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THE INFLUENCE OF SIMULATED MICROGRAVITY ON MYELINATION OF THE CENTRAL NERVOUS SYSTEM

Abstract

Oligodendrocytes (OL) are the essential supporting cells of the central nervous system; their ability to synthesize and sustain the protective myelin sheath around axons allows the nervous system to communicate rapidly in an organized manner. Myelin speeds up the conduction of messages within the nervous system, a crucial part of normal nervous system function. Simulated microgravity as it relates to OL biology is a new area of research that has a dual potential to answer the physiological effects of space exploration due to the microgravity environment as well as problems of de-myelinating diseases. The purpose of our study is to determine if OLs retain their functional ability to myelinate axons of the CNS when subjected to zero-gravity (0G) in a simulated microgravity environment. Currently, gravitational regulation of cellular features is poorly understood. A co-culture of human induced pluripotent stem cells (hIPS) derived OL and neonate mouse brain diced tissue were placed in our proprietary co-culture chemically defined culture medium. We used the Mitsubishi 3-D Clinostat robot which produced the (0G) simulated microgravity environment where co-cultures were maintained. After 0G exposure, maturation of hIPS-OLs and potential myelination of the mouse brain axons was ascertained by double immune fluorescence. Here we used the transgenic GFP-PLP mouse under control of the Proteolipid Protein (PLP) promoter where OLs were marked green. Frozen sections were obtained from these co-cultures; these frozen sections were stained with antibodies against Sox transcription factor 9 (SOX9) that is an immature OL marker and Myelin Basic protein (MBP) which is a mature OL marker to determine the extent of maturation reached by cells in these co-cultures. We examined the expression of NF-160 and MBP. Our preliminary findings show that there is MBP expression that colocalized with GFP-PLP arranged along fibers suggesting that there is myelin formation. An interesting finding was that Sox9 appeared to colocalize with MBP and PLP. The presence of Sox9 is not surprising as we reported previously that OL are less mature in 0G than in 1G. Extensive characterization of cell markers will be performed to assess the presence and status of neurons and astrocytes. Supported by CG-NIH 0461