Using silicon dioxide as a binding layer for replacement bone prosthetics

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Using the stuff of sand, silicon dioxide, as a binding layer for replacement bone prosthetics could allow more biocompatible artificial joints to be manufactured as well as reducing the risk of post-operative infection, according to research published in the *International Journal of Surface Science and Engineering*.

The metals titanium and tantalum are widely used to make replacement implants for diseased or damaged bone, in the classic hip replacement, for instance. Unfortunately, a smooth metal surface, while long-lasting and wear resistant is not entirely biocompatible so manufacturers are developing materials – such as the bony mineral hydroxyapatite – that can be used to coat such implants to allow the body to accept the prosthetic and for cells and blood vessels to accommodate it more effectively. Unfortunately, a smooth metal surface is also relatively non-stick when it comes to accepting appropriately biocompatible materials.

Researchers at Swinburne University of Technology in Hawthorn, Victoria, Australia, have demonstrated that they can deposit a thin layer of silicon dioxide, the main component of sand and glass, on to the metal surface. They use a vacuum technique known as electron beam evaporation to create this thin coating. They can then successfully spray this surface with hydroxyapatite using magnetron sputtering to create a composite coating on the implant metal just 200 nanometres thick.

There is an additional problem regarding metal implants. The smoothness of the metal surface is a hindrance when it comes to the

body incorporating the prosthetic, but at the same time this prevent pathogenic bacteria from adhering to the joint and causing serious infection around the replacement bone. By adding a more biocompatible layer to the metal this could theoretically provide a surface to which bacteria might stick. The team hoped that the nanoscopic nature of their composite might preclude this hindrance. As such, they tested the metal coated with the silica-hydroxyapatite layer against the invasive microbes Pseudomonas aeruginosa and Staphylococcus aureus and found that neither were able to adhere nor to grow on this surface. Indeed, there was some growth on uncoated metal, suggesting that a coated implant would not only be more biocompatible to the patient but would lower the risk of infection significantly.

More information: "Investigation of bacterial attachment on hydroxyapatite-coated titanium and tantalum" in *Int. J. Surface Science and Engineering*, 2014, 8, 255-263. www.inderscience.com/info/inar … icle.php?artid=60489

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