PhD in Materials Engineering (Engineering Design and Advanced Manufacture - Leaders for Technological Industries (MIT Portugal Program))

Research Area: Biomaterials

Title: Development of cartilage like-materials with controlled drug release ability for hip prosthesis applications

Osteoarthritis is among the ten most disabling diseases in developed countries. It is strongly associated with aging and its effects are worsened by obesity, two characteristics common to the actual societies. In advanced stages of osteoarthritis, total joint arthroplasty is the most effective procedure to reduce pain and restore the joints functionality. Hip joint arthroplasty is one of the most performed. Typically, in hip prosthesis, a metallic femoral head articulates against an acetabulum of UHMWPE. The main reason of failure of these devices is the wear of the polymer by the harder counterface, which may cause inflammation, osteolysis and consequent implant loosening. Different strategies have been attempted to increase the longevity of the hip prosthesis, but none of them was yet implemented. The main objective of the present research proposal is to use a biomimetic approach to develop a new concept of hip prosthesis, that presents simultaneously (1) an improved tribological behaviour comparatively to the conventional prosthesis, and (2) capacity to release drugs at local level. To achieve this objective, new cartilage-like polymeric materials will be synthesized, tested, optimized and loaded with different drugs. As far as it is known, this combined approach (low friction with drug release ability) has never been attempted before. It shall increase significantly the prosthesis durability and speed success of the post-operative recovery, with clear benefits for patients. The work will be carried out at Instituto Superior Técnico - Centro de Química Estrutural and Instituto de Engenharia Mecânica, Instituto Universitário Egas Moniz, University of Santiago de Compostela (Spain) - Department of Pharmacy and Technological Pharmacy and University of Rush (USA) - Department of Orthopaedic Surgery.

Keywords: contact Lens, surface modification, drug delivery, sterilization

Publications

https://doi.org/10.3390/lubricants8030036

https://doi.org/10.3390/ma12203413

https://doi.org/10.1016/j.jcrs.2019.07.016

https://doi.org/10.1016/j.ejps.2018.02.017

https://doi.org/10.1016/j.colsurfb.2017.11.021

https://doi.org/10.1080/07853890.2018.1427445 [pages: S56-S57; S57; and S57-S58]).

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