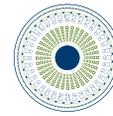


EDUCATION

Defense Related Vision Research:

Iowa Researcher Seeks to Improve Corneal Transplantation Outcomes



DECADE OF VISION
an initiative of the
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Alliance For Eye And Vision Research



Featured speaker Mark Greiner, M.D. (University of Iowa Carver College of Medicine)

On March 21, AEVR hosted its eighth military eye trauma Congressional Briefing entitled *Cornea Transplant Tissue Quality and Sight Restoration* co-sponsored by RPB, Blinded Veterans Association (BVA), the Eye Bank Association of America (EBAA), and ARVO.

The Briefing featured Mark Greiner, M.D., an Assistant Professor of Ophthalmology and Visual Sciences at the University of Iowa Carver College of Medicine. A clinician-scientist who specializes in corneal surgery and studies ways to improve the outcomes after corneal transplants, he is part of a team whose research is supported by funding from the DOD, Department of Veterans Affairs (VA), and the NEI. This was not Dr. Greiner's first time on Capitol Hill — in February 2016, he participated in the *Emerging Vision Scientist* track during ARVO's Advocacy Day, and was invited back to speak due to his effectiveness in describing the value of federally funded vision research.

The Briefing focused on the cornea—the clear front window of the eye that is the key to focusing light and essential for good vision. When the cornea is damaged or diseased, an individual's vision becomes impaired and their ability to fully function is jeopardized. The cornea has the highest density of nerve fibers in the body—forty times that of skin—and has no blood vessels, which affects the healing process. Corneal blindness is the fourth leading cause of vision loss around the world.

Corneal injuries are especially common among active military personnel since, in battlefield conditions, the front of the eye is vulnerable to trauma from chemical, biohazard, and laser assaults, as well as environmental conditions. In active-duty military personnel, corneal abrasions and lacerations have accounted for 26.7 percent of all inpatient visits for eye injuries, excluding minor injuries. In those personnel that sustained significant corneal injuries during Operations Enduring Freedom and Iraqi Freedom, 23.4 percent received a corneal transplant, and of these, 35 percent of the transplants failed, as evidenced by clouding of the cornea after surgery.

Dr. Greiner, who is also a Medical Director at the Iowa Lions Eye Bank and serves on the Board of Directors of EBAA, discussed the important role that eye banks play in ensuring a reliable supply of healthy donor tissue for transplants and research. He highlighted that the United States, almost uniquely in the world, has a sufficient supply of donor tissue thanks to the nationwide distribution network that the eye banks have created. Not only do corneal

transplant surgeries restore sight and greatly improve the quality of life for patients, they also confer significant economic benefits. A report commissioned by the EBAA estimates the lifetime economic benefits in the U.S. at nearly \$6 billion.

Approximately 50,000 corneal transplants are performed annually in the U.S. Of these, a substantial percentage fail due to poor tissue quality and approximately 10 percent are repeat surgeries for transplant failure. Currently, there are no measures that can indicate the health of cornea transplant tissue before surgery. To improve outcomes for both military and civilian patients, Dr. Greiner's research focuses on identifying individuals at the greatest risk for developing complications and poor outcomes after transplantation, and improving the quality of transplant tissue.

Although cornea transplants have been performed since 1905, until approximately 18 years ago the only type of transplantation technique performed was a full-tissue replacement of the cornea, which consists of five layers. More recently, two partial-tissue procedures been developed—Descemet Stripping Automated Endothelial Keratoplasty (DSAEK) and Descemet Membrane Endothelial

Diabetes could become a major factor in predicting the success or failure of transplants.
—Dr. Greiner

Keratoplasty (DMEK)—which only replace the endothelium, the inner portion of the cornea, leaving the recipient's remaining corneal tissue in place. Dr. Greiner has applied a new technology called extracellular flux analysis to the study of corneal endothelial cell function, which can give some indication of how a transplant will perform by measuring mitochondrial respiration and the capacity for a cell to use oxygen to create energy. Essentially, the device can function as a stress test to gauge how well the transplant may perform after surgery.

Noting other challenges to successful transplants, Dr. Greiner reported that diabetes can have a significant impact, although the exact reason for this is not yet known. Evidence indicates that diabetes increases cell loss in the endothelium after routine eye surgery, including cataract surgery. A donor history of diabetes also impacts the ability to prepare cornea transplant tissue. Additionally, for cornea transplant recipients with diabetes, the risk of transplant failure more than doubles from 2.4 percent to 5.7 percent. Diabetes could become a major factor in predicting the success or failure of transplants, as the incidence of diabetes in this country, currently at 9.3 percent of the population, is expected to rise to 33 percent by the year 2050.

Dr. Greiner concluded by discussing the future of corneal transplants and possible ways to improve outcomes after surgery. One goal would be the discovery of a biomarker that would

identify which tissues are ideal for transplants and which would likely fail, preventing the transplantation of unsuitable tissues. This could lead to the development of drugs that could stabilize corneal cells, making them more suitable for transplantation or less prone to damage during eye surgery. Another possible development would be the use of autologous corneal tissues—using a patient's own cells to grow new corneal tissue. He emphasized that federal funding is vital to support these research efforts, building on past federal support that has already resulted in significant advances in treatment options for patients.



Dr. Greiner with Aaron Falk, office of Cong. Martha McSally (R-AZ), who serves on the House Armed Services Committee



From left: Kevin Corcoran, Executive Director of the Eye Bank Association of America (EBAA), Dale Stamper, National President of Blinded Veterans Association (BVA), Joe Parker, BVA's National Vice President, Paul Mimms, BVA's National Secretary, Mark Cornell, BVA's Immediate-Past National President, and Dr. Greiner

Prior to and after the Briefing and under the auspices of NAEVR, Dr. Greiner visited offices of the Iowa delegation.



Dr. Greiner with Cong. Dave Loebsack (D-IA), who serves on the House E&C Committee