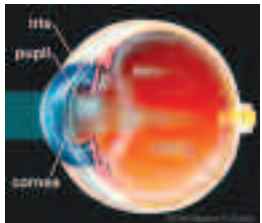


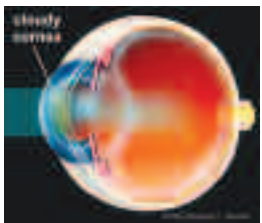
# New options in Corneal Transplants

Bascom Palmer Eye Institute is a comprehensive resource for corneal transplants, providing round-the-clock care to patients of all ages.

Bascom Palmer’s 13-physician cornea transplant team performs more than 250 transplantations each year for patients whose corneas have become cloudy or damaged due to disease, injury, accident or hereditary conditions. Despite the complexity of the surgery, corneal transplants are successful in restoring sight in more than 90 percent of cases.



The cornea is the clear part of the eye in front of the iris and pupil. To see clearly, the cornea and the lens must refract light rays so they focus properly on the retina.



When the cornea is cloudy, light rays cannot focus on the retina causing poor or low vision.

Using highly precise lasers, Bascom Palmer’s ophthalmologists can replace thin layers of damaged tissue. More than a century after the first successful transplant of a donor cornea, Bascom Palmer’s ophthalmologists have powerful new tools to repair corneal damage and restore vision. Using intense, short laser pulses, the Bascom Palmer team can cut and shape corneal tissue to precisely fit each patient’s eyes.

Bascom Palmer was one of the first three centers in the United States to perform this procedure, called *femtosecond laser-enabled keratoplasty* (FLEK), to make tiny incisions in the cornea. “FLEK is the first major advance in full-thickness corneal transplantation since the 1970s,” says William W. Culbertson, M.D., professor and Lou Higgins Distinguished Chair in Ophthalmology. “This will rapidly become the gold standard for corneal transplant surgery.”

Just ask Eddie Valdes, 42, a Miami-Dade police sergeant who was diagnosed at age 14 with keratoconus, a corneal disorder that causes serious distortion of vision. Previously, Valdes had *penetrating keratoplasties* (corneal transplants) using a traditional microsurgery procedure. The transplants improved his vision, although Valdes still needed to wear contact lenses to correct astigmatism. In 2006, Valdes came to Bascom Palmer, where Culbertson performed one of the first U.S. laser-enabled transplants using the IntraLase technology. “My first two transplants were done the traditional way with a scalpel,” says Valdes. “The third time was with the laser. The difference in terms of my vision was incredible. The day after the surgery, Dr. Culbertson removed the bandage and I was seeing almost perfectly with almost no discomfort. Now I can watch TV, read and work at the computer – before it was impossible.”

In the past two years, Culbertson has performed nearly 50 FLEK corneal transplant procedures on a wide range of patients. “Sergeant Valdes’ experience indicates why laser treatments are better,” he says. “We are getting very good results with a faster rehabilitation period, which is very important to a police officer, as well as our other patients.”



Corneal and external disease specialists, Drs. William Culbertson and Sonia Yoo, are part of the corneal transplant team in Miami.

### **An effective surgical procedure**

First performed in 1905, a corneal transplant is a surgical procedure where a damaged or diseased cornea is replaced by donated corneal tissue. With a traditional procedure, the ophthalmologist removes the cornea from the donor eye using tiny trephine blades, a special surgical instrument resembling a cookie cutter. The new cornea is then implanted in the patient's eye through the same process with tiny dissolving sutures holding the new cornea in place.

In 2007, according to the Eye Bank Association of America, approximately 50,000 corneal transplants were performed in the United States.

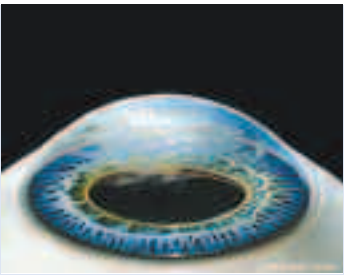
Located within Bascom Palmer's eye hospital is the Florida Lions Eye Bank, one of the most successful ophthalmic tissue banks in the country. During the past 40 years, the Florida Lions Eye Bank has provided approximately 57,000 corneas and scleras for transplantation throughout South Florida and around the world.

