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PERDITION OF LOAD TRANSFER IN BIOINSPIRED CONCEPTS FOR BONE IMPLANT INTERFACE, A FINITE ELEMENT STUDY

António Ramos[1], Gabriel Ribeiro[1], Lidia Carvalho[1], Michel Mesnard[2]
[1]TEMA; Department of Mechanical Engineering, University of Aveiro, Portugal
[2]Université de Bordeaux I Dép. Sciences de l'Ingénierie et du Numérique, CNRS UMR 5295 I Institut de Mécanique et d\'Ingénierie Bt. A11 I 351 cours de la Libération I 33405 Talence cedex, Fr
a.ramos@ua.pt, gabrielmr@ua.pt, lidiacarvalho@ua.pt, michel.mesnard@u-bordeaux.fr

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Summary: The bone implant interface is critical for the implant integration and the load transfer between implant and bone. The orthopaedic registers presented in the main arthroplasties as hip and knee the aseptic loosening the most frequent failure in the prosthesis. Several studies suggesting implant coatings increasing the surface roughness or add hydroxyapatite and other bio-active interfaces to improve the bone osseointegration. The main objective of the present work is evaluating the load transfer in the bio-inspiration structures at the implant interface as interface concepts. Based in the nature, five interfaces of implant were designed to improve the bone implant osseointegration. The inspiration used for interface bio design was the trabecular bone structure, the bamboo structure, sea sponge, the gecko foot structure and spore of mushrooms. Each bio interface structure was designed to guarantee the same size of pores around 500?æm and the same thickness in the implant base. The structures were designed to be produced by the additive manufacturing technology as SLM with a titanium alloy material Ti6AL4V considering the minimum structure thickness of that technology. In the finite element simulation was considered only a size of 5x5mm of implant with 1mm of layer to the bioinspired structure. The boundary conditions applied was only shear load of 5N considering a full bone integration. Was assumed the trabecular bone properties as a linear and elastic behaviour as the titanium structures. The influence of the interface bio design is observed in the models. The shear and equivalent Von Mises stress are influenced by the geometry of the interface. The results of shear stress in the interface are influenced by the design, the Gecko bio-interface presented the highest value of 4MPa and the spore bio-inspired structure presented the lowest value with a maximum of 2.9MPa a reduction around 27%. A similar behaviour was observed in the Maximum von Mises stress, the bamboo structure presented the lowest value with 2.04MPa and the Gecko biostructure the highest value of 3,84MPa.The results of the study as a comparison study and presented the advantages of a bioinspired interface. Within the limitations of the simulations performed, it was possible to observe the behaviour of the outside layer of implant. In the future step, the model will be implemented considering different active layers for a gradual load transfer.