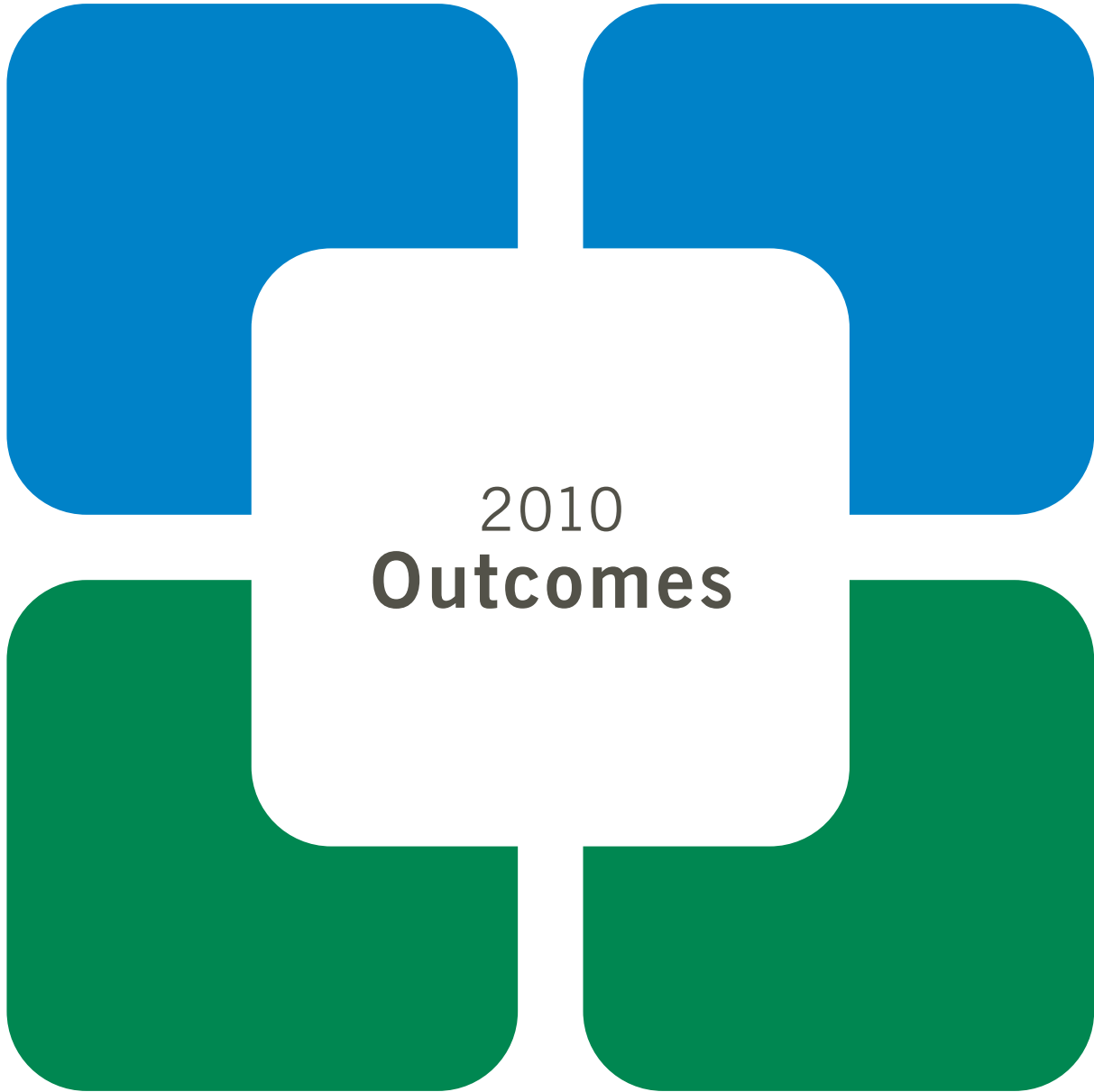


Cole Eye Institute



2010
Outcomes





To promote quality improvement, Cleveland Clinic has created a series of Outcomes books similar to this one for many of its institutes. Designed for a physician audience, the Outcomes books contain a summary of our surgical and medical trends and approaches, data on patient volumes and outcomes, and a review of new technologies and innovations.

Although we are unable to report all outcomes for all treatments provided at Cleveland Clinic — omission of outcomes for a particular treatment does not necessarily mean we do not offer that treatment — our goal is to increase outcomes reporting each year. When outcomes for a specific treatment are unavailable, we often report process measures associated with improved outcomes. When process measures are unavailable, we may report volume measures; a volume/outcome relationship has been demonstrated for many treatments, particularly those involving surgical techniques.

