Corneal transplantation is the most common and most successful type of human transplant surgery. With improvements in surgical approaches over the last decade, major eye centers such as UCLA are achieving better visual results with fewer postoperative complications. “There have been significant advances as we have moved toward more customized corneal transplantation,” says Anthony J. Aldave, MD, Walton Li Chair in Cornea and Uveitis and chief of the Cornea and Uveitis Division at the UCLA Stein Eye Institute. “Rather than always transplanting the full-thickness cornea the way we used to, we now replace only the portions of the cornea that are diseased. That means we are not altering the natural anatomy as much, continued on p. 4
UCLA Clinical Updates

Learn about the Latest Advances from UCLA

UCLA Adult Cystic Fibrosis Program

UCLA has an adult cystic fibrosis clinic focused on patients 18 years and older that provides careful attention to the seamless transition of pediatric patients to adult care.

Low-Testosterone Diagnosis and Treatment

A significant decline in testosterone can produce symptoms ranging from low sex drive and memory problems to fatigue and depression.

Undiagnosed Diseases Network

As part of the nationwide Undiagnosed Diseases Network, UCLA’s Department of Human Genetics and other clinical departments are now treating select patients at no cost to them or their insurance in an attempt to diagnose rare and difficult conditions.

Minimally Invasive Diagnoses and Treatment for Chest Diseases

UCLA’s Interventional Pulmonology Program offers an expanding list of minimally invasive procedures, giving patients the most advanced and comprehensive clinical care while benefiting from shorter recovery times.

Immunotherapy Checkpoint Blockers

Immunotherapy checkpoint blockers are a new class of drugs that help release restraints on the immune system.

Immunotherapy Approaches for Genitourinary Cancers

Breakthroughs in immunotherapy are revolutionizing the treatment of genitourinary cancer, with new treatment options available or imminent for patients with kidney, bladder or prostate cancer.

Robotic Technology Extends Minimally Invasive Colorectal Surgery

Colorectal robotic-assisted surgery is the latest advance in minimally invasive procedures for colon and rectal diseases, including colorectal cancers, diverticulitis and inflammatory bowel disease (ulcerative colitis and Crohn’s disease).

4π Radiation Therapy for Patients with Recurrent Glioblastoma

This external beam radiation therapy, which can deliver a dose of radiation more precisely, is currently available only at UCLA as part of a Phase 1 clinical trial for patients with recurrent glioblastoma multiforme.

Spinal Deformity Program

The Spinal Deformity Program at UCLA offers comprehensive clinical care services for infants, children, adolescents and adults with scoliosis and other spinal deformity disorders.

Pediatric Blood and Marrow Transplant Program

UCLA has been a pioneer in many alternative transplant protocols, including the use of haploidentical bone-marrow transplantation, and continues to find new ways to improve survival rates and decrease complications.

Surgery for Congenital Anomalies of the Kidney and Urinary Tract

Congenital anomalies of the kidney and urinary tract are birth defects that are often discovered in a routine fetal ultrasound during pregnancy. While some resolve on their own after birth, others require close monitoring and corrective surgery, often within the first year of life.

To download these and other clinical advances at UCLA Health, go to: uclahealth.org/clinicalupdates
Custom Molded Lens Benefits Patients with Irregular Eye Surface

Patients with irregularities to the surface of their eyes that have prevented them from benefiting from visual correction now can achieve better vision with a new technology that enables custom lens fabrication. The new product, which has been offered since 2015 at UCLA’s Stein Eye Institute, is a boon for patients who have been unable to benefit from glasses and can’t wear contact lenses due to factors such as a corneal transplant, scarring, chemical burns or ocular trauma that has altered their sclera.

“Traditionally, it has been very hard to fit these patients,” says Vivian Shibayama, OD, an optometrist at the UCLA Stein Eye Institute who performs specialty fits for patients with irregular corneas resulting from conditions such as keratoconus, corneal transplants, scars and dry eyes.

