Fibre – reinforced dental composites with antibacterial, re-mineralising and adhesive components

Objectives:

Evaluate the effect of antibacterial chlorhexidine, reactive mono and tri calcium phosphate fillers and adhesive monomers, on the strength and ivory bonding of fibre –reinforced dental composites.

Methods:

Urethane dimethacrylate: triethylene glycol dimethacrylate (3:1) was mixed with 5 wt% adhesive monomer (2-hydroxyethyl methacrylate or methacrylate phosphate and 4-META). This was combined with silane treated glass particles containing fibres (5 wt%), chlorhexidine diacetate (0 or 5 wt%) and calcium phosphate (0 or 10 wt%). Powder to liquid ratio was 4:1.

Biaxial flexural strength of light cured discs (10 mm diameter, 1 mm thick, n=6) was determined after 24 hours in distilled water and compared with commercial controls.

Cylindrical holes 3 mm diameter were drilled through 5 mm deep ivory blocks. These were restored after etching with 37% phosphoric acid for 0 or 20s. The debonding forces (n=3) required to push out new material cylinders with no bonding agent were compared with Z250 or Gradia fixed using ibond.

Results:

Z250 and Gradia strengths were 170 and 70 MPa. Fibre reinforced experimental composite strength was 160 MPa. Chlorhexidine and calcium phosphate addition decreased this by 15 and 20 MPa respectively. Varying adhesive monomer type had negligible effect.

The de-bonding force for commercial materials increased from 100 to 350 N upon phosphoric acid treatment and to 1000 N with additional ibond pre-application. With 4-META the debonding force increased from 700 to 850 N with acid treatment. With other formulations, debonding force increased from ~135 to > 900 N with acid pre-treatment.

Conclusions:

Fibre reinforced composites containing antibacterial, remineralising and adhesion promoting components have been produced with flexural strengths comparable with commercial materials. These materials could bond to ivory without need for a composite adhesive. 4-META helps to improve adhesion without acid treatment.