In addition to our internal efforts to measure clinical quality, Cleveland Clinic supports transparent public reporting of healthcare quality data and participates in the following public reporting initiatives:

- Joint Commission Performance Measurement Initiative (qualitycheck.org)
- Centers for Medicare & Medicaid (CMS) Hospital Compare (hospitalcompare.hhs.gov)
- Ohio Department of Health (ohiohospitalcompare.ohio.gov)
- Cleveland Clinic Quality Performance Report (clevelandclinic.org/QPR)

Our commitment to providing accurate, timely information about patient care also will help patients and referring physicians make informed healthcare decisions.

We hope you find these data valuable. To view all our Outcomes books, please visit Cleveland Clinic's Quality and Patient Safety website at clevelandclinic.org/quality/outcomes.



Dear Colleague:

It is my great pleasure to present Cleveland Clinic's annual Outcome books. The current edition includes outcomes and volumes along with innovations and publications for Cleveland Clinic's clinical services through calendar year 2010.

Cleveland Clinic is celebrating its 90th Anniversary in 2011. Our founders were innovators. They created a unique model of medicine based on patient care, enhanced by research and education. We honor this legacy, measuring quality, reporting outcomes and continuously improving the value of medical services.

Cleveland Clinic Outcomes books are offered in print and online. Additional data is available through our online Quality Performance Report (clevelandclinic.org/QPR). The site offers data in advance of national and state public reporting sites, in key areas including heart attack, heart failure, stroke and infection prevention.

Thank you for your interest in Cleveland Clinic Outcomes books. We hope you will find them useful and informative.

Sincerely,

A handwritten signature in black ink, appearing to read "DMC".

Delos M. Cosgrove, MD
CEO and President

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Visit clevelandclinic.org/OutcomesOnline, and we'll remove you from the hard copy mailing list and email you when next year's books are online.

Chairman's Letter

I am pleased to present the 2010 Outcomes Book for Cleveland Clinic Cole Eye Institute. This is the fifth year that we have shared our clinical outcomes with referring physicians, alumni and potential patients around the country. As you will see in the pages that follow, we have had a busy year, with more than 173,000 patient visits, 8,000 surgical procedures, many new innovations and grants, and increasing involvement in clinical trials and cutting-edge research programs.

We put an enormous amount of effort into collecting and analyzing the data for this book. Our goal is to be as complete and accurate as possible. We do not alter our results and work very hard to provide all outcomes for each condition listed. This exercise allows us to objectively measure and understand our surgical results.

Our key assessment measures continue to be visual acuity and the rate of surgical complications. We continue to use Early Treatment of Diabetic Retinopathy Study (ETDRS) protocol refraction as the means of measuring all visual outcomes reported in this book. We meet regularly to discuss our outcomes and charge ourselves each year with expanding the scope of this exercise. In addition, we are constantly looking for ways to implement what we learn to improve results for our patients.

On behalf of my colleagues, I hope that you find this edition of the Cole Eye Institute Outcomes book useful. As always, our team of clinicians and researchers remains committed to innovate, educate, discover and, most important, put patients first in all that we do.



Daniel F. Martin, MD
Chair, Cole Eye Institute



Institute Overview

Cleveland Clinic Cole Eye Institute is a center of excellence for highly specialized ophthalmologic care and research, with a reputation for innovation and superior outcomes. Our staff has one of the highest patient volumes in the United States and aggressively pursues research to bridge the gap between laboratory and patient care. We are ranked among the top 10 ophthalmology programs in the nation by *U.S. News & World Report* — the highest ranking in Ohio.

Cornea and External Diseases

Our Cornea and External Diseases staff performs more than 1,500 cataract surgeries each year. They also offer advanced procedures such as Descemet's stripping automated endothelial keratoplasty (DSAEK), deep anterior lamellar keratoplasty (DALK) and highly specialized transplant procedures.

Vitreoretinal Conditions

Surgical procedures developed by our vitreoretinal faculty are used worldwide to treat retinal detachments, diabetic macular edema, diabetic traction detachments, macular holes and pediatric retinal surgery. Cole Eye Institute experts are also helping develop the next generation of vitreoretinal surgical devices. They utilize advanced retinal imaging devices such as spectral domain optical coherence tomography, both in the clinic and OR, and provide access to the latest clinical trials for patients who are in the early stages of age-related macular degeneration or who have failed standard medical therapy.



Glaucoma

Our glaucoma specialists employ automated visual field testing, retinal nerve fiber layer photography, stereoscopic disc photography and computerized optic disc analysis in the diagnosis of primary, secondary and complicated glaucoma. They offer patients of all ages access to the latest treatments: topical medications, glaucoma implants, mitomycin C, glaucoma filtration surgery, cataract surgery, combined glaucoma/cataract surgery, and laser surgery (argon, Nd:YAG and pulsed-dye).

