Poster session 11: Scaffold free biofabrication approaches

P11.1

The fabrication of scaffold free cardiomyocytes constructs by using Bio-3D printer

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Aim: Cardiac tissue engineering has the problem by unfavorable cell and host responses to biomaterial scaffolds. Then we established a system for assembling scaffold-free cell constructs. And we had ever developed an automatic fabrication device named "Bio-3D printer" which can fabricate cell only three dimensional (3D) constructs such as liver blood vessels and cartilage. In this study we fabricated cardiomyocytes spheroids and produce cell constructs with this system for reconstruction of cardiac tissue.
Method: Cardiomyocytes derived from iPS cells (iCells) was kindly gifted from iPS PORTAL Inc. And Human Umbilical Vein Endothelial Cells (HUVECs) and Normal Human Dermal Fibroblasts (NHDFs) were purchased and used to make the spheroids. In this study we fabricated iCell spheroids and iCells co-cultured spheroids with HUVECs and NHDFs. Briefly cell suspension was plated into ultra-low attachment 96 U-well plates to form both spheroids. Both spheroids contained a total of 20000 cells. After plating both spheroids were maintained in a humidified atmosphere at 37℃ under a 5% CO2 incubator and the culture medium was changed every two days.
For bio-3D fabrications spheroids were set on an automatic spheroid assembling device (Regenova; Cyfuse Biomedical K.K.). After fabrication cell construct cultured and observed for 1week.
Result: iCells and iCells including HUVECs and NHDFs spheroid formation were observed at time course. Compared with the formation of iCells spheroids the addition of fibroblasts and endothelial cells promoted rapid self-organization of the cells to form spheroids. In both spheroids group the contractile beating after 2days of cultivation were observed. After 7days of cultivation the circle rate of co-cultured spheroids was greater than that of iCell spheroids. In addition the diameter of co-cultured spheroids shows greater uniform at approximately 540μm at 7days but not it of iCell spheroids.
Our study shows that it is possible to make 3D constructs of co-cultured spheroids by using the Bio-3D printer. And these spheroids in 3D construct were confirmed to fuse with each other after 5days of fabrication and the contractile beating for 1week.
Conclusion: In conclusion we succeeded to fabricate cardiomyocytes spheroids and produce 3D construct by using co-cultured spheroids. In future work it is expected that this technology can fabricate cardiac tube and sheet constructs for clinical application.