Polydimethylsiloxane

Establishing an effective three-dimensional (3D) in vitro culture system to better model human neurological diseases is desirable, since the human brain is a 3D structure. Here, we demonstrated the development of a polydimethylsiloxane (PDMS) pillar-based 3D scaffold that mimicked the 3D microenvironment of the brain. We utilized this scaffold for the growth of human cortical glutamatergic neurons that were differentiated from human pluripotent stem cells. In comparison with the 2D culture, we demonstrated that the developed 3D culture promoted the maturation of human cortical glutamatergic neurons by showing significantly more MAP2 and less Ki67 expression. Based on this 3D culture system, we further developed an in vitro disease-like model of traumatic brain injury (TBI), which showed a robust increase of glutamate-release from the neurons, in response to mechanical impacts, recapitulating the critical pathology of TBI. The increased glutamate-release from our 3D culture model was attenuated by the treatment of neural protective drugs, memantine or nimodipine. The established 3D in vitro human neural culture system and TBI-like model may be used to facilitate mechanistic studies and drug screening for neurotrauma or other neurological diseases [1)].

1)
Chen C, Dong X, Fang KH, Yuan F, Hu Y, Xu M, Huang Y, Zhang X, Fang D, Liu Y. Develop a 3D neurological disease model of human cortical glutamatergic neurons using micropillar-based scaffolds. Acta Pharm Sin B. 2019 May;9(3):557-564. doi: 10.1016/j.apsb.2019.03.004. Epub 2019 Mar 23. PubMed PMID: 31193866; PubMed Central PMCID: PMC6543078.

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