

Healthy Outlook Blog

Innovative Techniques for Tissue and Eye Surgery

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By Jane Langille | Posted March 22 2012

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Futuristic Photochemical Tissue Bonding for Better Outcomes

Imagine in the future, if your surgeon could seal your incision using just a special dye and a non-thermal laser light – no sutures, staples or glues required. This technology could be available sooner than you think, because the Department of Defense (DoD) has been funding research for photochemical tissue bonding (PTB) for more than 8 years.

PTB involves using a light-sensitive dye and non-thermal light source to create a strong, watertight bond for tissue repair. The bond is superior to traditional closure methods because there is no inflammation and less scarring. PTB has shown promise for a variety of tissue repairs, such as closure of skin incisions and corneal surgeries.



Dr. Irene Kochevar says, “The human clinical study using the PTB technique for closure of skin excisions is showing promising initial results,” so she anticipates that an application for FDA approval will be filed in a few months. Kochevar is a photochemist and biochemist with the Wellman Center for Photomedicine at Massachusetts General Hospital and professor at Harvard/MIT Division of Health Sciences Technology.

Eye injury is a significant civilian health issue in the United States – there are more than 2.5 million eye injuries annually, happening either in the home, during sports, at work, or during motor vehicle accidents. Eye injuries also represent a significant and rising percentage of battlefield injuries among soldiers in active duty, especially in recent conflicts in Iraq and Afghanistan where IEDs (improvised explosive devices) have become the weapon of choice.

Under the same DoD funding umbrella as the skin PTB project, Kochevar and her

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colleague, Dr. Robert Redmond are moving forward on two other priority studies, in collaboration with Dr. Anthony Johnson at the Brooke Army Medical Centre in San Antonio, Texas. They are looking for ways to use PTB to improve eye surgery techniques:

1. Penetrating Eye Wounds – Amnion, a patch of amniotic membrane, is currently used in civilian eye surgery, but the current technique requires the time-consuming use of tiny hairline sutures to connect the amnion to the sclera or cornea. Kochevar says, “With PTB, the patch could be applied quickly to seal the eye to maintain ocular pressure and prevent fluids from leaking out while other more critical trauma care is performed on a wounded soldier. The patch could be applied by any medic, not necessarily an ophthalmologist or cornea specialist, and could remain in place for a day or two until the injured soldier can be seen by a specialist.”

An amnion patch applied with PTB might work well with irregularly-shaped or stellate wounds. So far this research has only been conducted on rabbits. Kochevar hopes the project earns FDA approval down the road because the PTB technique would be much easier for ophthalmologists to perform and may reduce inflammation and scarring for the patient.

2. Preventing Cornea Damage in Burn Victims – Burned facial skin tends to pull and tighten as it heals, making it difficult to blink. Burn victims may lose their corneas and require transplant surgery if they can’t keep their corneas moist. The problem with using amnion applied with current technology is that the eye produces enzymes after a day or two to try to dissolve the foreign material.

Researchers hope that PTB technology will stabilize the amnion so that it can be left in place for a week or two, saving money, time and corneas. Dr. Anthony Johnson is currently setting up the animal model for testing, and Kochevar says they have worked out ways to crosslink proteins in the amnion to prevent eye enzymes from dissolving it.

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