IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Biology in Space (8)

Author: Mr. Juan David Carvajal Agudelo
Mount Saint Vincent University, Canada

Dr. Tamara Franz-Odendaal
Canada
Ms. Jordan Eaton
Mount Saint Vincent University, Canada

EXPOSURE OF 2D AND 3D SIMULATED MICROGRAVITY REDUCED OSSIFICATION AND ALTERED GENE EXPRESSION IN LARVAL AND ADULT ZEBRAFISH (DANIO RERIO)

Abstract

Microgravity can affect the development, density, and homeostasis of bone tissue. Ground-based studies use random positioning machines in either a 2D or a 3D mode to assess the effects of simulated microgravity (SMG), however the outcomes of these results are difficult to compare due to different experimental parameters. Furthermore, larvae and adult bone can respond differently to microgravity effects due to differences in their biology. We exposed larval fish at 3 days post fertilisation and cultured fish scales from adult fish to 6 h, 18 h and 24 h of SMG using a 2D and a 3D mode of rotation in a clinostat. We then measured ossification in several skeletal elements and the gene expression of several genes associated with osteoclasts, osteoblast, and osteocytes. We found that SMG-3D treatment significantly reduced the overall ossification level of the skeletal elements compared with SMG-2D. Specifically, the anterior end of the notochord, the ceratobranchial-5, the lower jaw articulation, the pharyngeal teeth, and the operculum were affected compared with control groups. These results indicate that SMG-3D produced a stronger SMG effect compared with the SMG-2D in larval fish. Gene expression analyses showed that after SMG-3D exposure osteoblast-related genes were unaffected while osteoclast genes increased (RANKL). Interestingly, adult scales showed a more sensitive outcome in gene expression with an increase in osteoclast genes at earlier time points. This research provides valuable insight into how SMG can cause negative effects on ossification and gene expression in the developing skeleton in zebrafish as well as in adult bone tissue.