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Laser-Assisted Modification of Titanium Implant Surfaces to Enhance Bone Cell Mineralization and Antimicrobial Properties

Laser-textured, silver-coated Ti implants that enhance bone integration while resisting infection.

Researchers at Purdue University have developed a new method to manufacture antimicrobial, cell-integrated implants. Despite the great advancement and wide use of titanium (Ti) and Ti-based alloys in different orthopedic implants, device-related infections remain the major complication in orthopedic and trauma surgery. Most of these infections are often caused by both poor antibacterial and osteoinductive properties of the implant surface. The Purdue researchers' process is a two-step laser nanotexturing (LN) and immobilization (LI) method of coating silver onto titanium implants. LN increases cell integration, and LI reduces the toxicity of silver nanoparticles to surrounding cells. Use of this method causes implants to better-integrate into the body and be toxic to bacteria but not cells, and ultimately reduce chances of bacterial infection.

Technology Validation: The researchers' nanotexturing method caused a 2.5-fold increase in osseointegration compared to pristine Ti surface. In testing with gram-positive and gram-negative bacteria, the LN-Ti/LI-Ag surface was observed to have efficient and stable antimicrobial properties for over six days yet has similar cytotoxicity to LN-Ti.

Advantages:

- Increases cell integration compared to pristine Ti implants- Antimicrobial properties

- Not toxic for animal cells

Applications:

- Titanium implants

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Category
Materials Science & Nanotechnology/Biomedical & Bioinspired Materials
Digital Health & Medtech/Implantable Medical Devices

Authors
Rahim Rahimi
Vidhya Selvamani

Further information
Patrick Finnerty
pwfinnerty@prf.org

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