Keratorefractive Surgery

Cole Eye Institute surgeons use a state-of-the-art excimer laser system for customized treatment of myopia, hyperopia and astigmatism. Our keratorefractive surgeons rely on advanced laser technologies that offer increased accuracy and faster healing, including all-laser or “bladeless” LASIK and photorefractive keratectomy (PRK).

Neuro-Ophthalmology

Our neuro-ophthalmologists are experts in optic nerve disorders, visual field loss, unexplained or transient vision loss, diplopia, nystagmus, thyroid eye disease, ocular myasthenia gravis, unequal pupil size and eyelid abnormalities. They collaborate with Cleveland Clinic Neurological Institute specialists as needed.

Pediatric Ophthalmology/Strabismus

Cole Eye Institute pediatric specialists offer expert treatment for strabismus, retinopathy of prematurity (ROP) and congenital cataracts. They perform about 150 surgical procedures annually for esotropia, exotropia, thyroid eye disease, cranial nerve palsies, dissociated deviations, hypertropia and hypotropias, Duane and Brown syndromes, nystagmus and related conditions.

Oculoplastics

Our oculoplastic specialists perform more than 600 procedures annually for eyelid, lacrimal (tear duct) and orbital surgery. Complex procedures performed include repairs of orbital fractures, ptosis and lacrimal obstruction.

Ophthalmologic Oncology

Cole Eye Institute oncologists treat uveal melanoma and other ocular tumors using advanced techniques such as radioactive plaque therapy to preserve vision. They collaborate with Taussig Cancer Institute and other Cleveland Clinic specialists on translational research projects to improve the outlook for these diseases.

Uveitis

Cole Eye Institute specialists are international leaders in the diagnosis and management of uveitis. They work with rheumatologists and other Cleveland Clinic specialists when uveitis signals a systemic immune disorder, offering topical therapy, antibiotics or other medications along with careful follow-up to prevent/manage relapses and to minimize vision damage.

Genetic Eye Diseases

Cole Eye Institute's Center for Genetic Eye Diseases is an international referral center for multidisciplinary diagnosis, treatment and research of genetic diseases. Our specialists care for patients with inherited corneal and retinal dystrophies and microphthalmia, as well as patients with inherited systemic disorders that involve the eye such as neurofibromatosis, albinism, neurodegenerative disorders and Marfan syndrome.

Many Locations

Cole Eye Institute offers comprehensive specialized ophthalmic care in a state-of-the-art building equipped with advanced technology designed for patients' comfort. In addition, Cole Eye Institute offers high-quality ophthalmic care at six community locations across Northeast Ohio so that patients may receive routine care closer to home. Cole Eye Institute specialists are also on call 24/7 for emergency care.

Research

Cole Eye Institute is heavily engaged in both basic and clinical research, with an aggregate annual grant level of \$9,323,757 for 2009-2010, including \$4,109,754 from federal sources for basic research and \$1,283,000 annually for clinical research. This funding helps both basic and clinical researchers better understand ophthalmic conditions, and pioneer new treatments and techniques that will improve visual outcomes. Major research initiatives under way include those in the areas of age-related macular degeneration, diabetic retinopathy, retinal degeneration, imaging and retinopathy of prematurity.

Teaching

Teaching is an important part of Cole Eye Institute's mission. Our residents and fellows enjoy in-depth clinical experiences in both tertiary and community care settings. Ophthalmology residents now rotate through Lakeland Eye Surgeons facilities in Lorain County. Cole Eye Institute also offers rewarding research fellowships.

2010 Key Statistics

Total Clinic Visits	173,224
Total Surgeries	6,637
Total Surgical Procedures (surgeries in OR and all outpatient procedures)	8,871
Total Laser Procedures	1,385
Total Intraocular Drug Therapies	3,408

Cataract Surgery



Cataract surgery is the most commonly performed surgical procedure in ophthalmology and thus represents a significant proportion of the surgical caseload performed at Cleveland Clinic Cole Eye Institute. From October 2009 through September 2010, a total of 1,755 cataract extraction procedures were performed.

The goal of cataract surgery is improvement of visual acuity, which is accomplished for the vast majority of our patients. There was a ≥ 15 -letter improvement in ETDRS protocol refraction visual acuity in 44.3 percent of patients at their one-month follow-up, and 51 percent of patients had at least some improvement. The remaining 4.5 percent had no change or a decrease from baseline status.

The overall improvement in vision was seen in patients with a cataract condition; some also may have other disorders of the eye, such as glaucoma, retina disease or anterior segment disease. A significant number of our cataract patients have multiple clinical morbidities. In patients without other eye disease, the mean visual acuity score with best glasses correction following surgery was 78 ETDRS letters, corresponding to nearly 20/20 vision.

