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Regulation tissue healing hematoma for osteogenesis

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Abstract

Blood coagulation in wound healing not only prevents blood loss, but also forms a natural scaffold for tissue repair and regeneration. It is well known that blood clot formation is the initial and foremost phase upon bone injury, and the quality of blood clot (hematoma) orchestrates the following inflammatory and cellular processes as well as the subsequent callus formation and bone remodeling process. Inspired by the natural healing hematoma, tissue-engineered biomimic scaffold/hydrogels and blood prefabrication strategies have attracted significant interest in developing functional bone substitutes. The alteration of the fracture hematoma can significantly accelerate or impair the overall bone healing process. This review summarizes the impact of biomaterials on blood coagulation and provides evidence on fibrin network structure, growth factors, and biomolecules that contribute to bone healing within the hematoma. The aim is to provide insights into the development of novel implant and bone biomaterials for enhanced osteogenesis. Advances in the understanding of biomaterial characteristics (e.g., morphology, chemistry, wettability, protein adsorption) and their effect on hematoma properties are highlighted. We conclude by emphasizing the importance of influencing the initial healing phase of the hematoma, which allows us to design advanced biomaterials with the desired regulatory properties for optimal coagulation and hematoma properties, thereby facilitating enhanced osteogenesis and ideal therapeutic effects.

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