### **Innovative procedures**

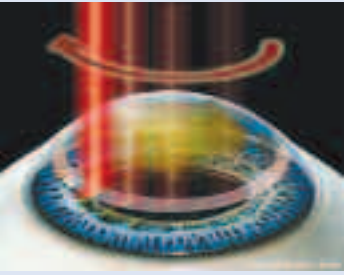
Through the decades, Bascom Palmer physicians, engineers and scientists have developed a number of techniques and instruments to make corneal transplants safer for patients, such as special diamond surgical knives and storage solutions that prolong the viability of donor cornea grafts prior to transplantation. The focus is on ensuring a uniform cut of the donor and recipient corneas for the best match, avoiding damage to the eye's structures and producing the best possible long-term outcomes.

While most cornea transplant patients regain good vision, a common problem is astigmatism, which blurs both near and distance vision. It occurs when the cornea surface is slightly more curved in one direction rather than being spherical. Astigmatism may result from a tiny mismatch in the shape of the donor and recipient's corneal tissue or from slightly asymmetric suture tension. These types of conditions can usually be corrected with contact lenses. With corneal transplant patients there is also a risk that a sudden injury or bump on the head could dislodge the new tissue. In those cases, the tissue can be reattached or a second transplant can be performed.

To schedule an appointment with a Bascom Palmer specialist, please call 1-888-845-0002 or visit [bascompalmer.org](http://bascompalmer.org)



Damaged cornea



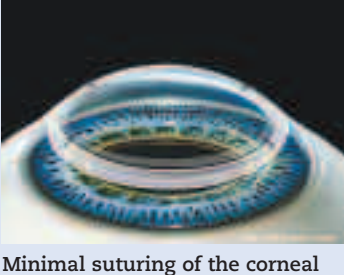
Laser removal of damaged cornea



Removal of cloudy corneal tissue



Placement of new, clear cornea



Minimal suturing of the corneal transplant



Clear cornea with sutures removed

“There had not been a major advancement in corneal transplantation techniques for the past 30 years,” says Sonia Yoo, M.D., cornea specialist and associate professor of clinical ophthalmology. “We have been able to store donor tissue for longer periods and develop more effective anti-rejection medications. Now, the use of lasers is a quantum leap to the next level.”

Noting that the FLEK technology received U.S. Food and Drug Administration (FDA) approval for the transplant procedure in 2006, she added. “This technology will potentially make our outcomes even more successful than in the past.”

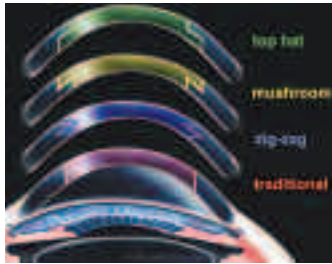
**Precise 3D tissue shaping**

For Bascom Palmer’s ophthalmologists, femtosecond laser technology opens the door to many new advanced options for cornea transplantation. The equipment’s sophisticated computer-controlled software allows physicians to program a nearly infinite variety of three-dimensional shapes with highly precise dimensions.

Looking first at full-thickness transplants, or FLEK procedures, Yoo emphasizes the importance of being able to customize the shape of the donor and recipient corneal tissue based on the size and curvature of the patient’s eye. “You can definitely create a better fit for the patient,” says Yoo.

With the laser, physicians can also cut at different angles along the sides of the tissue for a stronger attachment and lower risk of dislodgement. Rather

than a simple vertical cut with a blade, the surgeon can program different laser configurations, such as the “top hat,” “mushroom” or “zigzag.”



Different types of corneal transplant configurations

“We can create overlapping and interlocking shapes to optimize the junction of the donor and recipient tissue so the tissue is more secure, and the overall healing process is faster.” says Culbertson. Another benefit from those tighter “seals” between the tissue is less tension on the sutures, potentially lowering the level of astigmatism.

