

Ocular Coherence Tomography in the Evaluation of Anterior Eye Injuries in Space Flight

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PROBLEM STATEMENT: While Ocular Coherence Tomography (OCT) is not a first-line modality to evaluate anterior eye structures terrestrially, it is a resource already available on the International Space Station (ISS) that can be used in medical contingencies that involve the anterior eye. With remote guidance and subject matter expert (SME) support from the ground, a minimally trained crewmember can now use OCT to evaluate anterior eye pathologies on orbit.

TOPIC: OCT utilizes low-coherence interferometry to produce detailed cross-sectional and 3D images of the eye in real time. Terrestrially, it has been used to evaluate macular pathologies and glaucoma. Since 2013, OCT has been used onboard the ISS as one part of a suite of hardware to evaluate the Visual Impairment/Intracranial Pressure risk faced by astronauts, specifically assessing changes in the retina and choroid during space flight. The Anterior Segment Module (ASM), an add-on lens, was also flown for research studies, providing an opportunity to evaluate the anterior eye in real time if clinically indicated.

Anterior eye pathologies that could be evaluated using OCT were identified. These included corneal abrasions and ulcers, scleritis, and acute angle closure glaucoma. A remote guider script was written to provide ground specialists with step-by-step instructions to guide ISS crewmembers, who do not get trained on the ASM, to evaluate the anterior eye. The instructions were tested on novice subjects and/or operators, whose feedback was incorporated iteratively. The final remote guider script was reviewed by SME optometrists and NASA flight surgeons.

APPLICATIONS: The novel application of OCT technology to space flight allows for the acquisition of objective data to diagnose anterior eye pathologies when other modalities are not available. This demonstrates the versatility of OCT and highlights the advantages of using existing hardware and remote guidance skills to expand clinical capabilities in space flight.

RESOURCES:

1. Doors M, Berendschot TT, de Brabander J, Webers CA, Nuijts RM. Value of optical coherence tomography for anterior segment surgery. J Cataract Refract Surg. 2010 Jul;36(7):1213-29.