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8 - Natural polymers for bone repair

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Abstract

The incidence of bone disorders and orthopedic surgeries is increasing worldwide, representing a premier clinical need. The serious limitation in conventional therapies has led to a new discipline, the so-called bone tissue engineering (BTE), which aims to explore novel functional regeneration strategies via the synergistic combination of biomaterial design with cell and factor therapies. The core of BTE is the design of an "ideal" synthetic bone graft that mimics the tissue from macro- to nanoscale level, including the biochemical and biophysical cues of bone extracellular matrix (ECM). Engineering of natural polymers to obtain biomaterials is one of the most attractive options, mainly due to their similarities with the bone ECM, chemical versatility, and good biological performance. In this chapter, the most relevant natural polymeric formulations for bone repair and the principal stimulus proposed as contributors or mediators for promoting cell activity and bone tissue formation are discussed. Finally, we focus on the current challenges and future directions in bone regeneration regarding recent advances in 3D printing of customized bone grafts.

Keywords

Biomimetic mineralization; Bioprinting; Bone tissue engineering; Cell encapsulation; Collagen; Cross-linking; Growth factor; Natural polymer; Scaffold