Highly Moldable "Clay"-Like Fluffy Biodegradable Nanofibrous Scaffolds for 3D Cell Culture and Gene Delivery

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In this presentation, development of 3D electrospun biodegradable scaffolds with 'rubber clay'-like properties is discussed. By co-axially electrospinning polystyrene (shell) and poly (ε-caprolactone) (core) followed by selectively leaching the polystyrene out of the scaffolds, the resulted scaffolds showed high flexibility and moldability maintainng fibrous structure. Due to the 'clay'-like properties of PCL scaffolds, the scaffolds could be formed into any desired shape without deformation of micro- and macroscopic structural integrity. Importantly, cells cultured in the 'clay'-like PCL fibrous scaffolds both in vitro and in vivo infiltrated homogeneously into entire scaffolds and maintained their phenotypic morphologies and viabilities, all of which can be regarded as significant improvements compared with conventional 2D electrospinning. Furthermore, combinatorial approaches with viral gene delivery system or conductive materials are investigated. In conclusion, nanofibrous and biodegradable scaffolds with any desirable three-dimensional shapes have substantial potential to contribute to tissue engineering.