Angiogenic and osteogenic potential of platelet-rich plasma and adipose-derived stem cell laden alginate microspheres

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1. Introduction

In the field of orthopedics, oral and maxillofacial surgery, bone regeneration remains to be a clinical challenge, despite the introduction of various bone augmentation techniques and bone graft materials. In recent decades, development of bone tissue engineering brings great excitement through the combination of engineered scaffolds, cells, and biologically active molecules or microenvironment [1,2]. Extensive experimental and clinical researches have been done in the field, and considerable progress has been achieved [3–5]. However, its clinical success was mainly impeded by the poor vascularization in tissue-engineered constructs. The lack of vascular networks throughout constructs leads to insufficient oxygen and nutrients supply, and in no doubt compromises the survival rate of implanted cells and their final performance. To ensure the viability of seeded cells, a distance of less than 200 μm is required between cells and a blood vessel [6]. However, from the perspective of clinical application, 200 μm is such a short distance for any bone defect that the inner pre-seeded cells’ viability is hardly to be maintained, not to expect these cells to participate in the regeneration process. Thus, a scaffold, seeded with appropriate pluripotent cells, providing a favorable micro-environment and nutrient for cells’ prolonged viability, and with angiogenic and osteogenic potential, could be an inspiring strategy for bone tissue engineering.

Recently, adipose-derived stem cells (ADSCs) have been proposed by some researchers as a promising alternative for bone marrow stem cells (BMSCs) in bone tissue engineering [7]. With comparable multilineage capability to BMSCs, ADSCs are much more easily harvested in high yield using simpler, less expensive and less invasive procedures with a lower incidence of donor site morbidity. As an autologous cell-based therapy, ADSCs transplant have been successfully used in both soft tissue and bone regeneration [8–10]. A recent research showed that ADSCs, originating from pericytes, could contribute to vascularization both in vitro and

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