The EyePrintPRO is a type of scleral-lens design based on impressions of the patient’s ocular surface so that it can match the contour of any eye. The custom-made lens, fabricated from a high-oxygen permeable material, improves vision, much like standard corrective lenses, through a smooth refractive surface for the affected eye.

Scleral contact lenses — designed to vault over the corneal surface and land on the sclera — are effective in many patients with hard-to-fit eyes in need of correction who are unable to wear either soft lenses or the standard gas-permeable hard lenses that can smooth the irregularity on the cornea, Dr. Shibayama explains. The types of patients for whom scleral lenses are most commonly prescribed include individuals with irregular corneas, as well as those with refractive errors and presbyopia. Because they can hold fluid against the cornea, scleral lenses are also prescribed for patients with severe dry eyes.

But not everyone who needs a scleral lens has been able to wear them. “The scleral lens that is available on the market right now fits about 90 percent of the population that needs it,” Dr. Shibayama says. “However, there are some patients — those with irregular scleras, those with surgical tubes and blebs — who can’t wear this lens because the lens needs to land on a smooth surface to fit properly.”

She explains that fitting patients with basic scleral lenses involves drawing from a fitting set of approximately 20 prefabricated lenses that come in different shapes. Dr. Shibayama chooses the one closest to the patient’s shape, then adjusts the curvatures on the lenses to approximate the patient’s fit. But this can be particularly challenging for patients with an irregular eye surface, Dr. Shibayama notes. She estimates that about 5-to-10 percent of her patients are unable to wear the lenses.

Up to now, many of these individuals have been forced to go without visual correction — or, in some cases, to have transplant surgery. “The EyePrintPRO has made an incredible difference in the lives of these individuals,” Dr. Shibayama says. “Because it’s molded to their eye, it’s a perfect fit every time, as opposed to the traditional scleral lens where waiting for remakes can take weeks to finalize a fit.”

Using the same material as a dentist would employ to make a mold for teeth, Dr. Shibayama takes an impression by inserting a tray containing the puddy-like material into the eye and allowing it to set for one minute to mold the irregularities of the cornea and sclera surface. The impression is then sent to a prosthetics lab, which builds a custom lens based on the scan.

Dr. Shibayama says EyePrintPRO is effective for most patients with an irregular sclera, including those who have had multiple eye surgeries, such as glaucoma surgeries as well as corneal transplants. “Not only does this lens provide therapeutic relief in eye pain and discomfort associated with ocular-surface disease, but these patients typically have irregular astigmatism that cannot be fully corrected by glasses,” she explains. “Assuming the poor vision is due to the irregular cornea and not another factor like a detached retina or severe glaucoma, the EyePrintPRO lens will mask this corneal irregularity and give the patient better vision.”

EyePrintPRO lenses are designed to last at least a year and can be kept longer if maintained properly and no changes occur in the eyes, Dr. Shibayama says. “The visual result is more effective because of the perfect fit,” she says.
Improvements in Corneal Transplantation Achieving Better Outcomes

(continued from cover)

and because there is less tissue transplanted, it reduces the risk of rejection.”

Hugo Y. Hsu, MD, a corneal transplant surgeon at Doheny Eye Center UCLA in Pasadena, Arcadia and Fountain Valley, notes that until the mid-2000s, corneal transplants had been done using what he calls a “one-size-fits-all” approach. “Now we are much more selective and accurate in how we transplant the cornea, and for the vast majority of patients, that’s translating into better visual outcomes and faster recovery,” Dr. Hsu says. “The techniques are still evolving and improving, but we are getting closer to making this on par with cataract surgery in terms of the visual success, rehabilitation and minimal complication rates.”

The cornea — the clear, outermost layer of the eye — plays a central role in focusing sight. The cornea can become diseased, affecting vision, from a variety of conditions, including protrusion of the center of the cornea (keratoconus), scarring or inflammation from infections or injuries and cloudiness of the cornea’s inner layer (Fuchs’ dystrophy). Approximately 50,000 cornea transplants are performed in the United States each year.