**New lasers expand**

For many years, Theodore Zaravinos, M.D., a Fort Lauderdale medical oncologist, needed glasses to read the newspaper because of severe astigmatism, a vision problem that occurs when an unequal curvature of the lens creates a blurred image. Dr. Yoo examined Zaravinos’ eyes to see if he was a candidate for LASIK surgery.

Bascom Palmer has been at the forefront of LASIK and vision correction since its earliest use in 1980 to correct refractive errors in the lens, such as myopia (nearsightedness), hyperopia (farsightedness) and astigmatism. “Everybody has a different reason for wanting to be free of contacts or glasses,” adds Culbertson. “Some patients crave the freedom for lifestyle reasons. Others, like policemen and firemen who can lose their glasses in the line of duty, have vision correction surgery for safety reasons.”

Yoo felt that Zaravinos was a good candidate for Bascom Palmer’s latest LASIK technology – a femtosecond laser that reshapes the corneal lens using ultra-short pulses of energy. In two procedures – one for each eye – Yoo corrected the 60-year-old doctor’s astigmatism.

“Immediately after the left eye was corrected, I was able to see far away,” said Zaravinos. “Then after the right eye was done, I was able to read without glasses. I was particularly happy because I had a difficult case and other doctors had told me I would always have to wear glasses.”

**A growing toolbox**

Bascom Palmer Eye Institute has one of the world’s largest arrays of optical laser technology for treating vision problems. They include excimer lasers, which use ultraviolet light beams, and femtosecond lasers, which emit short pulses of infrared light lasting just one billionth of one millionth of a second. “Each of these lasers

# LASIK vision procedures

has unique advantages and properties, allowing the Bascom Palmer physicians to select the most appropriate laser for an individual patient based upon the patient's needs and eye condition," says Terrence P. O'Brien, M.D.

Bascom Palmer got its first excimer laser in 1993 and began doing LASIK procedures to help patients with low to moderate refractive errors. Since then, the Institute has steadily increased its "toolbox" of powerful lasers. In addition to the VISX S4 laser and the Intralase femtosecond laser, the latest arrivals include the Zeiss Visumax and the Zeimer Femto LDV femtosecond lasers, and the new state-of-the-art Zeiss MEL 80 and Alcon Wavelight Allegretto excimer lasers. These lasers are new generation "flying-spot lasers," which are extremely fast and deliver very smooth treatments.

For LASIK patients, Bascom Palmer's physicians use the Intralase femtosecond laser to create corneal flaps more accurately and dependably than with a standard surgical blade called a microkeratome. "We can create a more precise flap customized to the patient's eye – thicker or thinner with a larger or smaller diameter," Yoo says. "A flap that is too thick leaves less room to reshape the underlying corneal tissue."

Yoo notes that the Intralase flattens the cornea in order to make its incisions, while the Zeiss laser creates the flaps without changing the cornea's shape. "That allows us to make deep corneal incisions on a slope – a more natural shape for the eye."

David A. Goldman, M.D., assistant professor of clinical ophthalmology, adds that the Intralase and Visumax lasers can create corneal flaps like "jigsaw puzzle pieces" that result in stronger reattachment. For LASIK patients, that typically translates into better vision and a faster healing time. "There is also a reduced risk of tiny wrinkles in the cornea, so it is definitely an advancement," says Goldman, who has treated hundreds of LASIK patients with the femtosecond laser.

Recent upgrades in Intralase laser software now allow Bascom Palmer ophthalmologists to create the initial corneal flaps in just 18 to 20 seconds. "That means patients are more comfortable during the procedure," Goldman says.

The Intralase technology can also be used to implant tiny ring segments called "Intacs" to create a more normal corneal surface for patients with keratoconus. Because the Intacs reshape the cornea without removing tissue, the eye's central vision tissues remain intact.

