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BONE ARCHITECTURE AND TURNOVER CHANGES IN WILD TYPE AND PLEIOTROPHIN-TRANSGENIC MICE EXPOSED TO NEAR ZERO AND 2G ENVIRONMENT

Abstract

Bone tissue is constantly remodeled through a deposition/resorption process that is strongly influenced by mechanical stimuli. The gravity force intensity has a marked effect on the mechanotransduction response of bone cells, either in the case of microgravity or hypergravity exposure. The Mice Drawer System (MDS) experiment conducted in our laboratory demonstrated that after a 3-months permanence in space (the longest permanence for mice) bone loss was evident both in C57BLJ10 wild type mice and in Pleiotrophin-overexpressing transgenic mice (PTN-Tg). Further studies showed that an appropriate level of hypergravity could improve bone strengthening. Considering all these results, our lab performed a 3-months experiment in order to study the effect of hypergravity exposure on bone metabolism of the same Wt and PTN-Tg mice employed in the microgravity exposure experiment. Seven Wt and four PTN-Tg were exposed to hypergravity by means of a centrifuge that generates a 2g-force environment inside the rotating cages. At the same time 6 Wt and 5 PTN-Tg mice were maintained in standard vivarium conditions while 7 Wt and 6 PTN-Tg mice were tail-suspended: these two experiments represent further controls. We collected weight bearing and non-weight bearing bone samples from all the 34 animals and we performed a structural analysis by means of the computed micro-tomography (μCT) technique. At variance with the results obtained from mice bone samples analyzed after the 3-months flight, when a decrease in the bone trabecular number and an increase of the trabecular separation was present, data obtained from the 2g experiment suggest an increase in the trabecular thickness of bones from the mice exposed to the 2g compared to their 1g controls. Moreover, since the analysis of specific bone formation markers of the bone samples from the MDS experiment demonstrated that the microgravity-induced bone loss was due to both an increased bone resorption and a decreased bone deposition, we are now analysing also bone marrow samples from the same animals to shine a light on the effect of hypergravity exposure on the gene expression pattern of the samples considered. All the data that we will obtain from the 2g, vivarium and tail suspension experiments will hopefully corroborate the microgravity experiment results. Moreover, we hope that space agencies will let us perform additional experiments both on microgravity and on hypergravity effects on bone metabolism in order to expand the observations made and to create a background for possible further researches.