Strategizing the Use of Bone Morphogenetic Proteins (BMPs) for Bone Regeneration

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Abstract
Of the 7.9 million fractures sustained each year in the United States, 5% to 20% result in non-unions or delayed healings. Since these fractures do not heal naturally, they need therapeutic interventions. Current treatment options for nonunion fractures rely on transplantation of autografts, allografts, bone marrow aspirate, synthetic bone graft substitutes and a commercially available bone morphogenetic protein 2 (BMP-2) product, Infuse. In 2009, the cumulative purchase cost of bone grafts, BMPs and bone graft substitutes reached 1.5 billion dollars with BMPs accounting for 50% of this market. However, limitations associated with the availability of autografts and allografts, donor site morbidity associated with autograft use, risk of disease transmission through allografts, presence of insufficient numbers of mesenchymal stem cells (MSCs) in the bone marrow aspirate, lack of osteoinductive potential of synthetic grafts and reported disappointing outcomes of Infuse therapy, necessitate the search for alternative treatments.

Our laboratory has been engaged in research related to MSCs and BMPs, with a long term goal of developing an optimum therapeutic approach for effective bone regeneration. We study osteoimmunology and MSCs signaling pathways that control osteogenesis. The failure of existing BMP-2 therapy and alternative approaches for bone regeneration developed by our laboratory will be discussed.