Sealing Penetrating Eye Injuries Using Photoactivated Bonding

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PUBLIC ABSTRACT

The overall goal of these studies is to preserve vision in wounded warfighters who have sustained penetrating injuries to their eyes. These wounds have become more frequent as the use of improvised explosive devices (IEDs) in the current conflict has increased compared to earlier wars. Fragments and debris are propelled at high velocity by IEDs and enter the eye through the cornea, the outermost clear front of the eye, or the sclera, the “white” of the eye. Approximately 10% of injuries in the Global War on Terrorism include eye damage, and penetrating wounds constitute approximately 50% of these severe injuries.

It is very important to rapidly close wounds in the cornea and sclera to prevent infection and possible loss of sight. The wounds are currently closed by sewing (suturing) with hair-fine threads (sutures). Sometimes a drop of glue is added when then sutures cannot close the wound. Suturing the cornea and sclera requires a microscope because the sutures are almost impossible to see with the naked eye and need to be placed with great accuracy. This is very time consuming process. Only highly trained eye specialists can suture the ragged and tattered eye tissue of a battlefield wound to produce the water-tight seal that is needed to prevent infection. Physicians with the proper skills are not always available in battlefield hospitals.

We are proposing a new method for closing penetrating wounds in the cornea and sclera that rapidly forms a water-tight seal and requires less skill than suturing. We will use green light and an FDS-approved dye to bond a biological membrane over the wounds. We will also bond the injured tissues together directly using light and the dye. We will use light sources and light blockers that will seal the cornea and scleral wounds without damaging the retina.

Upon successful completion of these studies, military physicians will have an improved method for closing battlefield wounds in the outer layers of the eye. The surgery will be faster than suturing and produce a strong, water-tight seal to protect the eye against infection. Because the new technique is simpler than suturing, physicians who are not eye specialists may be able to treat these severely wounded soldiers.