Damiano Pasini, J Tissue Sci Eng 2013, 4:2
http://dx.doi.org/10.4172/2157-7552.S1.010

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference on
Tissue Science & Regenerative Medicine
August 26-28, 2013 DoubleTree by Hilton, Raleigh, NC, USA

A microarchitectured material for a mechanically biocompatible hip implant

Damiano Pasini
McGill University, Canada

Bone resorption is ubiquitous in reconstructive orthopaedics. The process generally occurs when the mechanical properties of the implant do not match those of the surrounding bone tissue that hosts it. Lack of mechanical biocompatibility is universally recognized to be a major detriment of existing hip replacement implants. Among those in the market, cementless or porous-coated prostheses, there is not a single implant that can avoid bone resorption. The problem triggered by implant loosening and stress shieldingis critical for both primary and revision hip surgery.

We have recently introduced a hipreplacement implant that prevents stress-shielding, as well as reduces implant micromotion, two conflicting requirements. The hallmark of the implant lies in the material microarchitecture: an open cell Ti-6AL-4V microlattice with functionally graded structure. Its properties are locally tailored to match the strain energy density of bone tissue. Compared to existing implants, bone resorption and maximum interface stress are about 70% and 50% less than those of a fully dense titanium stem, and 53% and 65% less than those of a porous-coated implant. Stem prototypes with Ti-6Al-4V isoelasticmicrolattices have been successfully built with Electron Beam Melting.

In this talk, I will describe the biomechanics and optimization of the material microarchitecture, the multiscale behavior of the femoral stem, as well as the technology aspects. The results show that tuning the mechanical biocompatibility of the lattice enables the surrounding bone tissue to remodel in the long term, thereby keeping femur bone stock.

Biography

Damiano Pasini is Associate Professor of Mechanical Engineering and cross-appointed to Biomedical Engineering at McGill University. He received a Ph.D. in applied mechanics from Bristol University (UK) in 2003. Pasini has authored over 120 journal and conference papers in the area of microarchitectured materials and laminate composites with three patents on biomedical devices. In 2011, he was a recipient of the Alexander von Humboldt Foundation fellowship for contribution in the area of lattice materials. He is a member of the Centre for Bone and Periodontal Research and the McGill Institute for Advanced Materials. He also serves on the Editorial board of the Journal of Bionic Engineering, and the International Journal of Design and Nature.

Damiano.pasini@mcgill.ca