Tissue Engineering Strategies for Bone and Cartilage Repair

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Tissue engineering is one of the recent theraputic approaches for both soft and hard tissue repair. Healthy cells taken from the host own tissues or from other sources are used together with scaffolds. Target specific (eg., osteoblasts, chodrocytes, etc.) or preferentially stem cells are isolated, differentiated (in the case of stem cells), or even genetically modified (for instance to express growth factors, eg., BMPs) and are used in two different approaches. In the first approach, they are just loaded into the scaffolds (as seeds) and apply as biohybrid implants. Alternatively, cells are propagated withinthe pores of scaffolds within bioreactors (*in vitro*) to form tissue-like structures and then they are implanted for tissue replacement. Scaffolds have large and interconnected pores which allows 3D-cell ingrowth are used. They have to be degradable *in vivo*, means that they should degrade such a rate that the new forming tissues to replace them properly. Of course both they and their degradation products must be biocompatible. They are produced several techniques, such as moulding/salt extraction, electrospinning, cryogelation, etc. They are made of several natural polymers (e.g., collagen and its denaturated form gelatin, dextran) and synthetic polymers (e.g., lactides, glycolide and ε-caprolactone). Several bioactive agents (e.g., growth factors, etc.) may be also incorporated (usually as controlled release formulations) to trigger the regeneration rate and proper new tissue formation. After careful *in vitro* biocompatibility test, tissue engineering scaffolds (loaded with cells) or biohybrid implants are applied *in vivo* in proper animal models. Critical size defects (means that the defects do not recover by themselves) are created in animals. In the maxillofacial applications, cranium, cleft palate, zgyoma, mandibula, etc. models have been used for bone tissue engineering. Ear defects are created to study cartilage repair. Several macro-, histological, molecular techniques are used to investigate tissue regeneration. This talk briefly reviews the topics mentioned above by using the experience of the author's group in this field.