The most common indication for corneal transplantation in the United States is Fuchs’ corneal dystrophy, an inherited disorder of the cornea’s innermost layer, the endothelium. Beginning in the mid-2000s, the approach known as Descemet’s stripping endothelial keratoplasty (DSEK) gained traction in the U.S., marking a major advance. Unlike full-thickness corneal transplantation, DSEK selectively replaces the posterior portions of the cornea with the donor’s corneal tissue. “The cornea has multiple layers, and it’s clear that in most patients we don’t need to replace the entire cornea,” says Dr. Hsu. “This has led to major improvements in visual acuity along with more rapid recovery and lower rejection risk.”

Following the DSEK, a significant portion of patients with otherwise healthy eyes can expect to achieve up to 20/40 vision with glasses — far better than what most could have expected from older techniques, Dr. Hsu notes.

Dr. Aldave, who began performing DSEK in 2006, notes that in the last several years, a new version of DSEK has been popularized at UCLA and other highly specialized centers, particularly for patients whose corneal edema is caused by endothelial dysfunction or failure, including Fuchs’ patients. Descemet’s membrane endothelial keratoplasty (DMEK) replaces only Descemet’s membrane, the thin innermost layer of the cornea on which the endothelial cells reside, with no stromal tissue involved. This has led to a further improvement in results for the surgeons who perform the procedure.

For patients with keratoconus, a corneal disorder that affects approximately one-in-2,000 people in the U.S., Descemet’s membrane is the only healthy portion of the cornea. “In this case it’s a problem with the cornea’s shape that progresses, usually affecting people in their teens or 20s, to the point where they may not see well with glasses or contact lenses,” Dr. Aldave explains. For these patients, the surgeons transplant the diseased portion of the cornea while leaving the critical inner Descemet’s membrane layer intact in a surgery known as deep anterior lamellar keratoplasty (DALK). This, too, has led to better outcomes, including elimination of the risk of corneal endothelial rejection.

For patients who can’t benefit from donor tissue, including those who have had previous corneal transplants, advances in artificial corneal...
Improvements in Corneal Transplantation Achieving Better Outcomes

What was once considered experimental is now an accepted approach for a variety of indications. Dr. Aldave notes that two developments have significantly improved outcomes in the last decade: modifications in the design of the surgical device and improved medical therapy after the surgery.

Advances in corneal transplantation are having an impact on indications: Because the outcomes are better, patients with less severe disease are increasingly recommended for surgery. “When the surgery wasn’t likely to give you much better vision, we tended to wait until the patient’s vision was really poor,” says Dr. Hsu. “Now, the results are so much better that it makes more sense to address the problem at an early stage. Corneal transplantation is the most successful solid-organ transplant, and unlike other organs, it doesn’t require systemic immunosuppression after the surgery. Patients who are in need should be encouraged not to delay seeking a consultation.”

“Corneal transplantation is the most successful solid organ transplant, and unlike other organs it doesn’t require systemic immunosuppression after the surgery. Patients who are in need should be encouraged not to delay seeking a consultation.”

Optical cross-section of cornea following deep anterior lamellar keratoplasty. The total corneal thickness is 483 microns; the transplanted portion is 453 microns and the remaining inner layer of host cornea (arrow) measures 30 microns.

Image: Courtesy of Dr. Anthony Aldave
Femtosecond Laser Increases Precision of Cataract Surgery

The femtosecond laser — a “micro-scalpel” capable of cutting tissues on a microscopic scale with extreme precision — has increased the accuracy of the most common surgical procedure in the United States. The instrument now being used for many precision cataract procedures at the UCLA Stein Eye Institute’s outpatient surgical center and the Doheny Eye Center UCLA in Arcadia emits optical pulses of a femtosecond — one-millionth-of-one-billionth of a second.

