



Evaluation of menstrual blood stem cells seeded in biocompatible Bombyx mori silk fibroin scaffold for cardiac tissue engineering

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Abstract

Recently, silk fibroin scaffolds have been introduced as novel and promising biomaterials in the field of cardiac tissue engineering. This study was designed to compare infiltration, proliferation, and cardiac differentiation potential of menstrual blood-derived stem cells (MenSCs) versus bone marrow-derived mesenchymal stem cells (BMSCs) in Bombyx mori-derived silk scaffold. Our primary data revealed that the fabricated scaffold has mechanical and physical qualities suitable for cardiac tissue engineering. The MenSCs tracking in scaffolds using immunofluorescent staining and scanning electron microscopy confirmed MenSCs attachment, penetration, and distribution within the porous scaffold matrix. Based on proliferation assay using propidium iodide DNA quantification, the significantly higher level of growth rates of both MenSCs and BMSCs was documented in scaffolds than that in two-dimensional culture ($p < 0.01$). The expression level of TNNT2, a bona fide cardiac differentiation marker, in BMSCs differentiated on silk scaffolds was markedly higher than those cultured in two-dimensional culture indicating the improvement of cardiac differentiation in the silk scaffolds. Furthermore, differentiated MenSCs exhibited higher expression of TNNT2 compared with induced BMSCs. It seems that silk scaffold-seeded MenSCs could be viewed as a novel, safe, natural, and accessible construct for cardiac tissue engineering.

Keywords

Menstrual blood, bone marrow, stem cells, silk scaffold, cardiac tissue engineering

Introduction

Cardiovascular disorders are leading cause of million deaths each year. The efficacy of direct myocardial or intra-coronary injection of stem cells has been shown in treating chronic heart diseases.¹ However, such strategies suffer from several shortcomings, such as low cell survival, and insufficient prevention of progressive left ventricular dilation. To improve these drawbacks, an alternative therapeutic approach is to use stem cells seeded in bio-absorbable scaffolds to repair infarcted cardiac tissues.^{2,3} Cardiac tissue engineering requires two complementary key ingredients including: (1) biologically compatible scaffolds that are readily adopted by the body, and (2) suitable cells that effectively replace the damaged tissues without adverse consequences.^{2,4}

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