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Creating miniaturized tissue constructs on a micropillar/microwell chip via 3D bioprinting technology

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Abstract

Liver tumor tissues in the human body consist of different layers of hepatic cells including hepatoma cells and surrounding normal cells. To mimic *in vivo* tumor tissues, three-dimensional (3D) microarray bioprinting was demonstrated on a microwell chip via layer-by-layer printing of Hep3B human hepatoma cell line. The 3D microarray printing coupled with high-content imaging (HCI) of cell layers on the chip might open new opportunities for predictive drug screening for patients. Our goal is to demonstrate high-throughput cell printing in hydrogel layers and establish HCI of cell layers from the microwell chip for miniaturized tumor tissue engineering. To achieve this goal, Hep3B cell suspension stained with TMRM and Hoechst 33342 was mixed with alginate as well as photocrosslinkable alginate and then printed onto the microwell chip using a microarray spotter. The images of Hep3B cells encapsulated in two alginate layers were acquired by scanning the chip with a chip scanner. As a result, we successfully demonstrated two layer cell printing with Hep3B cells encapsulated in alginate and establish high-throughput HCI with fluorescently-labeled Hep3B cells at different z-focus positions. To improve imaging of cells in different layers, further optimization of gelation conditions with photocrosslinkable alginate will be necessary.