Graphene oxide could make stronger dental fillings

December 3 2015

Graphene oxide could be used to make super strong dental fillings that don't corrode, according to a new study published in Colloids and Surfaces B: Biointerfaces.

Research suggests we chew around 800 times in an average meal; that's almost a million times a year. We put our teeth under huge strain, and often require fillings to repair them. Fillings are typically made of a mixture of metals, such as copper, mercury, silver and tin, or composites of powdered glass and ceramic.

Typical metal fillings can corrode and composite fillings are not very strong; Graphene on the other hand is 200 times stronger than steel and doesn't corrode, making it a prime new candidate for dental fillings.

In the study, researchers from Iuliu Hatieganu University of Medicine and Pharmacy, the National Institute for Research and Development of Isotopic and Molecular Technologies, and the University of Agricultural Sciences and Veterinary Medicine in Romania, and Ross University School of Veterinary Medicine Basseterre in the West Indies investigated whether different forms of graphene are toxic to teeth.

"The idea of the project was to add graphene into dental materials, in order to increase their resistance to corrosion as well as to improve their mechanical properties," explained Dr. Stela Pruneanu, one of the authors of the study from the National Institute for Research and Development of Isotopic and Molecular Technologies in Romania. "There is

contradictory information regarding the cytotoxicity of graphene, so we first wanted to determine how toxic it is for teeth."

Graphene comes in different forms, including graphene oxide, nitrogen-doped graphene and thermally reduced graphene oxide. The researchers tested how toxic these different types of graphene are in vitro for stem cells found in teeth.

Thermally reduced graphene oxide was highly toxic, making it inappropriate as a dental filling material. Nitrogen-doped graphene caused membrane damage at high doses (20 and 40 micrograms per milliliter). However, it was shown to have antioxidant properties, so it could be useful if covered in a protective layer. Graphene oxide was least toxic to cells, making it an ideal candidate.

"The results were very interesting and proved that graphene is appropriate for use in dental materials," said Dr. Gabriela Adriana Filip, one of the authors of the study and Associate Professor at Iuliu Hatieganu University of Medicine and Pharmacy Cluj-Napoca in Romania. "We believe that this research will bring new knowledge about the cytotoxic properties of graphene-based materials and their potential applications in dental materials."

The next step for this research is for the team to make dental materials with graphene oxide and test how compatible they are with teeth, and how toxic they are to cells. The results are due to be published soon.

More information: Diana Olteanu et al. Cytotoxicity assessment of graphene-based nanomaterials on human dental follicle stem cells, *Colloids and Surfaces B: Biointerfaces* (2015). DOI: 10.1016/j.colsurfb.2015.10.023

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