NASA INFORMATION

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Balance Issues (Integrated Treadmill Locomotion & Functional Mobility Tests)

Our brain uses information from the eyes, ears, and sensors in the joints and skin to help us stay oriented and balanced. In space, without the effects of gravity, these touch, navigation and balance systems become temporarily confused.

For example, space travelers often experience stints of disorientation and weird perceptual illusions. They may feel upside down when they are right side up. At the beginning of a space mission, astronauts often feel dizzy and even experience motion sickness until they get used to their new environment.

When they return to Earth, they experience another adjustment period before they can balance themselves. A treadmill training system under development at NASA's Johnson Space Center could help shorten or remove post-flight balance problems experienced by astronauts returning from long-duration stays aboard the International Space Station.

It may also eventually help elderly patients and others with similar problems. Astronauts and cosmonauts returning from long-duration flights on the Space Station walk with an unstable gait and can take about two weeks to regain their balance and coordination.

Long-duration missions typically affect crewmembers' balance and coordination. The goal of this research is to develop an in-flight treadmill training system that will improve the brain's ability to readapt to gravity environments.

Dr. Jacob Bloomberg and his scientific team are using a new, integrated research tool that looks at how multiple systems in the human body—including the inner ear balance organs and the associated brain centers—interact and adapt during spaceflight to cause balance problems.

A person's performance on a series of integrated tests such as an obstacle course, a treadmill and a visual acuity test, will help researchers develop solutions to balance, mobility and eye coordination. These tests will evaluate the effectiveness of in-flight interventions designed to reduce the negative effects of spaceflight on post-flight balance, walking and coordination functions.

During testing, subjects walk on a treadmill while head, eye and body movements are monitored using a video-based motion capture system. Other sensors record body accelerations and the vertical forces that occur during each footfall. Throughout the testing, subjects identify symbols on a computer screen to monitor visual acuity.

This allows Bloomberg and his team to determine how the nervous system responds and adapts to different alterations in sensory input during walking. To complement the treadmill test, the obstacle course helps researchers better understand how sensory-motor changes contribute to post-flight walking disturbances.

This research also has important implications for those suffering from balance problems here on Earth. Nearly 80 million people have experienced clinically significant dizziness problems at some point in their lives.

Further development of these tests may lead to the development of better tools to diagnose neurovestibular problems. It may also help train some people to overcome these afflictions.