
Chapter

# Peptide-Based Functional Nanomaterials for Soft-Tissue Repair

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## ABSTRACT

Soft-tissue injury is characterized by damage of muscles, ligaments or tendons, blood vessels, etc., which is a common form of injury reported worldwide. The global soft-tissue repair market is growing at rate of approximately 7.5%; still research is going on to find sustainable treatment options ranging right from drug-based therapies to scaffold-based treatments. By exploiting the versatile nature of nanomaterials peptide/protein-based nanomaterials (PBNMs) may prove to be an efficient soft-tissue repair method. PBNMs are getting prime importance as these materials can mimic endogenous full-length peptides both structurally and functionally. These can enhance cell attachment, induce several cellular signaling pathways, and promote natural biochemical responses. Nanomaterials with pro-angiogenic sequences, anti-inflammatory sequences, and proadherence sequences can be utilized for repairing soft tissues. PBNMs can be fabricated in two and three dimensions. The high density of chemical functionality in peptides can be exploited to fabricate nanomaterials of smaller and higher dimensions, including nanoparticles and nanofibers. In the past few decades the self-assembly strategy has been utilized for preparing PBNMs with high stability and multivalency. Controlled self-assembly for fabrication of PBNMs can also be achieved by application of externally applied stimuli such as pH, light, enzyme etc. Compatibility with immune system, cell survival, restoration of mechanical properties, compositional considerations, cell exhaustion, and ethical regulations are the major challenges to be overcome for clinical translations of PBNMs.