Compressed collagen constructs with optimized mechanical properties and cell interactions for tissue engineering applications - DTU Orbit (05/10/2019)

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In this study, we are introducing a simple, fast and reliable add-in to the technique of plastic compression (PC) to obtain collagen sheets with decreased fibrillar densities, representing improved cell-interactions and mechanical properties. Collagen hydrogels with different initial concentrations (1.64mg/mL - 0.41mg/mL) were compressed around an electrospun sheet of PLGA. The scaffolds were then studied as non-seeded, or seeded with 3T3 fibroblast cells and cultured for 7 days. Confocal microscopy and TEM imaging of non-seeded scaffolds showed that by decreasing the share of collagen in the hydrogel formula, collagen sheets with similar thickness but lower fibrous densities were achieved. Nanomechanical characterization of compressed collagen sheets by AFM showed that Young's modulus was inversely proportional to the final concentration of collagen. Similarly, according to SEM, MTS, and cell nuclei counting, all the scaffolds supported cell adhesion and proliferation, whilst the highest metabolic activities and proliferation were seen in the scaffolds with lowest collagen content in hydrogel formula. We conclude that by decreasing the collagen content in the formula of collagen hydrogel for plastic compression, not only a better cell environment and optimum mechanical properties are achieved, but also the application costs of this biopolymer is reduced.

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