**BACKGROUND**

Astronauts experience a chronic headward fluid shift in weightlessness as evidenced by increased cardiac output, decreased leg volume, and venous congestion in the upper body. Alterations in cerebrospinal fluid hydrodynamics and changes in cerebral venous pressure secondary to the headward fluid shift may contribute to ocular changes associated with spaceflight-associated neuro-ocular syndrome (SANS). Veno-constrictive thigh cuffs (VTC; Braslets) provided to Soyuz crewmembers alleviate symptoms of the headward fluid shift during the first week of spaceflight and have been shown to reduce internal jugular vein (IJV) distension during weightlessness.

Application of VTCs designed collaboratively by NASA Johnson Space Center Cardiovascular and Vision Laboratory (CVL) and Clemson Textile Laboratory at Clemson University to improve fit and comfort was documented to mitigate changes in choroid thickness, intraocular pressure, and IJV area during postural-induced headward fluid shifts.

VTCs are demonstrated to reduce headward fluid shifts in both ground-based and spaceflight studies, and thus, may be a countermeasure against development of SANS. In addition, VTCs are a simple mechanical countermeasure currently at a high technical readiness level (TRL) and are compact and lightweight, making them compatible with the spaceflight operations environment.

**SPECIFIC AIM**

To demonstrate efficacy of VTC application to mitigate a spaceflight-induced headward fluid shift.

We hypothesize that a VTC countermeasure will temporarily reverse or attenuate ocular and cardiovascular changes. In addition, the study protocol is designed to investigate what effect extended duration countermeasure exposure (~6 hours of compression at 50mmHg) has on our outcome variables.

**PROJECT STATUS**

CVL Human Research Program Flight Hardware Engineering, Research Operations and Integration, and Clemson University Textile Laboratory are collaboratively preparing VTC hardware to support the flight experiment. The study has been reviewed and approved by the NASA and ESA Institutional and Human Research Multilateral Review Boards and is being considered for implementation on future ISS missions. Recently, the Flight Hardware Engineering team has integrated a pressure transducer into the cuff in order to directly measure VTC skin contact pressure.

The VTC device is expected to be flight-ready in early 2023 along with supporting experiment documentation. VTC study team are developing infight operational procedures for VTC application during spaceflight. Data will be collected using remote guidance. First flight and data collection onboard the International Space Stations (ISS) is anticipated in 2024.

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**REFERENCES**