“A femtosecond laser can be thought of as a micro-scalpel, incising the cornea and lens capsule and breaking up the cataract on a microscopic scale with an incredible level of precision,” says Kevin M. Miller, MD, Kolokotrones Chair in Ophthalmology at the UCLA Stein Eye Institute. “With a femtosecond laser, we can operate more efficiently and more precisely. For our patients, it reduces the time the eye is open and eases the stress on the internal structures of the eye. And with such accuracy at our disposal, we believe that the laser will open new avenues of treatment that have never been possible before.”

Dr. Miller and other UCLA eye surgeons have been using a femtosecond laser to assist with several steps of cataract surgery, under imaging...
guidance. These procedures include corneal incisions to remove the cataract and manage astigmatism, lens softening and making an opening in the capsular bag.

“I explain to patients that this is like what they see in the movies, where a laser is applied to whatever needs to be cut easily,” says Kenneth Lu, MD, an ophthalmologist at Doheny Eye Center UCLA in Arcadia. “We can use it to do all of the cutting portion of the surgery, in an automated fashion rather than being manually performed, which makes it more precise.” Dr. Lu says she employs the femtosecond technology for approximately one-third of the cataract surgeries he performs, depending on factors such as the difficulty of the case and patient preference.

For cataract procedures, the femtosecond laser system is gently docked to the patient’s eye and optical coherence tomography imaging is used to map the internal structures of the eye. Prior to the operation, the surgeon programs the location and size of the incisions as well as the region of the lens to be softened. After the imaging, the surgeon can make adjustments to the location and size of the incisions and the region of lens softening. The surgeon then depresses a foot pedal, which fires the laser to create the incisions and lens fragmentation pattern. The eye is undocked from the laser and the patient is moved under the operating microscope. The surgeon proceeds to remove the cataract and implant the intraocular lens to complete the surgery.

Cataract procedures are already highly successful, Dr. Miller notes, but the femtosecond laser offers an incremental improvement in the precision and reproducibility of the incisions for modifying the patient’s astigmatism and for removing the cataract. “It can make a 90-degree turn inside the cornea, which we can’t possibly do with a metal blade or diamond knife,” Dr. Miller says. “And it eliminates surgeon variability by stamping out a perfect incision every time.”

But the femtosecond laser does more than produce precise repeatable incisions in cataract procedures. It also makes a perfectly round and centered opening in the anterior lens capsule — the capsulorrhexis. This has benefits that go beyond the cosmetic and into the realm of improving safety, Dr. Lu notes. In addition, by pre-softening the cataract, the femtosecond laser reduces the amount of cumulative dissipated energy needed — thereby reducing the time spent emulsifying the cataract with ultrasound. This is particularly important for dense-cataract patients, improving safety by limiting exposure as well as leading to faster recovery.

Drs. Miller and Lu believe future lens designs will take advantage of the technology’s capabilities, including the precisely sized and positioned capsulorrhexis. “Multifocal lenses have to be perfectly centered on the pupil to function at their optimum,” Dr. Miller says. “Locking the lens implant in would ensure quality each time. That is just one example of what I believe will be many new compelling reasons to use the femtosecond laser in the future.”
New minimally invasive surgical techniques developed by UCLA ophthalmologists are improving the overall function and aesthetic appearance of patients with thyroid eye disease — a disorder that can not only cause vision problems but also be disfiguring. The new approaches, which can be utilized alone or in conjunction with more traditional therapies, are allowing a much wider range of patients to benefit from treatment. Among patients who can benefit are those with milder forms of the disease who were not considered candidates when the treatment was more invasive, as well as patients with active inflammatory disease who previously might have been advised to wait until their symptoms subsided, even if that meant living with the disfigurement.

Thyroid eye disease, most commonly associated with Graves' hyperthyroidism, is an autoimmune disorder in which the muscles and soft tissue behind the eye become inflamed. “There is a wide range of severity with this disease,” says Robert Alan Goldberg, MD, Karen and Frank Dabby Endowed Chair in Ophthalmology at the UCLA Stein Eye Institute and director of the UCLA Orbital Disease Center. “The swelling can cause double vision and even vision loss. And the cosmetic concerns are significant; patients can become quite disfigured.”

