OCT Technology Development to Assess Ocular Integrity and Characterize Intraocular Scatterers

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View Technical Abstract
The goal of this project is to develop a portable eye imaging system that can be carried by early responders to help them diagnose eye injuries. The technology behind this eye imaging system is called optical coherence tomography (OCT) and is used worldwide in eye clinics. OCT is similar to ultrasound (the technology used to image babies in pregnant women) except OCT uses light so it does not require any touching and has much more resolution than ultrasound. However, OCT systems are typically large (the size of a desk) and cannot image live in 3D. The technologies we develop in this application will make OCT transportable, easy to use for the first responder, and provide live 3D scans of the eye. These 3D scans of the eye are digital and can also be sent by the internet to specialists to assist the early responder if needed. All this will be done without touching the eye, which is important in cases of eye injuries.

Ultimately, the result of this research should be a device that can be carried into the field to help early responders identify the eyes that are critically injured so that those patients can be appropriately sent for specialist care. In a study of injuries during the Iraq wars, 13% of injuries involved the eye. However, eye injuries are very hard for non-specialists to diagnose. In fact, in a study of patients airlifted out of theater in Iraq and Afghanistan in the mid-2000s, only 11% had truly vision-threatening disorders. Appropriate identification of eye injuries should help early responders appropriately treat military personnel with eye injuries to help them obtain appropriate care and prevent vision loss.

It will take 3 years to develop this device. The first year will be spent increasing the speed of the system to produce 3D scans and decreasing the size of a small OCT system that we previously developed with defense funding. We will make the system the size of a briefcase that can be carried around. The second year will be spent adding the ability to see small red and white blood cells in the eye with the system. These cells are signs of eye disease that are really hard to see even for eye doctors. The second and third years will be used to show the system working in patients presenting with eye injuries to the Duke Medical Center.

We anticipate that the portable eye imaging system that results from this research will benefit Service members who need eye care in difficult to reach areas where an eye doctor may not be available.
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