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Healing times for dental implants could be cut

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The technology used to replace lost teeth with titanium dental implants could be improved. By studying the surface structure of dental implants not only at micro level but also at nano level, researchers at the University of Gothenburg; Sweden, have come up with a method that could shorten the healing time for patients.

"Increasing the active surface at nano level and changing the conductivity of the implant allows us to affect the body's own biomechanics and speed up the healing of the implant," says Johanna Löberg at the University of Gothenburg's Department of Chemistry. "This would reduce the discomfort for patients and makes for a better quality of life during the healing process."

Dental implants have been used to replace lost teeth for more than 40 years now. Per-Ingvar Brånemark, who was recently awarded the prestigious European Inventor Award, was the first person to realise that titanium was very body-friendly and could be implanted into bone without being rejected. Titanium is covered with a thin layer of naturally formed oxide and it is this oxide's properties that determine how well an implant fuses with the bone.

It became clear at an early point that a rough surface was better than a smooth one, and the surface of today's implants is often characterised by different levels of roughness, from the thread to the superimposed nanostructures. Anchoring the implant in the bone exerts a mechanical influence on the bone tissue known as biomechanical stimulation, and

this facilitates the formation of new bone. As the topography (roughness) of the surface is important for the formation of new bone, it is essential to be able to measure and describe the surface appearance in detail. But roughness is not the only property that affects healing.

Johanna Löberg has come up with a method that describes the implant's topography from micrometre to nanometre scale and allows theoretical estimations of anchoring in the bone by different surface topographies. The method can be used in the development of new dental implants to optimise the properties for increased bone formation and healing. She has also studied the oxide's conductivity, and the results show that a slightly higher conductivity results in a better cell response and earlier deposition of minerals that are important for bone formation.

The results are in line with animal studies and clinical trials of the commercial implant OsseoSpeed (Astra Tech AB), which show a slightly higher conductivity for the oxide and also an exchange between hydroxide and fluoride on the surface of the oxide. Surfaces with a well-defined nanostructure have a larger active area and respond quickly to the deposition of bone-forming minerals.

The project is a collaboration between the University of Gothenburg and Astra Tech AB in Mölndal, and will be further evaluated in follow-up studies.

Provided by University of Gothenburg