## What's next?

An exciting area of research is the use of femtosecond lasers to soften the lens. The goal is to change the flexibility of the lens and to ultimately restore accommodation, which is the eye's natural focusing power for near vision that all people lose as they age. "If we could restore accommodation, reading glasses could be a thing of the past," says Yoo.

Lasers can also correct optical defects that affect quality of vision, especially at night. Using an instrument called an aberrometer, physicians develop a patient-specific, computer designed excimer laser treatment pattern to remove visual aberrations that may help people see more clearly and, perhaps, confidently drive at night.

## A new option: partial transplants

Bascom Palmer's corneal specialists are also using the femtosecond laser to perform partial transplants, "peeling away" a thin layer of damaged cells on the front or back of the cornea and replacing them with healthy donor tissue. For patients, that means a more secure attachment with less risk of tissue rejection.

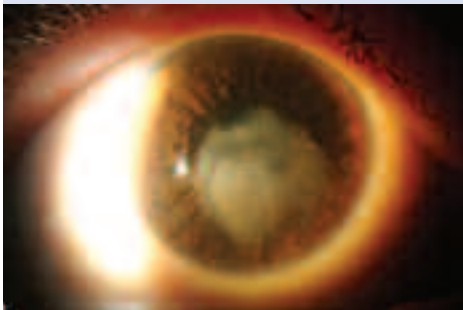
"With this selective keratoplasty, we can transplant different portions of the cornea based on the extent of damage," says Terrence P. O'Brien, M.D., the Charlotte Breyer Rodgers Distinguished Chair in Ophthalmology and director of the refractive surgery service at Bascom Palmer's Palm Beach Gardens location. "This represents a revolution in corneal surgery, since we can now split the cornea into different layers depending on the patient's needs. It is more precise, controlled and safer than manual dissections of the cornea."

To help patients who have corneal edema from damage to the back layer of the cornea, Bascom Palmer's doctors have been selectively transplanting the back of the cornea for more than ten years. The most recent procedure is called *Descemet's stripping automated endothelial keratoplasty* (DSAEK). "Because the front of the cornea remains intact, the patient's prescription usually doesn't change significantly and can usually be corrected with glasses," Yoo says.

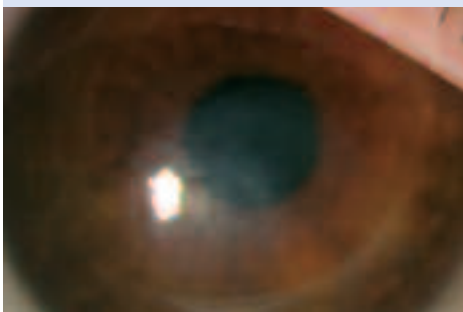
Now, Yoo is studying how the femtosecond laser may simplify the DSAEK procedure for some patients. "The laser may provide greater precision in determining the depth and diameter of layers of donor and recipient tissue," she says.

The new laser technology also offers advantages when working with tissue in the front (anterior) of the cornea.

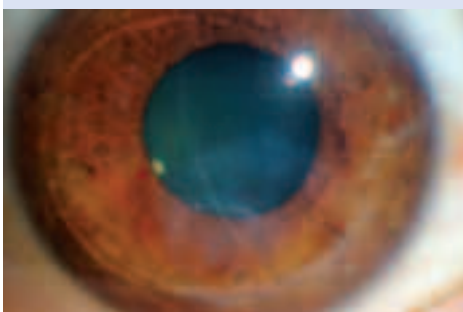
**A CORNEAL TRANSPLANT IS A SURGICAL PROCEDURE WHERE A DAMAGED OR DISEASED CORNEA IS REPLACED BY DONATED CORNEAL TISSUE.**



The white cloudy area shows damage to the front (anterior) part of the cornea. The damaged area will be removed and replaced with a healthy donor graft.



One day following surgery



Eleven days following surgery shows the cornea is clear and vision has been greatly improved

*Femtosecond-assisted anterior lamellar keratoplasty (FALK)* allows corneal specialists to remove only the damaged area and replace it with a healthy donor graft. “We can go as deeply as necessary to remove the cloudy or scarred corneal tissue.”