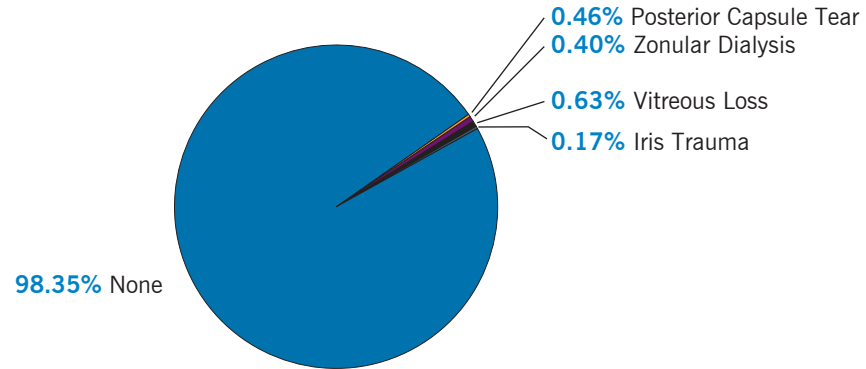
Intraoperative complications during cataract surgery were uncommon, occurring in only 1.6 percent of patients. The most common complication was vitreous loss, reported in 0.6 percent of patients.

Postoperative complications were also rare, occurring in 1 percent of patients. The most common complications observed were retina-related. Other postoperative complications included cystoid macular edema, corneal edema and vitreous hemorrhage, reported in less than 0.2 percent of patients.

Most patients achieved a refractive outcome following cataract surgery that was near the anticipated refractive error. Despite the large number of patients with other conditions that can influence the refractive outcome, or the accuracy in measuring the final refractive error, 71 percent of patients achieved a final spherical equivalent refractive error within 1 diopter of the expected result.

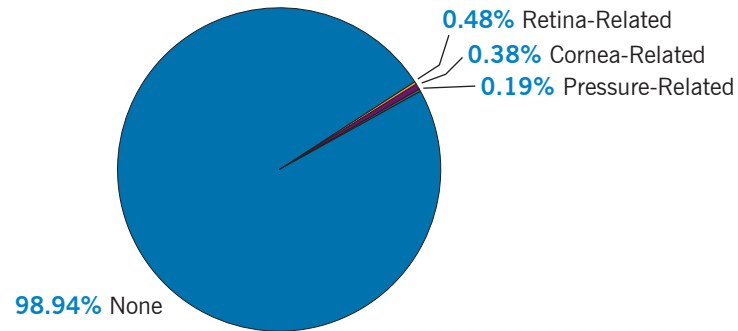
Complications During Cataract Surgery (N = 1,755)

October 2009 – September 2010



Postoperative Complications (N = 1,039)

