

Tiny silica particles could be used to repair damaged teeth, research shows

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Researchers at the University of Birmingham have shown how the development of coated silica nanoparticles could be used in restorative treatment of sensitive teeth and preventing the onset of tooth decay.

The study, published in the *Journal of Dentistry*, shows how sub-micron silica particles can be prepared to deliver important compounds into damaged teeth through tubules in the dentine.

The [tiny particles](#) can be bound to compounds ranging from calcium tooth building materials to antimicrobials that prevent infection.

Professor Damien Walmsley, from the School of Dentistry at the University of Birmingham, explained, "The dentine of our teeth have numerous microscopic holes, which are the entrances to tubules that run through to the nerve. When your outer enamel is breached, the exposure of these tubules is really noticeable. If you drink something cold, you can feel the sensitivity in your teeth because these tubules run directly through to the nerve and the soft tissue of the tooth."

"Our plan was to use target those same tubules with a multifunctional agent that can help repair and restore the tooth, while protecting it against further infection that could penetrate the pulp and cause irreversible damage."

The aim of restorative agents is to increase the mineral content of both the enamel and dentine, with the particles acting like seeds for further

growth that would close the tubules.

Previous attempts have used compounds of calcium fluoride, combinations of carbonate-hydroxyapatite nanocrystals and bioactive glass, but all have seen limited success as they are liable to aggregate on delivery to the tubules. This prevents them from being able to enter the opening which is only 1 to 4 microns in width.

However, the Birmingham team turned to sub-micron silica particles that had been prepared with a surface coating to reduce the chance of aggregation.

When observed using high definition SEM (Scanning Electron Microscopy), the researchers saw promising signs that suggested that the aggregation obstacle had been overcome.

Professor Zoe Pikramenou, from the School of Chemistry at the University of Birmingham, said, "These silica particles are available in a range of sizes, from nanometre to sub-micron, without altering their porous nature. It is this that makes them an ideal container for calcium based compounds to restore the teeth, and antibacterial compounds to protect them. All we needed to do was find the right way of coating them to get them to their target. We have found that different coatings does change the way that they interact with the tooth surface."

"We tested a number of different options to see which would allow for the highest level particle penetration into the tubules, and identified a hydrophobic surface coating that provides real hope for the development of an effective agent."

Our next steps are to optimise the coatings and then see how effective the particles are blocking the communication with the inside of the tooth. The ultimate aim is to provide relief from the pain of sensitivity.

Provided by University of Birmingham

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