Poly(dopamine) coating of 3D-printed PLA scaffolds for bone tissue engineering

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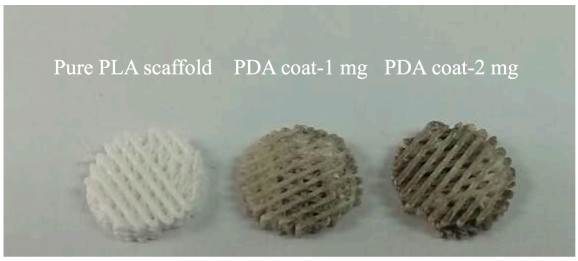
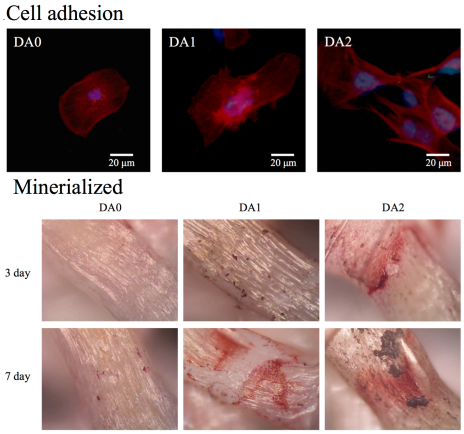
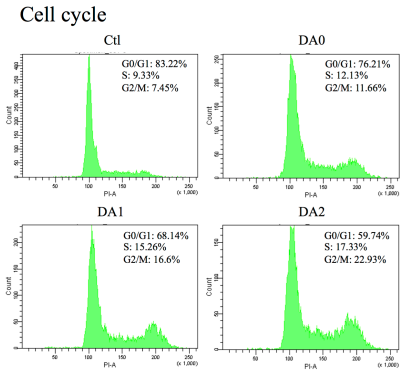
3D printing is a versatile technique to generate large quantities of a wide variety of shapes and sizes of polymer. The aim of this study is to develop functionalized 3D printed poly(lactic acid) (PLA) scaffolds and use a mussel-inspired surface coating to regulate cell adhesion, proliferation and differentiation of human adipose-derived stem cells (hADSCs). We prepared PLA 3D scaffolds coated with polydopamine (PDA). The chemical composition and surface properties of PDA/PLA were characterized by XPS. PDA/PLA modulated hADSCs' responses in several ways. Firstly, adhesion and proliferation, and cell cycle of hADSCs cultured on PDA/PLA were significantly enhanced relative to those on PLA. In addition, the collagen I secreted from cells were increased and promoted cell attachment and cell cycle progression were depended on the PDA content. In osteogenesis assay, the ALP activity and osteocalcin of hADSCs cultured on PDA/PLA were significantly higher than seen in those cultured on a pure PLA scaffolds. Moreover, hADSCs cultured on PDA/PLA showed up-regulation of the ang-1 and vWF proteins associated with angiogenic differentiation. Our results demonstrate that the bio-inspired coating synthetic PLA polymer can be used as a simple technique to render the surfaces of synthetic scaffolds active, thus enabling them to direct the specific responses of hADSCs.







References

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