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Drug delivery systems and smart functionalizations

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Recent Advance of Drug Delivery System to Enhance Natural Healing Potentials for Regenerative Medicine

A new therapeutic trial based on the natural-healing potential of body itself to induce tissues regeneration and repairing, has been recently expected. To realize this regenerative therapy, there are two approaches of cell transplantation and tissue engineering. Tissue engineering is a biomaterial technology or methodology to artificially create a local environment which enables cells to enhance their proliferation and differentiation for tissue regeneration. If a key bio-signaling molecule is supplied to target cells at the right place and the right time period or concentration, the body system initiates to physiologically function, resulting in the natural induction of cell-based tissue regeneration. The biological functions of bio-signaling molecules can be promoted with drug delivery system (DDS) technology. Biodegradable hydrogels enabled the controlled release of various growth factors and chemokines to succeed in the healing potential -based regeneration and repairing of various tissues through the recruitment and activation of cells. This release and/or cell scaffold technologies can be combined with cell transplantation to significantly enhance the therapeutic efficacy in tissue regeneration. The DDS technology of regenerative medicine is also applicable to regulate immunological responses which play an important role in the wound healing process of tissue regeneration and repairing. For example, a positive pro-inflammation promotion of macrophages induced by a drug release technology, followed by the DDS-induced activation of stem cells recruited, further enhanced the therapeutic efficacy of cell-based tissue regeneration. In this paper, several applications of DDS technologies with or without cell scaffolds to the tissue regeneration therapy are introduced to emphasize clinical significance of biomaterials technologies in tissue regenerative therapy.

