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Title: Cardiogenic differentiation of mesenchymal stem cells with gold nanoparticle loaded functionalized nanofibers

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Abstract: Cardiac tissue engineering promises to revolutionize the treatment of patients with end-stage heart failure and provide new solutions to the serious problems of shortage of heart donors. The influence of extracellular matrix (ECM) plays an influential role along with nanostructured components for guided stem cell differentiation. Hence, nanoparticle embedded Nanofibrous scaffolds of FDA approved polycaprolactone (PCL), Vitamin B12 (Vit B12), Aloe Vera(AV) and Silk fibroin(SF) was constructed to differentiate mesenchymal stem cells into cardiac lineage. Cardiomyocytes (CM) and Mesenchymal stem cells (MSC) were co-cultured on these fabricated nanofibrous scaffolds for the regeneration of infarcted myocardium. Results demonstrated that gold nanoparticles blended VitB12 scaffolds were of the size 16 nm and has a mechanical strength of 2.56MPa, respectively which was found to be comparable to that of native myocardium. The gold nanoparticle blended PCL scaffolds were found to be enhancing the MSCs proliferation and differentiation into cardiogenesis. Most importantly the phenotype and cardiac marker expression in differentiated MSCs were highly resonated in gold nanoparticle loaded nanofibrous scaffolds. The appropriate mechanical strength provided by the functionalized nanofibrous scaffolds profoundly supported MSCs to produce contractile proteins and achieve typical cardiac phenotype.

Response to Reviewers:

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