Fabrication of Hydroxyapatite with Bioglass Nanocomposite for Human Wharton's-Jelly-Derived Mesenchymal Stem Cell Growing Substrate

ABSTRACT

Recently, composite scaffolding has found many applications in hard tissue engineering due to a number of desirable features. In this present study, hydroxyapatite/bioglass (HAp/BG) nanocomposite scaffolds were prepared in different ratios using a hydrothermal approach. The aim of this research was to evaluate the adhesion, growth, viability, and osteoblast differentiation behavior of human Wharton's-jelly-derived mesenchymal stem cells (hWJMSCs) on HAp/BG in vitro as a scaffold for application in bone tissue engineering. Particle size and morphology were investigated by TEM and bioactivity was assessed and proven using SEM analysis with hWJMSCs in contact with the HAp/BG nanocomposite. Viability was evaluated using PrestoBlue™ assay and early osteoblast differentiation and mineralization behaviors were investigated by ALP activity and EDX analysis simultaneously. TEM results showed that the prepared HAp/BG nanocomposite had dimensions of less than 40 nm. The morphology of hWJMSCs showed a fibroblast-like shape, with a clear filopodia structure. The viability of hWJMSCs was highest for the HAp/BG nanocomposite with a 70:30 ratio of HAp to BG (HAp70/BG30). The in vitro biological results confirmed that HAp/BG composite was not cytotoxic. It was also observed that the biological performance of HAp70/BG30 was higher than HAp scaffold alone. In summary, HAp/BG scaffold combined with mesenchymal stem cells showed significant potential for bone repair applications in tissue engineering.