The condition affects about five times more women than men, and it generally occurs when they are in their 30s or 40s. “Although the classic picture of thyroid eye disease is a patient with red, bulging, misaligned eyes, the disease is distinctly heterogeneous and most patients are more mildly affected,” says Daniel B. Rootman, MD, MS, an orbital and ophthalmic plastic surgery specialist who sees patients at Doheny Eye Center UCLA in Pasadena and at the UCLA Orbital Disease Center in Westwood. “But, whether severe or not, patients are often deeply affected by these alterations in their appearance.”
Dr. Rootman explains that historically, surgical rehabilitation has been offered only in the most severe cases, and usually only after the disease has passed through its active phase over the course of some 18 months. At that point, treatments are typically focused on the functional goals of reducing eye bulging, double vision and eyelid retraction. “This concentration tends to neglect a range of patients who do not fit classic anatomic or physiologic indications, yet still are transformed by the course of this disease,” Dr. Rootman says. “Further, patients in this paradigm are often left untreated for more than two years, which can feel like a lifetime.”

At the UCLA Orbital Disease Center, Drs. Goldberg and Rootman have advanced techniques that are changing this paradigm. Most notably, they have developed minimally invasive approaches to orbital decompression, the core surgery for thyroid eye disease. Orbital decompression addresses both the functional and aesthetic concerns with thyroid eye disease by seeking to reduce the proptosis and congestion that occur as a result of the increased size of the muscles and fat behind the eye that occurs in the disease.

“In the past, this was done through large incisions,” Dr. Goldberg explains. “It involved taking a lot of bone out from around the eye, and the techniques were unpredictable. They could cause numbness or double vision, and usually required hospitalization. Our newer techniques go through smaller incisions, take out more of the fatty tissue and less of the bone, and use improved instrumentation and anatomic techniques for much more delicate bone removal.”

Whereas surgeons once made incisions on the eyelid or the side of the face, often introducing new cosmetic and visual problems, tiny incisions involving the mucous membrane have minimized complications and scarring.

Dr. Rootman notes. And newer techniques that involve focusing on the deep orbital bone while leaving the lateral bony wall intact have minimized complications that were common in the past.

These and other approaches developed at the UCLA Orbital Disease Center — including rehabilitative surgeries for the eyelids, eye muscles and facial changes — have resulted in less-visible scars and significantly reduced rates of double vision, improving aesthetic and functional results while reducing side effects and complications of the disease. Surgeries that once took two-to-three hours can be completed in less than an hour on an outpatient basis. All of this has expanded surgical indications for the population. “In the past, we would only subject patients to the big scars and potential complications if they had severe vision or aesthetic problems,” Dr. Rootman says. “Now we can offer this to a much wider range of people, including patients with less severe symptoms.”

The UCLA Orbital Disease Center is a major international referral facility for thyroid eye disease patients, in part because of such approaches. “These are patients with a very difficult disease, who may be looking at multiple stages of surgical rehabilitation,” Dr. Goldberg says. “It’s especially important to minimize the invasiveness and side effects of the surgery — both for psychological reasons and for medical purposes. That is what has driven our efforts at this center for the last 25 years.”

(Left) This axial (cross sectional) CT image from a person with Graves’ hyperthyroidism shows excessive fat deposition in both orbits with bilateral proptosis. These findings can be seen with thyroid ophthalmopathy (thyroid eye disease) without thickening of the extra-ocular muscles.

Image: Science Source

Minimally invasive approaches to orbital decompression surgery performed by surgeons of the UCLA Orbital Disease Center focus on both functional and aesthetic concerns with thyroid eye disease by addressing the increased size of the muscles and fat behind the eye that occurs in the disease.