October 2009 – September 2010



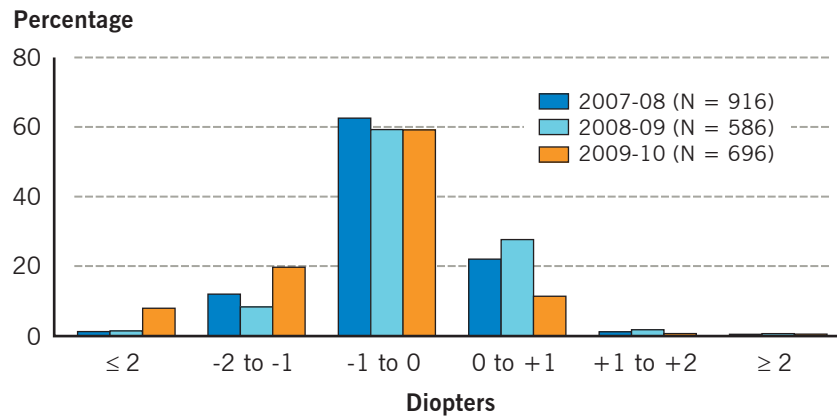
Cataract Surgery

Difference Between Actual and Target Refractive Error

October 2007 – September 2008

October 2008 – September 2009

October 2009 – September 2010



Change in Visual Acuity by Ocular Comorbidity

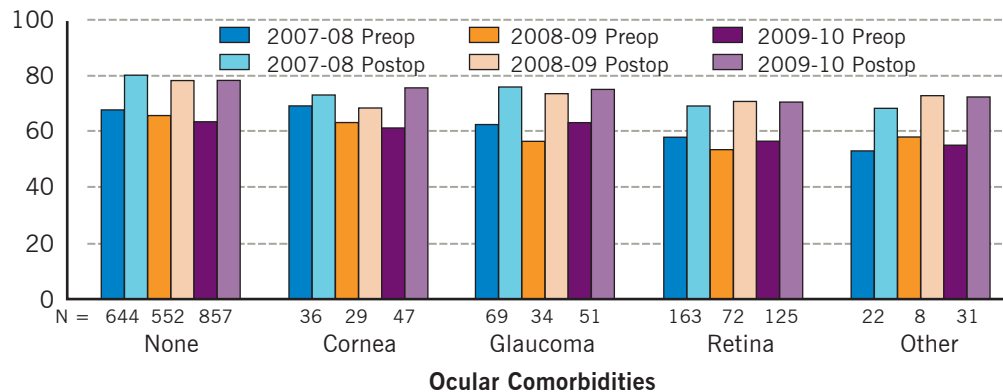
October 2007 – September 2008

October 2008 – September 2009

October 2009 – September 2010

ETDRS* Visual Acuity Score

*Early Treatment of Diabetic Retinopathy Study



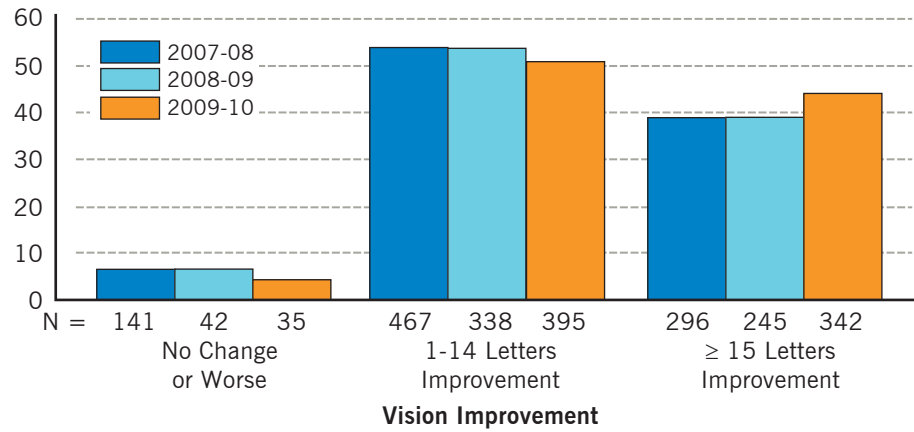
ETDRS Vision Improvement

October 2007 – September 2008

October 2008 – September 2009

October 2009 – September 2010

Percentage of Surgeries



Cornea Surgery

Corneal transplant surgeons at Cleveland Clinic Cole Eye Institute perform state-of-the-art procedures for numerous conditions that distort or cloud the normally transparent cornea. Traditional full-thickness procedures, also known as penetrating keratoplasties (PK), make up most of the grafts performed over the past couple of years. From October 2009 to September 2010, 59 PKs were performed, and 96 percent of these grafts remained clear at three to six months.

Cole Eye Institute surgeons also are contributing to the development of cutting-edge lamellar corneal transplant procedures in which only the diseased portion of the cornea is replaced. Using a procedure called Descemet's stripping automated endothelial keratoplasty (DSAEK), surgeons selectively transplant the endothelium for conditions such as pseudophakic bullous keratopathy and Fuchs' endothelial dystrophy. These patients experience faster visual recovery and more stable and predictable refractive outcomes than with traditional PK. During the period mentioned above, 90 DSAEKs were performed at Cole Eye Institute, and all of these grafts remained clear at three to six months.

In deep anterior lamellar keratoplasty (DALK) for corneal scars and keratoconus, the recipient's anterior cornea is replaced but the patient's healthy endothelium is retained, eliminating the risk of endothelial rejection. In 2008 to 2009, equivalent numbers of PKs and DSAEKs were performed. This year, DSAEK cases outnumbered PK cases, reflecting an international trend toward less-invasive corneal transplant procedures for endothelial disease.

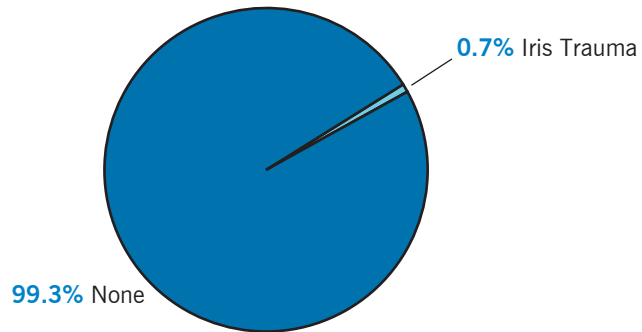
Highly specialized transplants are performed in smaller numbers for uncommon sight-threatening corneal conditions. Certain disorders disrupt or destroy the stem cells responsible for maintaining a healthy and visually useful ocular surface. Cleveland Clinic surgeons continue to perform corneal limbal stem cell transplants to restore damaged ocular surfaces. For end-stage corneal disease in patients who were not candidates for other forms of transplantation, synthetic corneas (Boston Keratoprotheses) were implanted last year to allow them to regain their visual function.

