Fighting Post-Operative Infection: New Funding for Development of Bio-active Implants that Speed Recovery

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Innovate UK are supporting research and clinical trials of a bio-active implant to treat post-operative infection after total knee replacement (TKR). This could reduce significantly the cost of post-operative complications to the NHS, estimated to be £300 million per year. Implant manufacturers MatOrtho and advanced metal coating developer the Wallwork Group (http://www.wallworkht.co.uk/) are leading the programme. Significant support with clinical trials and evaluation is being provided by the Royal National Orthopaedic Hospital, University College London and Queen Mary University London.

Infection after total knee replacement is a distressing, complex and costly complication. The new implant, known as Smart Spacer, combines a bespoke TKR implant with an innovative surface coating that responds to the physical and chemical stimulation provided by use and implantation in the body. The patented chromium-nitride silver coating (CrN-Ag) is bonded directly to an existing cobalt-chromium TKR prosthesis. This will be employed as a temporary spacer device, during the eradication of the periprosthetic infection.

Infections, including MRSA and Staphylococcus Epidermis, which are resistant to standard antibiotics are treated directly by the Smart Spacer. This presents significant advantages over current treatments and opens opportunities for the future of coated prosthesis becoming a long term primary treatment.

Physical vapour deposition (PVD) is the technique used by Wallwork to apply the smart coating. The company run one of the largest specialist PVD coating facilities in Europe and manufacture the high vacuum coating chambers used in the coating process. They have extensive development laboratories, staffed by highly trained scientists and technicians, who can optimise the nano-composite coatings to achieve the required surface characteristics and performance. In addition to the coating of medical devices, Wallwork provide surface engineering for components used in the aerospace, automotive, nuclear and other technologically advanced industries.

The Smart Spacer has two initial functions. By the release of silver ions from the CrN-Ag coating it can actively reduce infection. The coating also protects and shields the cobalt-chromium TKR device, preventing the leaching of potentially harmful metal ions into the patient. Initial trials have shown chromium and molybdenum ion leakage to be 200 times less than that for uncoated devices and well within accepted concentrations.

The coating will operate in two phases with movement and loading of the knee joint initiating a boost of silver ions from the sacrificial surface layer immediately after initial implantation to counter infection. After this phase the device will release lower levels of silver ions to maintain stability as recovery progresses.

The programme will have several key stages. Primary development work in the laboratory will include simulated life testing of the coated knee joints by mechanical replication of normal movement. This will enable Wallwork scientists to optimise coating performance. When this phase is complete, closely supervised clinical trials begin with patients.

Conventionally, spacers are usually in place for six weeks after the removal of the primary TKR implant where post-operative infection has arisen. High levels of antibiotics are required to eradicate infection and permit the removal of the spacer and fitting of a new TKR prosthesis. Smart Spacer has the potential to facilitate speedier stabilisation of the infection and may reduce heavy reliance on antibiotics.
Evidence from the performance of Smart Spacers will be used to evaluate effectiveness and may open possibilities for similarly coated TKR devices to be eventually adopted as primary knee replacements and in other surgical and dental implants.

As populations live longer so the need for knee replacement increases. The consortium anticipates a high level of interest from around the world.

More Information
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Images are on the web at www.ainsmag.co.uk/wa253/5458wa1a-knee-replacement-coatings.htm

Additional Note
Innovate UK is the UK's innovation agency. It works with people, companies and partner organisations to find and drive the science and technology innovations that will grow the UK economy. For further information visit www.innovateuk.gov.uk

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