

Mussel adhesive protein for acceleration of bone substitute-assisted bone regeneration

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To date, hydroxyapatite and related calcium phosphates have been intensively investigated as the bone substitutes for bone tissue engineering. However, lack of cell recognition motifs and/or biochemical factors has been considered a limitation. Mussel adhesive proteins (MAPs) are one of most remarkable and powerful adhesive materials in nature. Previously, recombinant MAPs were successfully demonstrated to be functional cell adhesion materials on various surfaces due to their peculiar adhesive properties. Herein, MAPs were applied as surface coating and functionalization biomaterials to xenograft materials. We successfully coated MAPs onto xenograft surfaces by simply mixing xenografts with the MAP solution. Through in vitro study using mouse osteoblast cell line MC3T3-E1, significant enhancement of cellular activities such as attachment, proliferation, spreading, and osteogenic differentiation was observed on MAP-coated xenografts. In addition, we found that in vivo implantation of MAP-coated xenografts enhanced bone regeneration in a rat calvarial defect model. These results collectively demonstrate that facile coating of xenografts using biofunctional MAP would be a promising strategy for successful bone tissue engineering applications.