BLOOD-DERIVED GROWTH FACTORS

R. Civinini, A. Macera, B. Redl, M. Innocenti

C.T.O. II Orthopaedics Clinic – University of Florence, Italy

Regenerative medicine is the science that studies the regeneration of biological tissues that are obtained through the use of cells, with the aid of supporting structures, and through the modulation of biomolecules. This definition embraces the different elements that allow the regeneration process to occur: the cell, which has the ability to produce new tissue; the scaffold, a three-dimensional structure that serves as a substrate for the regeneration of new tissue, and finally growth factors, i.e. signalling molecules with the capacity to modulate cell adhesion, survival, proliferation and differentiation.
Analysing growth factors in detail, we see that they can originate from platelets, from plasma, from the bone matrix, from osteocyctes and osteoblasts, from fibroblasts, and from bone marrow.
It thus emerges that a proportion of growth factors are derived from blood; blood is, indeed, an important source of growth factors that can be used to therapeutic ends.
The most widely used modality is the use of platelet-rich plasma (PRP), i.e. of the portion of plasma that, after centrifugation, is rich in platelets.
PRP contains numerous growth factors, the main ones being: platelet-derived growth factor (PDGF), transforming growth factor (TGF), platelet-derived endothelial growth factor (PDEGF), interleukin 1, insulin-like growth factor (IGF), osteocalcin and osteonectin, although there are many others.
Growth factors act by stimulating different cell mechanisms, including angiogenesis, macrophage chemotaxis, fibroblast proliferation and migration, collagen synthesis and, above all, the proliferation and differentiation of numerous cell types, including: mesenchymal stem cells, osteoblasts, fibroblasts, endothelial cells and chondroprogenitor cells.
PRP has been used successfully in orthopaedics for the biological regeneration of cartilage, tendons, ligaments and, of course, bone tissue.
With regard to bone tissue, very important use is made of blood-derived growth factors in the treatment of pseudoarthroses, the treatment of loss of bone substance, in prosthetic primary and revision surgery, and in the treatment of osteochondral defects. *References: Alsousou J et al. The biology of platelet-rich plasma and its application in trauma and orthopaedic surgery. J Bone Joint Surg [Br] 2009;91-B:987-96. Axelrad TW et al. New technologies for the enhancement of skeletal repair. Injury 2007;38S1:S49-62. Mehta S and Watson JT. Platelet rich concentrate: basic science and current clinical applications. J Orthop Trauma 2008;22:433-8.*

THE NEW BIOMATERIALS IN ORTHOPAEDICS

F. Matassi, D. Chicon Paez, L. Nistri, M. Innocenti

Second Orthopaedics Clinic, University of Florence, Italy

Modern joint reconstruction surgery is founded not only on the concept of repairing pre-existing tissues with other, analogous tissues (often with both quantitative and qualitative differences), and on that of prosthetic replacement, but also on the concept of tissue healing, which involves the creation of tissue proper, the same as the pre-existing tissue. Whereas this is always possible in the case of bone tissue, for decades it did not prove possible for the other types of tissue (cartilage, ligaments, tendons). Nowadays, thanks to tissue engineering, which is based on study of the interaction between cells, growth factors and substrates, it has proved possible to recreate new tissues *in vitro* and subsequently to apply them *in vivo*. And it is the substrates, or scaffolds, that constitute the basis for joint reconstruction surgery, as regards both bone and other aspects.
The authors outline the rationale and main characteristics of the most important and most widely used scaffolds (of homologous and of synthesised materials, resorbable and non-resorbable), and also take a look at the new developments now emerging in the field of bioengineering. They then look at the peculiarities of bioactive surfaces in prosthetics, which have the capacity to bring about more rapid and effective integration of the components with the recipient bone. Finally, they illustrate cases of clinical application of these biomaterials in various situations frequently encountered by the specialist in orthopaedics. *References: Babis GC and Soucacos PN. Bone scaffolds: the role of mechanical stability and instrumentation. Injury 2005;36S:S38-44. Glowacki J and Mizuno S. Collagen scaffolds for tissue engineering. Biopolymers 2007;89:338-44. De Long WG Jr et al. Bone grafts and bone graft substitutes in orthopaedic trauma surgery. A critical analysis. J Bone J Surg Am 2007;89:649-58.*