

# 'Nanospheres' that block pain of sensitive teeth

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Nanospheres could help dentists fill the tiny holes in our teeth that make them incredibly sensitive, and that cause severe pain for millions of adults and children worldwide.

Preliminary research presented today at the Institute of Physics conference EMAG-NANO 2005 shows that creating tiny spheres of a ceramic material called hydroxyapatite could be a long term solution or cure for sensitive teeth.

Sensitive teeth or 'dental hypersensitivity' is a condition that arises when the dentine of the tooth is exposed. The dentine is made up of thousands of tiny fluid-filled channels which radiate outwards from the nerve endings at the centre of the tooth. Heat, some chemicals, and physical contact can cause the fluid in these channels to move  $\updownarrow$  in or out  $\updownarrow$  triggering the nerve endings and causing sharp pain.

If these channels (or 'tubules') are fully or partially blocked, the flow can be reduced and the pain stopped or significantly reduced. Currently, the only way to treat this condition is through good dental hygiene  $\updownarrow$  using special toothpastes and fluorine mouthwashes which encourage re-mineralization of the dentine coating.

Jonathan Earl, David Wood and Steve Milne from the Institute of Materials Research at the University of Leeds have found that the most successful particle shape for filling these channels is a 'nanosphere' and are now trying to synthesize nanospheres of hydroxyapatite.

Hydroxyapatite is a ceramic material which is highly compatible with teeth and bone and so is widely used by medics for bone grafts or dental coatings (because it binds strongly with the bone material).

Earl and his colleagues grew hydroxyapatite at various pH levels to vary the size of the particles it is made up of. At normal pH, it is composed of long rod-like structures but at high pH levels the particles of hydroxyapatite become smaller and more rounded, better for fitting inside the tiny channels in teeth.

To see whether nanospheres would be successful at filling the channels they used commercially available silica nanospheres of around 40nm in diameter.

Earl said: "We found these tiny spheres are really good at filling the channels in teeth, packing inside them quite evenly and going down the holes to a good depth. They'd be the perfect shape of particle for filling these channels and reducing or preventing the pain caused by sensitive teeth".

The next stage of their research will be to work out how to synthesize nanospheres of hydroxyapatite or a combination of hydroxyapatite and fluorine which would fill the holes and encourage re-mineralization at the same time and so be an incredibly powerful repair tool for dentists.

Source: Institute of Physics

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