A total of 153 keratoplasties were performed last year, and most patients had no complications. The intraoperative complication rate was 0.7 percent and included a case of iris trauma. The three-month postoperative complication rate was 1.4 percent with one case of cystoid macular edema.

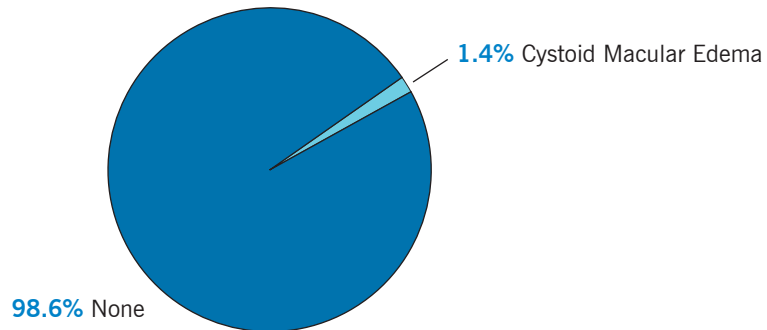
Analysis of intraoperative complications included all surgical procedures performed during the period mentioned above. Postoperative complications and outcomes of surgery included patients who had completed less than three months of follow-up. Consequently, the sample sizes reported for intraoperative and postoperative complications differ.

Changes in visual acuity by the type of corneal transplant procedure are shown in the graph on page 14. For patients who completed a three-to-six-month follow-up, the mean improvement in ETDRS visual acuity score in DSAEK patients was 20.5 letters, corresponding to an improvement of about four lines of visual acuity. PK patients had worse preoperative vision than DSAEK patients and gained 36 letters, equivalent to seven lines of vision.

Intraoperative Complications (N = 145)
October 2009 – September 2010



Postoperative Complications (N = 69)
October 2009 – September 2010

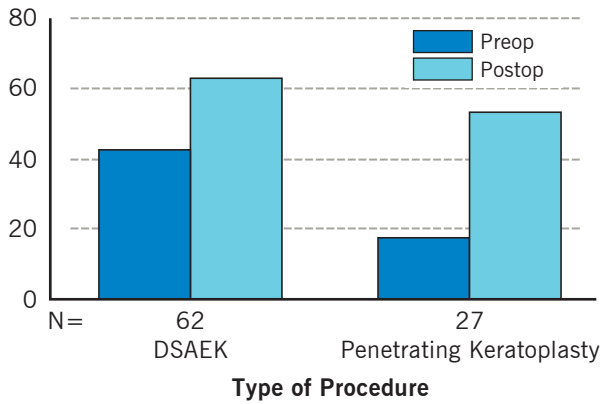


Cornea Surgery

Change in Visual Acuity by Procedure

October 2009 – September 2010

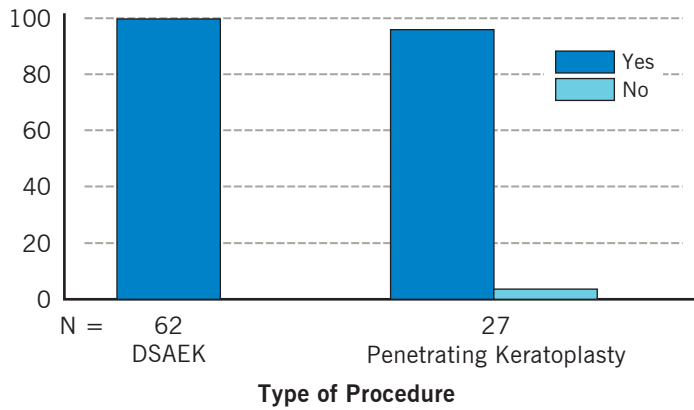
ETDRS Visual Acuity Score



Graft Clear at Three Months by Procedure

October 2009 – September 2010

Percentage of Surgeries



Glaucoma Surgery

Glaucoma is the second most common cause of irreversible blindness in the United States, after macular degeneration. While visual loss from glaucoma cannot be reversed, adequate control of eye pressure can halt the progressive loss of vision. The keys to preserving vision in glaucoma are early detection and good intraocular pressure control. Glaucoma can be managed with eye drops, laser treatment or surgery. Using medication can help patients avoid the need for laser treatment or surgery to control glaucoma, but medication, usually in the form of eye drops, entails long-term cost and some potential for local and systemic side effects. Laser treatment for glaucoma is generally quick, safe and convenient, but has only a relatively small effect

in reducing intraocular pressure in many patients and may wear off over time. For some patients, surgery to control glaucoma is the best option.

