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Application of bioactive hydrogels to the regeneration of tissues: A feasible approach to connective tissue

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Acute wounds in normal, healthy individuals heal through an orderly sequence of physiological events that include hemostasis, inflammation, epithelialization, fibroplasia, and maturation. When this process is altered or stalled, a chronic wound may develop and is more likely to occur in patients with underlying disorders such as peripheral artery disease, diabetes, venous insufficiency, nutritional deficiencies, and other disease states. Vascular diseases in combination with concomitant pathologies such as diabetes and/or cardiovascular or cerebrovascular disorders are frequent problems commonly treated in clinic. Vascular pathologies lead to cutaneous lesions in the lower limbs which are often complicated by ischemia. Actual treatments for venous and diabetic ulcers include the application of hydrogels in combination with cells or biological skin substitutes.

The application of biodegradable polymeric hydrogels offers the opportunity to contribute in one formulation to the activation of the healing processes in compromise healing processes. The present contribution deals with the design and application of new approaches to the healing with biodegradable hydrogels based on bilayered or multilayered membranes loaded with complementary and coordinate bioactive agents. The application bioactive compounds that promote the vascularization such as proteins like proadenomedulin PAMP, in connection with the activity produced by activators of growth factors such as heparin, have been loaded in a two layered polymeric dressing for application in complicated wounds. The respond of the connective or dermal tissue to the application of hydrophilic membranes is very positive, and for controlled degradation processes has been obtained an excellent response in cell cultures and *in vivo* experiments.

The experiments carried out in a normalized model using the ear of rabbits proved the excellent biocompatibility of the polymeric membrane, as well as the effect of the loaded PAM and heparin in the healing process. Results of the evolution of the healing process with a quantification of the contraction and epitelization as well as the control of inflammation in the animal model, demonstrate that any scaffold or support for cell proliferation and tissue regeneration has to offer not only the adequate medium for the regeneration of the natural extracellular matrix, but also a controlled system for the release in a targeting way of the element necessary to activate the regenerative processes. Data of experiments carried out with normal and ischemic tissues of rabbits will be presented and discussed considering the effect of the bioactive compounds loaded in the hydrogels in the regenerative processes.

Biography

Julio San Roman has completed his Doctor in Chemistry (Polymers Science) in 1975 and currently Heads the Group of Biomaterials, Instituto de Ciencia y Tecnología de Polímeros, Consejo Superior de Investigaciones Científicas, CSIC at Madrid, Spain. He is a Full Professor in the Consejo Superior de Investigaciones Científicas and a Member of the European Society for Biomaterials ESB, since 1987 and of the Council of the Society since 2006. He is the Fellow of the Biomaterials Societies since 2004. He held the President position of Iberian Society for Biomechanics and Biomaterials, Polymer Section of the Spanish Royal Society of Chemistry and European Polymer Federation. He has been a member of the Scientific Committee of ESB meetings in the last 10 years and the chairman of the European Polymer Congress EPF 2011 organised in Granada, Spain, and chairman of the 2013 congress of the European Society for Biomaterials organised in Madrid, Spain. The Scientific activities are centred in the study and development of polymer systems for biomedical applications, and specifically in Tissue Engineering, Polymer Drugs and Drug Delivery Systems. He has published more than 400 refereed articles in specialised journals of Polymer Science, Biomaterials, and the Biomedical field. He has contributed with more than 40 Chapters in specialised books and is co-editor of two books on biodegradable polymers for biomedical applications and Biomaterials.

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