Photo: Courtesy of Dr. Robert Alan Goldberg
Alternative Strabismus Surgery Offers Significant Benefits for Patient Outcomes

Surgery to tighten and strengthen eye muscles is among the standard procedures to correct misaligned eyes in patients with strabismus. Now a UCLA Stein Eye Institute group is pioneering the North American introduction of an alternative muscle-strengthening approach that represents a fundamental change in the way strabismus surgery is performed.

The alternative method, known as plication, offers numerous advantages and virtually no disadvantages compared to the approach taught for many decades in the United States, says Joseph L. Demer, MD, PhD, the Leonard Apt Professor of Pediatric Ophthalmology and chief of pediatric ophthalmology and strabismus. “This operation is less traumatic and more potentially reversible,” Dr. Demer explains. “It spares blood vessels, causes less inflammation and bleeding and is technically easier to perform than resection. We are constantly looking for ways to optimize surgery and make it less invasive. The technical innovation of plication does that, while expanding the options surgeons have for treating strabismus.”

Plication has been practiced in Europe for several decades. Dr. Demer learned the approach from strabismus surgeons in Heidelberg, Germany, more than 10 years ago. Since then, he has worked with UCLA Stein Eye Institute colleagues on studies to validate plication’s benefits.
One objective of strabismus surgery is to shorten an eye muscle so that it pulls harder — analogous to shortening the length of a rubber band so that the elastic material, stretched over the same distance, exerts more tension. “If the eye is crossed, for instance, the lateral rectus muscle can be tightened in this way to correct the crossing,” Dr. Demer explains. In the United States, eye-muscle tightening has traditionally been accomplished through resection — cutting out the tendon and a portion of the front of the muscle, then sewing it back into the eye, with the shortened muscle pulling tighter along the same path as a result.

Plication takes an alternative approach — placing sutures through the tendon or muscle an equivalent distance from the attachment point, and farther back along the length of the muscle, and then sewing those sutures to the wall of the eye at the original insertion point. While the muscle is still tightened just as much as in resection, in plication the redundant front part simply folds underneath rather than being cut away. “Instead of amputating the front part of the eye muscle and tendon, the surgeon simply folds it up and leaves it in place,” Dr. Demer says.

Plication carries several advantages, he says. Traditional resection surgery removes blood vessels when the tendon is removed, and this sacrifices part of the blood supply to the front of the eye. When the blood vessels are plicated rather than removed, they continue to supply blood to the interior of the eye. Folding, rather than amputating, a portion of the tendon and muscle also reduces the risk of inflammation and bleeding. And, finally, if the sutures break after part of the muscle is removed through resection, the muscle could snap back into the eye socket irreversibly, leaving the patient with a very difficult strabismus to correct. “If the sutures break following the plication approach, the patient would simply be back to where he or she was before the surgery,” Dr. Demer says. “The muscle would simply unfold to its original configuration.”

Dr. Demer has also experienced success using the procedure for patients with complicated forms of strabismus and nystagmus in which his team has had to operate on as many as eight muscles in a single setting. In such cases, surgery by traditional resection methods would have been impossible because of the threat it would pose to blood flow to the front of the eye, he notes, but plication doesn’t compromise blood flow.

For typical cases, plication is technically easier to perform and less invasive than resection, Dr. Demer says, because while the suturing task is basically the same, plication avoids the extra step of cutting away the muscle through two large incisions. Although not all strabismus patients stand to benefit from a muscle-tightening procedure, Dr. Demer estimates that the approach can be beneficial for up to three-fourths of strabismus patients.

“Plication is an innovative improvement that can be adopted overnight by any ophthalmologist who has ever learned to operate on the eye muscles,” Dr. Demer says. “Considering that it is very easy to do and has many advantages and essentially no disadvantages compared to resection, I expect that as more strabismus surgeons learn about plication, it will be adopted widely.”

“We are constantly looking for ways to optimize surgery and make it less invasive. The technical innovation of plication does that, while expanding the options surgeons have for treating strabismus.”
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