Trabeculectomy is the most frequently performed glaucoma surgical procedure in the United States. For some patients either with more difficult-to-control glaucoma or who have had previous other eye surgery or trauma, a glaucoma implant (glaucoma drainage device) is used instead. From January 2006 through September 2010, 1,306 glaucoma surgeries were performed at Cleveland Clinic Cole Eye Institute. These included 688 trabeculectomies, 484 glaucoma implants and 94 revisions of other glaucoma surgeries.

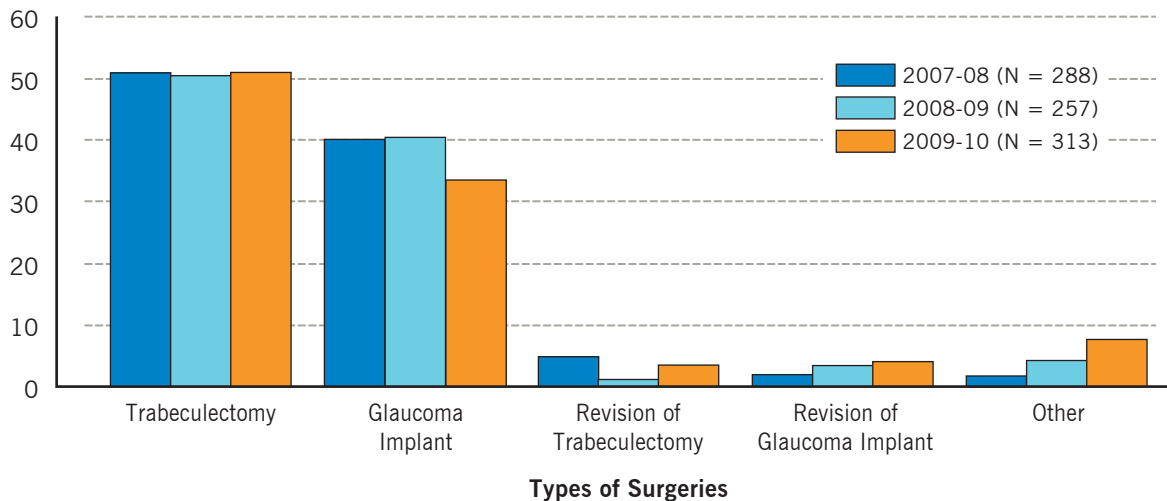
Volume of Glaucoma Surgeries

October 2007 – September 2008

October 2008 – September 2009

October 2009 – September 2010

Percentage of Surgeries



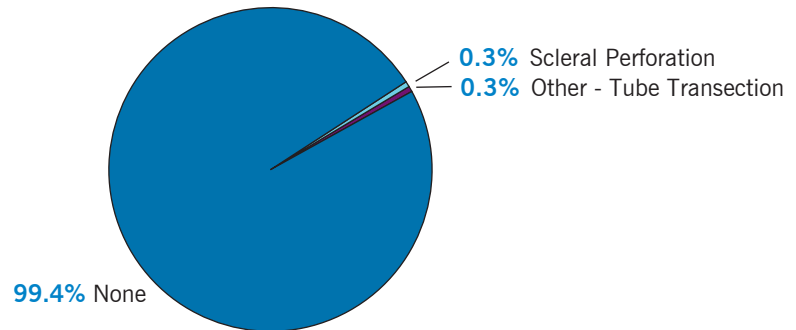
Glaucoma Surgery

In procedures performed in the 12-month period from Oct. 1, 2009, to Sept. 30, 2010, trabeculectomies reduced intraocular pressure (IOP) in our patients from a mean of 23.7 mm Hg to 16.3 mm Hg, and glaucoma implant surgery reduced the intraocular pressure from 27.3 mm Hg to 16.0 mm Hg. A normal range of eye pressure is approximately 10 to 21 mm Hg. The goal of glaucoma surgery is to preserve the current level of vision. Glaucoma surgery usually does not improve visual acuity unless combined with cataract surgery. In our surgeries, the mean level of visual acuity, as measured on ETDRS visual acuity charts, improved slightly after glaucoma surgery.

Intraoperative trabeculectomy complications were low (0.6 percent). The total postoperative complication rate was 1.3 percent, which included hypotony (IOP < 5 mm Hg) and choroidal effusion.

