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Green and Rapid Synthesis of Size Controlled TiO_2 Nanoparticles Used as Fillers in Light Curing Dental Nanocomposite Resins

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Silver amalgam has been used as a restorative material for the replacement of the decayed tooth structure for more than 150 years. The routine use of dental amalgam is gradually decreasing due to poor aesthetics for anterior restoration, mercury toxicity, and environmental consideration arising from mercury disposal, potential dental fracture, secondary caries, and marginal leakage. Physical properties of dental composites rely greatly on the particle size and filler volume. The hardness, compressive strength, elastic modulus and flexural strength etc increase while the polymerization shrinkage decreases as filler volume fraction increases[1]. In the last few years, the nanotechnology has played an important role in improving the clinical performance of dental resin composites. It deals with chemical and physical methods to produce nanoscale operational materials ranging in the size from 0.1 to 100 nm [2]. Nanocomposites contain filler particles with sizes in nano and micrometers i.e. hybrid in nature, are claimed to provide increased aesthetics, physical strength and durability. In order to improve mechanical properties of composites the surface of hybrid TiO_2 nanoparticles was modified with coupling agent.

The aim of our work is to synthesize titanium nanoparticles in a green and rapid way to be used as fillers in hybrid form. These are modified with coupling agent APTES (3-Aminopropyltriethoxysilane) and combined with organic matrix to get dental restorative nanocomposite material by using light curing method. *Citrus limon* fruit peel extract was used as solvent for the synthesis of NPs. The surface modification of green synthesized hybrid TiO_2 nanoparticles plays an important role to build up physical adhesion and covalent linkage of inorganic fillers and resin matrix. APTES is a universally used coupling agent that is responsible to protect fillers against fracture, to improve distribution and stress transfer from flexible organic matrix to stiffer and stronger inorganic filler particles. It also decreases water intake capacity of composites and minimizes wear. In addition, C=C functional group in APTES modified hybrid TiO_2 takes part in polymerization process while curing. The result shows that an increase in filler content increases the mechanical properties of resin material significantly such as compressive strength, flexural strength, and elastic modulus etc. Polymerization shrinkage decreases when compared with the resin material with no filler content. These results are compared with the light curing resins available in the market and show enhancement in dental properties after addition of fillers. TiO_2 are white in color, self-cleaning, and antimicrobial in nature. The development of such biocompatible materials in the field of restorative dentistry having aesthetic and antimicrobial properties has great potential for treating tooth decay and its prevention.

References:

[1] Ikejima I, Nomoto R, and McCabe JF

Shear punch strength and flexural strength of model composites with varying filler volume fraction, particle size and silanation. Dent Mater. 2003, 19(3): 206-11.

[2] Kirk R, Othmer D, Kroschwitz J, Howe-Grant M. 1991. Encyclopedia of chemical technology. New York, : Wiley. 397 p.