Microporous and solid metallic materials for medical and dental application

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Abstract

Purpose: *The aim of the book, containing a collection of 10 monographs on engineering topics developed by a group of individual authors under the guidance of its Scientific Editors, is to develop completely innovative groups of materials and their applications in the form of dental implants, mainly in dental implantology but also in other areas of regenerative medicine. Biological-engineering composite materials will eventually be developed and implemented, in which in pores of regulated size, natural-sized cells, most preferably autologous, will be grown and the artificial material will be combined with the patient's natural cells in the body. The shape of the implant prepared in such a way will correspond to the bone or tissue defect of the patient. In another application, the porous material after implantation into the implanted human body will allow for the patient's natural cells to grow in the implant's pores and over time complete bone or tissue. It applies to a new class of dental prosthetic restorations and implants, but also bone and tissue fillings and implants. The imaging with the use of the cone beam computed tomography is the basis of the geometric design of dental implants is.*

Design/methodology/approach: *Ten papers which deal with the own work done so far in this field, including structural and design issues, computer-aided design, technological issues of computer-aided manufacturing, subtractive manufacturing using multi-axis specialized machine tools, and additive manufacturing with selective laser sintering in order to produce solid and porous materials, coating of the inner surface of the pores by applying atomic layer*

deposition or sol-gel dip coating method and manufacturing by infiltration of composite materials with skeleton reinforcement are presented.

Findings: *The original achievement is the development of the concept of new structural, technological and clinical solutions resulting from the synergies of the knowledge of classical prosthetics/implantation of post-traumatic or post-resection bone and organ losses with the use of tissue engineering methods in the interface area of bone or organ stumps with prosthetic elements/implants. In the open porosity zone, biodegradable surfaces within the pores of the described structure will be produced on tissue scaffolds that allow for cell culture by tissue engineering methods. The pursuit of the proposed solutions is to obtain bioactive links as the most advantageous in terms of the binding force that are formed between bone tissue and implant-scaffolds made or covered with bioactive materials, greatly improving the stability and durability of the attachments, especially porous implant-scaffolds.*

Research limitations/implications: *In the book mainly the results of studies and own research on the engineering aspects of the subject matter are presented. The continuation of biological research is foreseen and its results will be included in the resumption of this work extended with the subject matter.*

Practical implications: *Scientific and research works in the field have been done, but now they are significantly developed and prepared to practical implementation and wide market dissemination.*

Originality/value: *The synergic use of medical knowledge, tissue engineering and materials engineering methods to produce a functional replacement for damaged tissues leads to the development of hybrid technologies of bioactive and engineering materials and a comprehensive methodology for the design of personalized tissues including bones. Because the proposed technical solutions necessary for their clinical practice applications are not yet a precedent, it is necessary to introduce and develop a completely new segment of the market for medical devices.*

Keywords: *Implant-scaffolds, dental implantology, regenerative medicine, tissue engineering, biomaterials*

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