ITEK Pty Ltd is now seeking research collaboration for

Developing nanocoated orthopedic and dental implants that speed up and strengthen bone integration

The commercialisation company
of the University of South Australia

Researchers at The University of South Australia have developed technology that has the potential to reduce the incidence of revision surgery by providing quicker, stronger, bone integration for implants.

Technology Background

The orthopedic nanocoating is a 50 to 100 nm coating functionally graded from metal through oxides, silcates, silica, hydroxyl groups and hydroxyapatite (HA). The arrangement and integration of the layers enable the great bonding strength of the layer, and bioactivity is achieved by high silanol (hydroxyl) and HA content.

Various trials have been performed to identify the performance of the Nanocoating. Physical tests show impressive bonding strength. In a scratch test, the nanocoating remained intact until the force reached 120.9 MPa, this is 43% greater than a controlled ceramic; however other similar studies on HA have shown strengths of 9 to 15 MPa, depending on the thickness, indicating the Wark Nanocoating is ~8 times as strong as plasma sprayed HA.

In a pull off test, the Wark Nanocoating was at least 35% stronger than manufacturers nominated strengths for current ceramic coatings, however the apparautus was unable to break the Nanocoating and this figure is the limit of the machine. In a study of dental implants in 18 sheep, nanocoated implants showed a 36% increase in bone compounds and a 35% reduction in extracellular matrix compared with uncoated controls. This indicates that with the nanocoating the bone is forming faster and gaps are being reduced; this is what surgeons want to see.

In a further sheep study, the nanocoated implants showed bone contact with the implant was 51% greater than uncoated controls, this means a greater area of implant can bond with the bone. Major concerns for orthopaedic surgeons are the speed of closing gaps between implant and bone as these allow loosening and sites for infection (the two biggest causes of revision surgery). The Nanocoating's ability to increase the speed of bone bonding and reduce gaps is what will cause surgeons to adopt the orthopedic nanocoating.

Application

A major problem for surgical impants has been the incompatibility of metal and bone. A number of methods for bonding metal to bone have been developed, but few are satisfactory. This technology is significant in offering implant surgeons a substantial leap in metal to bone bonding technology. The size of this advance is indicated by the Nanocoating being in the order of 100 times thinner and bonding 8 times stronger than current technologies.

Currently, the revision rate for orthopaedic implants is around 17% due mainly to loosening implants and infection caused by gaps. This technology has the potential to reduce revision surgery thus reducing the suffering of patients, and the associated costs to the health industry. In dentistry it has the potential to speed up implant integration reducing the time patients must wait before applying load to their implanted teeth, possibly from 3 months to 2 months.

Discussions with leading dental and orthopaedic surgeons and various implant manufacturers confirm that this technology is a significant advance in orthopaedics and dentistry.

IP Position

Methods of manufacture for the Wark Nanocoating are protected by a national phase patent that are active, although unexamined, in the USA, Europe, and Australia. These patents are owned by the University of South Australia. The patent is titled "Bioactive Coating of Biomedical Implants".

Modified hybrid coatings additional methods of application are under development and will be protected with additional patent applications.

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