

Hypoxia in bone and oxygen releasing biomaterials in fracture treatments using mesenchymal stem cell therapy: a review

ABSTRACT

Bone fractures have a high degree of severity. This is usually a result of the physical trauma of diseases that affect bone tissues, such as osteoporosis. Due to its highly vascular nature, the bone is in a constant state of remodeling. Although those of younger ages possess bones with high regenerative potential, the impact of a disrupted vasculature can severely affect the recovery process and cause osteonecrosis. This is commonly seen in the neck of femur, scaphoid, and talus bone. In recent years, mesenchymal stem cell (MSC) therapy has been used to aid in the regeneration of afflicted bone. However, the cut-off in blood supply due to bone fractures can lead to hypoxia-induced changes in engrafted MSCs. Researchers have designed several oxygen-generating biomaterials and yielded varying degrees of success in enhancing tissue salvage and preserving cellular metabolism under ischemia. These can be utilized to further improve stem cell therapy for bone repair. In this review, we touch on the pathophysiology of these bone fractures and review the application of oxygen-generating biomaterials to further enhance MSC-mediated repair of fractures in the three aforementioned parts of the bone.

Keyword: Bone fracture; Bone ischemia; Hypoxia; Oxygen-releasing biomaterials; Stem cells