Prefabrication of vascularized grafts based on pre-differentiated adipose derived stem cells, fibrin sealant and porous calcium phosphate cement scaffold. [Chinese]

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Abstract:

Background: Construction of vascularized bone substitutes to mimic free vascularized fibular grafting in treating large bone defects still remains challenges to researchers during the past years. Objective: To design and construct a new vascularized tissue-engineered bone graft using pre-differentiated adipose derived stem cells, fibrin sealant and porous calcium phosphate cement scaffold. Methods: Adipose derived stem cells isolated from rats were directly differentiated to endothelial cells and then incorporated in fibrin sealant and porous calcium phosphate cement scaffolds in vitro. Subsequently, the different composites of the three groups including vascularized tissue-engineered bone scaffold (group A), fibrin sealant and porous calcium phosphate cement scaffold (group B) and porous calcium phosphate cement scaffold (group C) were directly embedded into the quadriceps of the rats. Histological quantitative analysis and western blot assay were conducted 2 and 4 weeks after implantation. Results and Conclusion: The pre-differentiated adipose derived stem cells were demonstrated in good condition after 7 days co-culturing with the fibrin sealant and porous calcium phosphate cement scaffold. The results of in vivo experiments showed that the scaffolds were in-grown together with fibrous connective tissues and blood vessels. Newly formed vessels and immature capillaries were observed in the group A. The vessel density, vessel diameter and vascular endothelial growth factor C expression in the group A were significantly higher than those in the groups B and C. Our findings demonstrated that compared with simply fibrin sealant and porous calcium phosphate cement scaffold, the combination of

pre-differentiated adipose derived stem cells (endothelial differentiation) and fibrin sealant can achieve rapid angiogenesis of porous calcium phosphate cement scaffold.