Rationally Designed Bone Implants with Multifunctional Surface Properties

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Introduction

- Aging populations increases need for orthopedic implants
- Major reasons for failure of bone implants in relation to bone ingrowth
  - Implant loosening
  - Implant-associated infections
- Need for implants with multifunctional surfaces

Methods

1. Rational design of titanium porous implant
2. 3D metal printing by selective laser melting
3. Synthesis of multifunctional implant surface using plasma electrolytic oxidation with Ag, Cu & Zn nanoparticles (NPs)
4. Implant surface characterization
5. Analysis of biological properties: prevention of implant-associated infection with MRSA and stimulation of bone regeneration

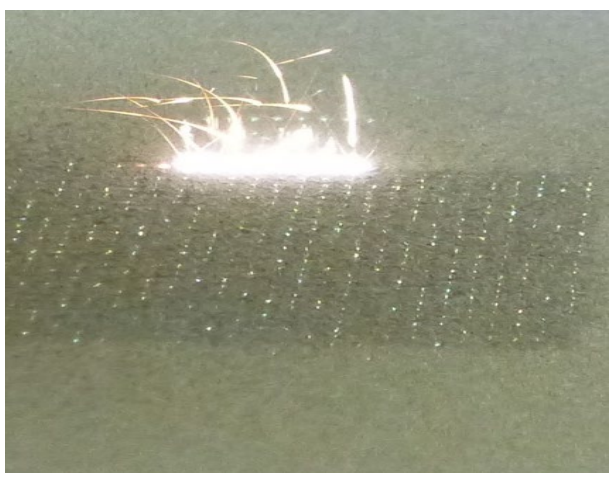
Results

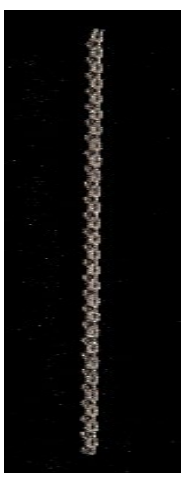
- Antibacterial ion release for at least 28 days
- Antimicrobial activity both *in vitro* and *ex vivo*
- Implants did not induce cytotoxicity in human mesenchymal stem cells

Conclusion

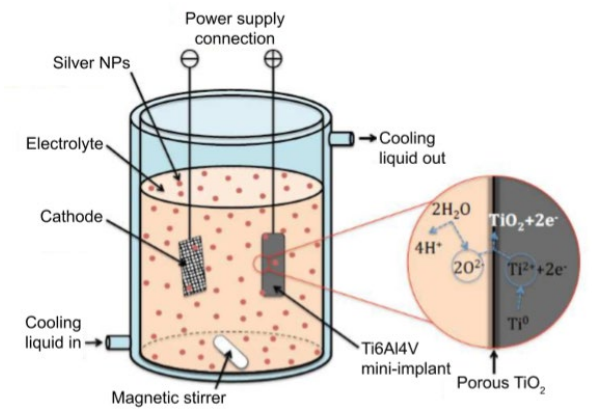
- Plasma electrolytic oxidation is suitable to supply porous titanium implants with both antibacterial and bone stimulating properties

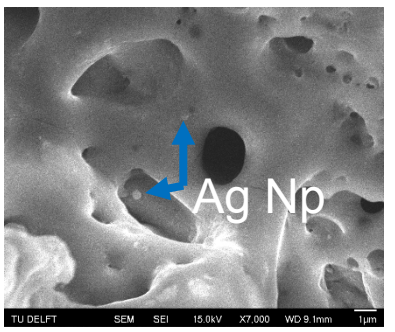
Implant design & fabrication



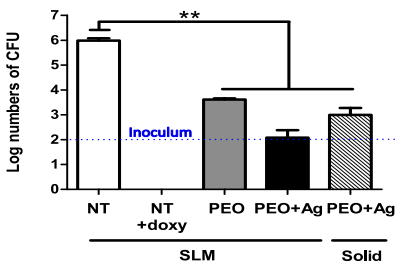


Surface treatment & characterization

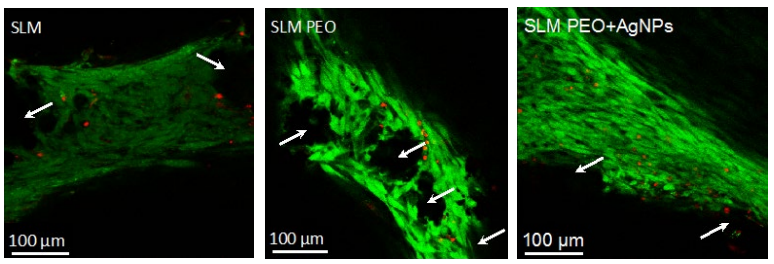




Prevention infection



Stimulation bone regeneration



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