PHYS.ORG

Researchers investigate the impacts of space travel on astronauts' eye health

June 19 2024, by Alyssa Schaechinger

Credit: Texas A&M Engineering

As space travel becomes more common, it is important to consider the impacts of space flight and altered gravity on the human body. Led by Dr. Ana Diaz Artiles, researchers at Texas A&M University are studying some of those impacts, specifically effects on the eye. The findings are published in the journal *npj Microgravity*.

Gravitational changes experienced by astronauts during space travel can cause fluids within the body to shift. This can cause changes to the cardiovascular system, including vessels in and around the eyes.

As the commercialization of space flight becomes more common and individual space travel increases, astronauts will not be the only ones experiencing these changes. Individuals traveling to space with commercial companies may not be as fit or healthy as astronauts, making it even more important to understand the role that fluid shift plays in cardiovascular and eye health.

"When we experience microgravity conditions, we see changes in the cardiovascular system because gravity is not pulling down all these fluids as it typically does on Earth when we are in an upright position," said Diaz Artiles, an assistant professor in the Department of Aerospace Engineering and a Williams Brothers Construction Company Faculty Fellow.

"When we're upright, a large part of our fluids are stored in our legs, but in microgravity we get a redistribution of fluids into the upper body."

These fluid shifts may be related to a phenomenon known as Spaceflight Associated Neuro-ocular Syndrome (SANS), which can cause astronauts to experience changes in eye shape and other ocular symptoms, such as changes in ocular perfusion pressure (OPP). At this time, researchers are unsure of the exact cause of SANS, but Diaz Artiles hopes to shed light on the underlying mechanism behind it.

Diaz Artiles and her team are investigating potential countermeasures to help counteract the headward fluid shifts of SANS. In a recent study, they examined the potential aid of lower body negative pressure (LBNP) to combat SANS. This countermeasure has the potential to counteract the effects of microgravity by pooling fluid back into the lower body.

While the role of ocular perfusion pressure in the development of SANS remains undetermined, Diaz Artiles and her team hypothesized that microgravity exposure could lead to a slight but chronic elevation (compared to upright postures) in OPP, which may have a role in the development of SANS.

The results of the study showed that lower body negative pressure, while effective in inducing fluid shift toward the lower body, was not an effective method for reducing OPP.

Should elevated ocular perfusion pressure be definitively linked to SANS, the use of LBNP could theoretically not be an effective countermeasure to this syndrome. But they emphasize that future work should seek to better understand the relationship between OPP and SANS, and the impact of LBNP on these ocular responses as part of the countermeasure development.

"This research is just one experiment of a three-part study to better understand the effects of fluid shift in the body and its relationship to SANS. Previous experiments in this study included the use of a tilt table for researchers to understand the cardiovascular effects of fluid shifts at different altered gravity levels, recreated by using different tilt angles," said Diaz Artiles.

The published study, as well as upcoming research, focuses on countermeasures to the fluid shift; in this case, lower body negative pressure.

In future studies, the researchers will examine the effects of using a centrifuge to combat the fluid shift and its effects. Diaz Artiles and her team aim to collect cardiovascular responses using each countermeasure and compare effects on ocular perfusion pressure and other cardiovascular functions that may be affected by microgravity environments.

These studies are performed on Earth, so gravitational changes that occur in space may cause different outcomes. Thus, they hope to conduct future studies in true microgravity conditions, such as parabolic flights.

More information: Eric A. Hall et al, Ocular perfusion pressure is not reduced in response to lower body negative pressure, *npj Microgravity* (2024). DOI: 10.1038/s41526-024-00404-5

Provided by Texas A&M University