Electrostimulation of metallic implants may help eradicate chronic infections

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"A Novel Electrical Stimulation Technology Changing the Paradigm for the Treatment of Orthopedic-related Infections"

Bioengineering Professor Mark Ehrensberger and Biomedical Sciences and Professor Anthony Campagnari

As the average age of the United States population continues to rise, so does the number of joint replacements and other orthopaedic procedures. Unfortunately, metallic implants can be prone to infection, and the number of periprosthetic joint infections (PJI) is expected to grow accordingly. Complicating the picture further is the formation of biofilms -- colonies of bacteria which coat the implants and become even more difficult to eradicate.

The current standard of care for chronic implant infections is surgical replacement of the hardware and debridement of the bone followed by intensive antibiotic treatment. In addition to the toll it takes on the patient, this method carries a heavy price tag.

A UB Jacobs Schools of Medicine and Biomedical Sciences research team has come up with a novel decontamination strategy which doesn't require replacement of infected implants, and has already been demonstrated to work in an *in vivo* infection model. Their minimally invasive strategy uses cathodic voltage-controlled electrical stimulation of biocompatible titanium (Ti), combined with antibiotics, to destroy harmful microbial biofilms. Ti is the most common material used in implants. The approach under investigation would only require the placement of two skin-surface electrodes and electrical contact to the infected hardware, the researchers say.

Principal investigators in the multi-disciplinary project are Mark Ehrensberger, PhD, assistant professor of Biomedical Engineering and Director of the Kenneth A. Krackow, MD, Orthopaedic Research Lab in the Department of Orthopaedics, and Anthony Campagnari, PhD, Senior Associate Dean for Graduate Education and Research and professor of Microbiology, Immunology and Medicine in the Department of Microbiology and Immunology.

Their overall goal is to further optimize the stimulation parameters of this novel method and to define the most effective and broadly applicable treatment for orthopaedic infections.

Awarded by the Clinical and Translational Science Award (CTSA), the $75,000 study was funded by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number UL1TR001412. Pilot studies such as this one advance the strategic aims of CTSA, including the development of innovative methods and treatments with the potential to attract additional outside funding.

In September, the team was awarded a $500,000 grant from the Office of Naval Research to optimize this infection control strategy for utilization with osseointegrated prosthetic limbs. The pilot study established proof of principle that the novel decontamination method has the

potential to become an effective and broadly applicable treatment for orthopedic infections.