

Abstract Seminar Prof. Dietmar Hutmacher

The role of Bone Engineering in the field of Regenerative Medicine has been the topic of substantial research over the past two decades. Technological advances have improved orthopaedic implants and surgical techniques for bone reconstruction. However, improvements in surgical techniques to reconstruct bone have been limited by the paucity of autologous materials available and donor site morbidity. Recent advances in the development of biomaterials have provided attractive alternatives to bone grafting expanding the surgical options for restoring the form and function of injured bone. Specifically, novel bioactive (second generation) biomaterials have been developed that are characterised by controlled action and reaction to the host tissue environment, whilst exhibiting controlled chemical breakdown and resorption with an ultimate replacement by regenerating tissue. Future generations of biomaterials (third generation) are designed to be not only osteoconductive but also osteoinductive, i.e. to stimulate regeneration of host tissues by combining tissue engineering and in situ tissue regeneration methods with a focus on novel applications. These techniques will lead to novel possibilities for tissue regeneration and repair. At present, tissue engineered constructs that may find future use as bone grafts for complex skeletal defects, whether from post-traumatic, degenerative, neoplastic or congenital/developmental “origin” require osseous reconstruction to ensure structural and functional integrity. Engineering functional bone using combinations of cells, scaffolds and bioactive factors is a promising strategy and a particular feature for future development in the area of hybrid materials which are able to exhibit suitable biomimetic and mechanical properties. This talk reviews the mayor current strategies in challenging bone engineering applications from a basic science perspective as well as from a clinical angle. Examples of the studies using biodegradable composite scaffolds in combination with bone morphogentic growth factors (BMP-2, BMP-7) and scaffolds in combination mesencymal precursor cells in thoroughly characterized and validated preclinical animal models will be presented. This talk will discuss the state of the art in this field and what we can expect from future generations of bone regeneration concepts.