Bottom-up 3D Tissue Engineering Approaches Using Collagen Microbeads as Particulate Scaffolds

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Various methods for culturing cells in 3D environments have been developed, including top-down and bottom-up approaches. In this study, we will briefly explain our recent research progresses on new bottom-up tissue engineering processes using single micrometer-sized collagen microbeads as cell-adhesive scaffolds that can be introduced into 3D cell culture systems. Collagen microbeads were produced using monodisperse microdroplets formed by means of microfluidics or membrane emulsification, and these beads were used to prepare composite spheroids of hepatocytes, multilayered thick tissues, and capillary tissue-embedding blocks. We evaluated the cellular functions, and clearly demonstrated the usefulness and versatility of the presented approaches.