Using Nanocomposites to Improve Dental Filling Performance

Curious Cat Science and Engineering Blog

After a dentist drills out a decayed tooth, the cavity still contains residual bacteria. Professor Huakun (Hockin) Xu [1] says it is not possible for a dentist to remove all the damaged tissue, so it's important to neutralize the harmful effects of the bacteria, which is just what the new nanocomposites are able to do.

Rather than just limiting decay with conventional fillings, the new composite he has developed is a revolutionary dental weapon to control harmful bacteria, which co-exist in the natural colony of microorganisms in the mouth.

"Tooth decay means that the mineral content in the tooth has been dissolved by the organic acids secreted by bacteria residing in biofilms or plaques on the tooth surface. These organisms convert carbohydrates to acids that decrease the minerals in the tooth structure," says Xu, director of the Division of Biomaterials and Tissue Engineering in the School's Department of Endodontics, Prosthodontics and Operative Dentistry.

The researchers also have built antibacterial agents into primer used first by dentists to prepare a drilled-out cavity and into adhesives that dentists spread into the cavity to make a filling stick tight to the tissue of the tooth. "The reason we want to get the antibacterial agents also into primers and adhesives is that these are the first things that cover the internal surfaces of the tooth cavity and flow into tiny dental tubules inside the tooth," says Xu.

The main reason for failures in tooth restorations, says Xu, is secondary caries or decay at the restoration margins. Applying the new primer and adhesive will kill the residual bacteria, he says.

Fillings made from the School of Dentistry's new nanocomposite, with antibacterial primer and antibacterial adhesive, should last longer than the typical five to 10 years, though the scientists have not thoroughly tested longevity. Xu says a key component of the new nanocomposite and nano-structured adhesive is calcium phosphate nanoparticles that regenerate tooth minerals. The antibacterial component has a base of quaternary ammonium and silver nanoparticles along with a high pH. The alkaline pH limits acid production by tooth bacteria.

The new products have been laboratory tested using biofilms from saliva of volunteers. The Xu team is planning to next test its products in animal teeth and in human volunteers in collaboration with the Federal University of Ceara in Brazil.

Bringing products into the market, after preliminary research success is very

difficult. I once made some money shorting a stock [2], Enamelon, that was targeting the regeneration of enamel. Short selling is when you sell it before you buy it, anticipating a decline in price. This research on does seem to hold promise, I hope it pans out and we can take advantage of these improvements.

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