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EFFECTS OF MICROGRAVITY ON STEM CELL ENGRAFTMENT, PROLIFERATION, AND DIFFERENTIATION THROUGH THE GROUND BASED RPM EXPERIMENTS

Abstract

Even physiologically healthy astronauts selected through rigorous medical tests suffer from a variety of cosmological diseases such as asthma, osteoporosis, constipation, arrhythmia, and hearing loss. It may come from a physiological cell activity under different gravity conditions between space and Earth. There is no report yet, but the recovery in the space environment of traumatic injury is expected to be different from the ground. As injured on the ground, the adult stem cells present in human body migrate to the wounded region at the same time as the proliferation, and differentiate into the constituting the tissue to replace and repair the damaged tissue. In space, such physiological cellular activity to recover the trauma could be different as in the Earth gravitational field. We cultured mesenchymal stem cells in both ground and RPM simulated microgravity environments, and compared proliferation, engraftment, and differentiation of stem cells for both cases. To provide alike an in vivo culturing environment, the stem cells were attached to 3D printed PCL scaffold coated with type2 collagen. Stem cell laden scaffolds were exposed to ground gravity and micro gravity for 2 weeks. Intracellular luciferase activity, known to be proportional to the number of cells is measured quantitatively at intervals of 2-3 days per week, and the number of cells is calculated using a quadratic equation. By calculating the number of cells, the ability to engraftment and proliferation can be determined. Mesenchymal stem cells can be differentiate into 3 types of cells such as adipocytes, bone cells, cartilage cells. Differentiation of cells was measured by oil red-O staining for adipocytes, alizarin red staining for bone, safranin-O staining for cartilage to quantitatively identify differences between ground gravity and micro gravity. Through this study, it will be possible to discuss the physiological changes of human adult stem cells in space, and also to provide a suitable therapeutic strategy for astronauts.