With either type of partial corneal transplant, the patient typically recovers vision more quickly than with a full-thickness procedure. “With the femtosecond laser, we can minimize the tissue to be transplanted,” she says, “resulting in more rapid healing, a stronger, long-term attachment and a reduced risk of transplant rejection.”

### Transplanting artificial corneas

In cases where a corneal transplant tissue has failed several times, a *keratoprosthesis* (artificial corneal transplant) may provide another option for restoring vision. Bascom Palmer physicians have implanted more than 50 of these thin, flexible devices first introduced in 1987.

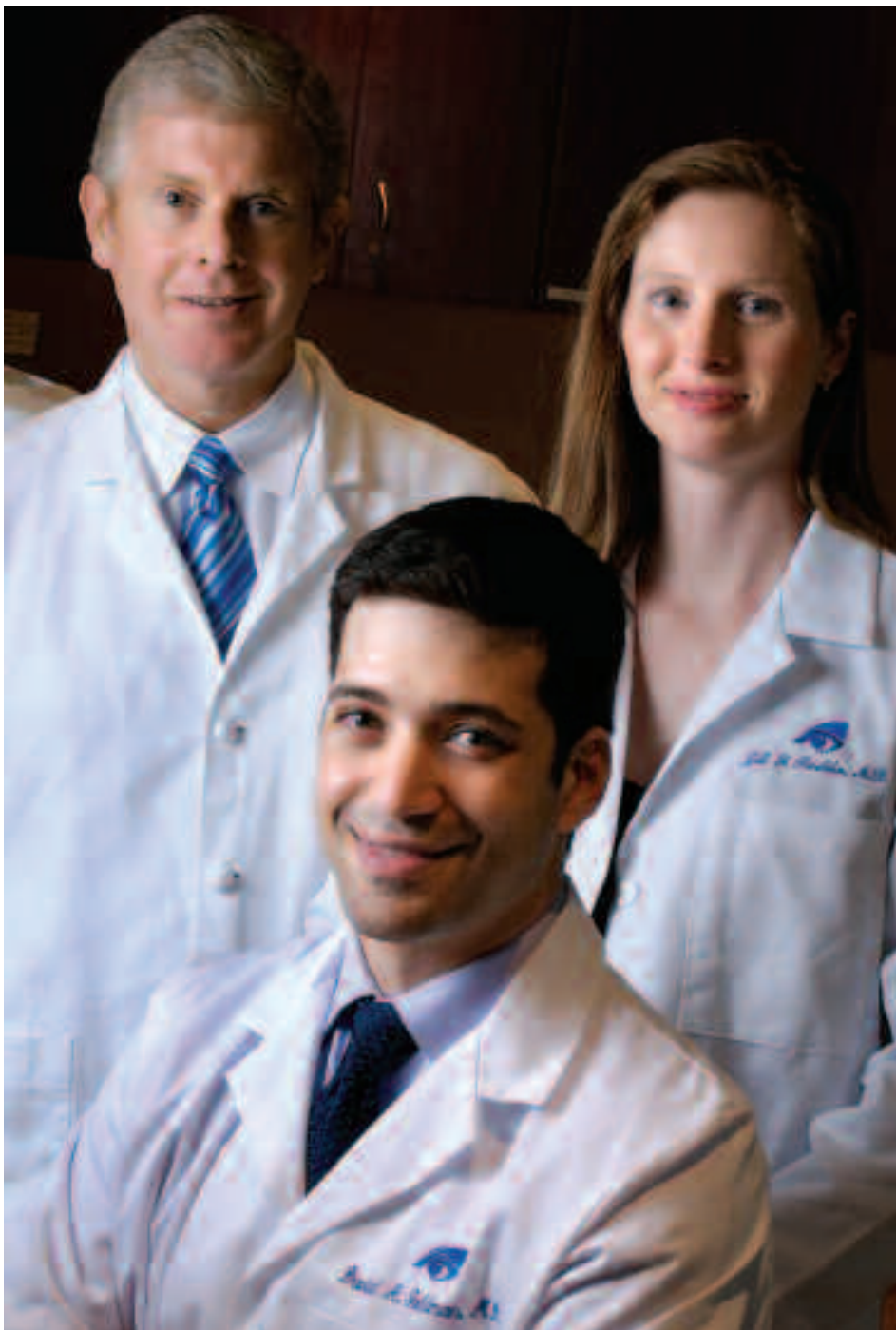
Recently, Eduardo C. Alfonso, M.D., Bascom Palmer’s interim chairman, and Jean-Marie Parel, Ph.D., director of the Institute’s Ophthalmic Biophysics Center, have co-developed a new type of artificial cornea that may eventually be more widely used than earlier devices. “The new keratoprosthesis is designed to rest in a bed placed into the patient’s cornea,” says Parel. “That is similar to partial-thickness corneal tissue transplant in that it forms a tighter bond with the rest of the eye.”

