THE PROMISE OF COMPOSITE POLYMERS FOR BONE TISSUE ENGINEERING

JOELLE AMEDEE*

INSERM U1026 TISSUE BIOENGINEERING
UNIVERSITY OF BORDEAUX, BORDEAUX, FRANCE
*E-MAIL: JOELLE.AMEDEE@INSERM.FR

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Abstract
The repair of bone defects is of particular interest for orthopaedic, oral, maxillofacial, and dental surgery. Bone loss is conventionally reconstructed by bone grafting. Depending on size and location of the defect, this method has limits and risks. In addition, in the context of reconstruction of the craniofacial skeleton after radiation therapy, we need to improve therapeutic options for patients suffering from such disastrous sequelae of radiation therapy.
While the use of BMPs has been approved for bone regeneration applications, their use is contraindicated in a carcinological context, due to concerns that these anabolic growth factors may contribute to tumor cell proliferation.
Moreover, the main limitations are to regenerate a functional vasculature [1] and to restore bone innervation that also played a major role for bone tissue regeneration [2,3].
In such context, biomaterials such as calcium phosphate matrices, free of reparative cells, cannot offer sufficient potential for supporting especially vascularization of newly formed bone. Polymers and mainly composite based-polysaccharides, because of their versatility, their possible supplementation with a mineral phase (i.e hydroxyapatite particles), have immense potential for mimicking bone tissue, by trapping osteogenic and angiogenic factors and then promoting both osteogenesis and angiogenesis [4,5].
The other challenge in the field of bone tissue engineering is to favour anchorage of sensory neurons within 3D matrices that could produce neurotrophic factors [6], activate the coupling of osteogenesis and angiogenesis.
Here, we will describe a cell-free approach for bone tissue engineering [7] using injectable composite polymers, their *in vitro* and *in vivo* validation in preclinical models from small to large animals. We will also show how composite polymer chemistry can also favour cell interactions between mesenchymal stem cells, endothelial cells and stimulate bone tissue regeneration.

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