentist and placed directly on the tooth to rebuild missing tooth structure. This is commonly called a composite resin. Current composite resins are based on filling a fluid monomer with micron/submicron glass or ceramic particles and then curing the monomer. These particles are not connected. This leads to problems with wear as the particles pull out and leave behind the relatively soft resin. Particle connection to the resin matrix is a significant problem. Also it is difficult to compress these materials into small spaces which often results in gaps between the filling material and the tooth, leading to recurrent decay and sensitivity.

The proposed new composite polymer material is based on using interconnecting infused ceramic blocks to produce a powder with particle sizes approximately 10–100 microns. The blocks may be cryogenically milled or hammer milled to produce the starting powder. The particles would actually be interconnected ceramic and polymeric units. The particles may be silane treated before mixing with monomer to improve wetting of the particles with the monomer and bonding of the particles. The silane treatment includes infusing the blocks with a silane solution for 24 hours before heating them at approximately 100° C. for about 1 hour before monomer infusion. The preferred silane solution is a 1 wt % 3-methaciyloxpropyltrimethoxysilane in a 50/50 mixture of ethanol and-water. The pH is adjusted with acetic acid to a value of about 4.

The particles would then be mixed with a light or heat curing agent (TEGDMA/UDM; BIS-GMA/UDM) similar to that described in the parent patent. This produces a viscous paste which can be directly applied to the tooth and cured. Subsequent adjustment and finishing procedures such as polishing allows the placement of the restoration in a single visit. Additional particles consisting of micron/submicron silica or ceramic may be added to the mixture to alter viscosity and mechanical properties. The total loading of the resin with filler will be in the range of 60–80% by volume. The advantages of this composite resin is two fold. First the filler material consists of interconnected polymer-ceramic particle which improves bonding of the filler to the polymer matrix and should result in decreased wear and improved mechanical properties. And second, the ability to compress this material is improved due to the interconnected filler units.

Other embodiments of the invention will be apparent to those skilled in the art from a consideration of this specification or practice of the invention disclosed herein. Although a detailed description and examples of the present invention has been provided above, it is to be understood these are exemplary and that the scope of the invention is not be limited thereby, but is to be determined by the claims which follow.

What is now claimed is:

1. A ceramic network composite for endodontic, orthodontic or implant dental restorations which comprises:

at least one and another layer, the one layer being infused with a metal to form an interpenetrating network composite and the other layer being infused with a composition selected from the group consisting essentially of glass or monomer to form an interpenetrating composite network, at least one of the physical properties of hardness, flexural strength and elastic modulus of one layer being distinct from that of the other layer.

2. The network composite of claim **1** wherein the ceramic is selected from the group consisting of feldspathic porcelain, a silica, alumina, or glass.

3. The network composite of claim **1** wherein the metal is selected from the group consisting of gold, platinum, or palladium.

4. The network composite of claim **1** wherein the monomer is selected from the group consisting essentially of hydroxy ethyl methacrylate; triethylene glycol dimethacrylate; 2,2bis [4(2-hydroxy-3methacryloyloxy-propyloxy)-phenyl]propane; urethane dimethylacrylate, biphenyldimethacrylate; n-tolyglycine-glycidylmethacrylate; polyethylene glycol dimethacrylate; or oligocarbonate dimethacrylic esters.

5. A ceramic network composite for endodontic, orthodontic or implant dental restorations which comprises:

at least one and another layer, the one layer being infused with a glass to form an interpenetrating network composite and the other layer being infused with a monomer to form an interpenetrating composite network, at least one of the physical properties of hardness, flexural strength and elastic modulus of one layer being distinct from that of the other layer.

6. The network composite of claim **5** wherein the monomer is selected from the group consisting of hydroxy ethyl methacrylate; triethylene glycol dimethacrylate; 2,2bis [4(2-hydroxy-3 methacryloyloxy-propyloxy)-phenyl]propane; urethane dimethylacrylate, biphenyldimethacrylate; n-tolyglycine-glycidylmethacrylate; polyethylene glycol dimethacrylate; or oligocarbonate dimethacrylic esters.

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