An in vitro/in vivo release test of risedronate drug loaded nano-bioactive glass composite scaffolds

Azza Ahmed ,Amany A Mostafa, Azza A Mahmoud, Mohamed A Abdel Hamid, Mona Basha, Mohamed S El-Okaily, Abdel Fattah A Abdelkhalek, Mohamed I El-Anwar, Sara El Moshy, Amr Gibaly, Elham A Hassan

Abstract

Three-dimensional (3D) matrices scaffolds play a noteworthy role in promoting cell generation and propagation. In this study, scaffolds prepared from chitosan/polyvinyl alcohol loaded with/without an osteoporotic drug (risedronate) and nano-bioactive glass (nBG) have been developed to promote healing of bone defects. The scaffolds were characterized by scanning electron microscopy (SEM), porosity test as well as mechanical strength. The pattern of drug release and ability to promote the proliferation of Saos-2osteosarcoma cells had also been reported. Osteogenic potential of the scaffolds was evaluated by testing their effect on healing critical-sized dog's mandibular bone defects. Increasing chitosan and nBG in the porous scaffolds induced decrease in drug release, increased the scaffold's strength and supported their cell proliferation, alkaline phosphatase (ALP) activities, as well as increased calcium deposition. Histological and histomorphometric results demonstrated newly formed bone trabeculae inside critical-sized mandibular defects when treated with scaffolds. Trabecular thickness, bone volume/tissue volume and the percentage of mature collagen fibers increased in groups treated with scaffolds loaded with 10% nBG and risedronate or loaded with 30% nBG with/without risedronate compared with those treated with non-loaded scaffolds and empty control groups. These findings confirmed the potential osteogenic activity of chitosan/polyvinyl alcohol-based scaffolds loaded with risedronate and nBG.

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