Alfonso notes that artificial corneas have several important benefits for patients, including greater availability, reduced risk of rejection and the ability to design an artificial cornea to the exact specifications of the eye.

“Unfortunately, there aren’t enough donors to provide corneal tissues for every transplant patient,” says Alfonso. “Artificial corneas may be the only solution for patients whose immune systems reject tissue transplants.”



Dr. Eduardo Alfonso leads Bascom Palmer’s 13-physician corneal transplant team which also includes Drs. William Culbertson, Kendall Donaldson, Richard Forster, Anat Galor, David Goldman, Carol Karp, Terrence O’Brien, Victor Perez, Jill Rodila, Sonia Yoo, Richard Awdeh and Anita Gupta.



The corneal transplant team in Palm Beach Gardens is (l to r) Dr. Terrence O'Brien, Dr. David Goldman and Dr. Jill Rodila.

## New possibilities in the future

With the new laser tools, Bascom Palmer's corneal specialists can also intervene earlier in the progression of some eye diseases. For instance, rather than "watch and wait" as scar tissue slowly develops, a thinner slice of the front of the cornea can now be precisely removed and replaced with an exactly matching, clear piece of tissue. "This is a definite quality-of-life benefit for patients who otherwise might struggle with uncomfortable rigid contact lenses and a lower level of visual function for many years," says O'Brien.

Summing up the possibilities, Culbertson says, "The femtosecond laser is an ideal platform for treating many conditions in the cornea, and the outcomes are already excellent. With the laser, there is almost an infinite horizon for improved surgical techniques to treat corneal diseases in the future, resulting in better outcomes for the patient." ■

## A COMPREHENSIVE RESOURCE FOR CORNEAL TRANSPLANT

Bascom Palmer's corneal transplant team treats patients of all ages from newborn infants to seniors. Babies who have a defective cornea at birth often have other eye problems, including glaucoma and retinal or optic nerve disorders. Bascom Palmer's team includes ophthalmologists in all those specialties in order to determine whether a corneal transplant would benefit the baby as well as providing services for other vision problems.

Adult patients at high risk for rejection of corneal tissue are often evaluated by Victor L. Perez, M.D., whose specialties include ocular inflammation and autoimmune diseases of the eye. When there is damage to the eye's sustaining tissues, as well as the cornea, Perez uses his knowledge of the patient's immune system to develop a long-term transplant maintenance program.

Bascom Palmer's Miami center also provides 24/7 emergency care for patients experiencing the typical "RSVP" symptoms of tissue rejection: Redness, Sensitivity to light, Vision decrease and Pain.

"Anyone with a cornea transplant who has these symptoms should come to Bascom Palmer's emergency department in Miami as quickly as possible," says Alfonso. "With proper treatment, corneal tissue rejection can be averted at an early stage. But if you delay, the transplant will fail."



Dr. Victor Perez often evaluates adult patients at high risk for rejection of corneal tissue.