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FINAL RESULTS OF THE MOP EXPERIMENT: VESTIBULAR ADAPTATION TO HYPO- AND HYPERGRAVITY

Abstract

It is well-known that during the first days in weightlessness many astronauts suffer from the Space Adaptation Syndrome (SAS), which involves space motion sickness, spatial disorientation and motion illusions. After return on Earth the problems re-appear, but now also accompanied by postural imbalance. Standard tests for motion sickness, typically applied in astronaut selection programs, do not correlate with SAS at all. TNO developed a method which effectively simulates SAS on Earth, by exposing astronauts to a G-load of 3G in a human centrifuge for one hour. It turned out that this prolonged hypergravity stimulus elicits motion sickness (designated "Sickness Induced by Centrifugation" or SIC), and other symptoms typical for SAS. Previously we tested the susceptibility for SIC in eight space travellers who also rated their susceptibility for SAS in actual spaceflight. The high statistical correlation indicates that there is a common mechanism for vestibular adaptation to any transition in G-level, whether it is from 1G to 0G or from 3G to 1G. This makes the centrifuge paradigm interesting for astronaut training.

With the Dutch Delta mission in 2004 the European Science Agency (ESA) started to facilitate again inflight research on this topic. The TNO experiment called "Motion Perception" (MOP) required astronauts to rate their feelings of discomfort and motion illusions in- and post-flight, which were compared to their susceptibility to SIC in the ground-based centrifuge paradigm. The project objective was to further consolidate the correlation between SAS and SIC in additional astronauts, and collect psychophysical evidence for vestibular adaptation. Recently the project was finished, after collecting data in eight additional astronauts. The final results of the study will be reported in this paper.