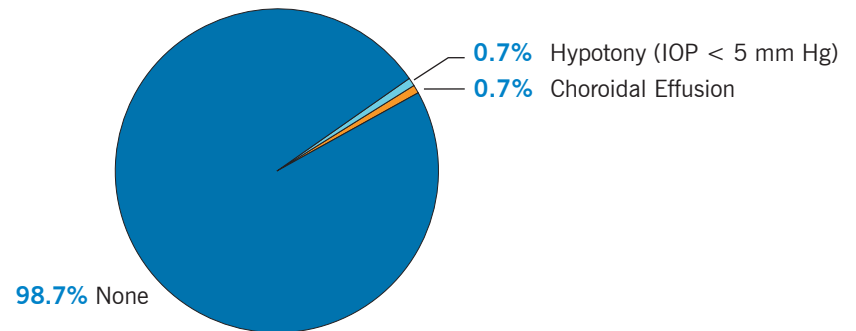
Intraoperative Complications (N = 313)

October 2009 – September 2010



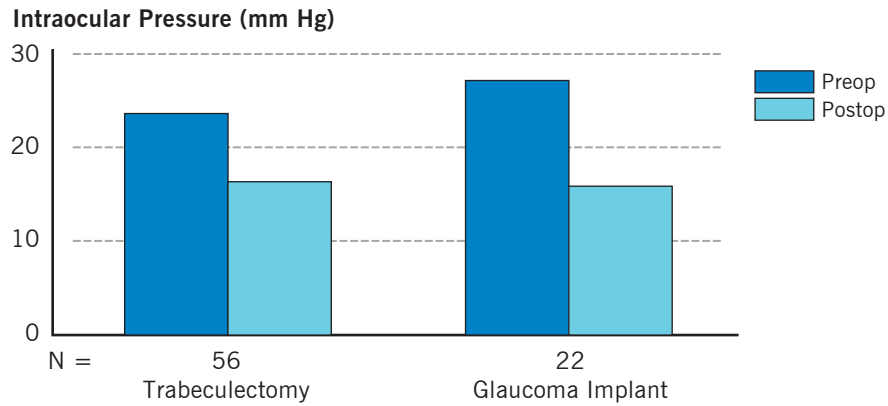
Postoperative Complications (N = 152)

October 2009 – September 2010



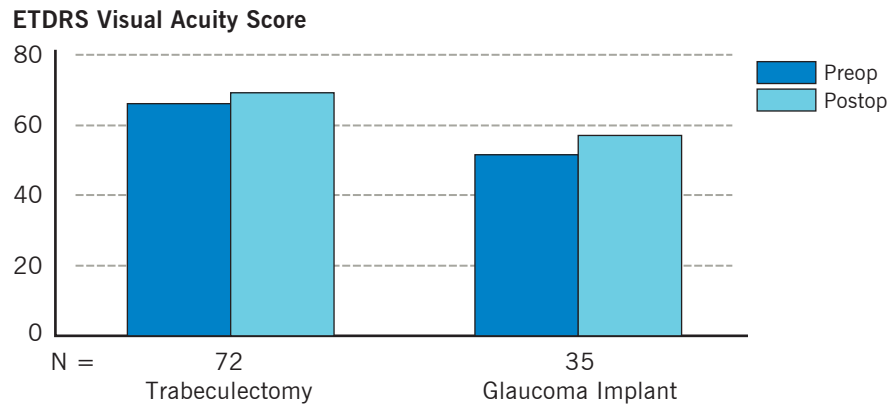
Change in Intraocular Pressure

October 2009 – September 2010



Change in Visual Acuity

October 2009 – September 2010



Oculoplastic Surgery

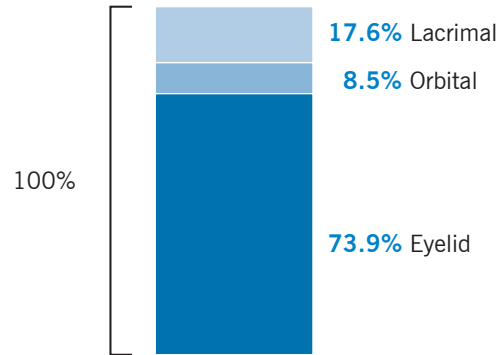
Oculoplastic service outcomes were divided into three categories: eyelid surgery, lacrimal surgery and orbital surgery. There were 812 oculoplastic surgeries performed at Cleveland Clinic Cole Eye Institute from October 2009 through September 2010. Eyelid surgery outcome measures included intraoperative complications and postoperative eyelid symmetry.

A total of 600 eyelid surgeries were performed during this period. Postoperative complications were rare, with 0.6 percent needing revision and another 0.6 percent developing recurrent erosion syndrome. Postoperative eyelid symmetry showed excellent results in 72 percent of cases and good results in the remaining 28 percent. Excellent and good eyelid symmetry was defined by a marginal reflex distance within 0.5 mm and 1.0 mm of the desired position, respectively.

There were 143 lacrimal and 69 orbital procedures performed from October 2009 through September 2010. No intraoperative or postoperative complications were observed in any of the lacrimal or orbital procedures performed.

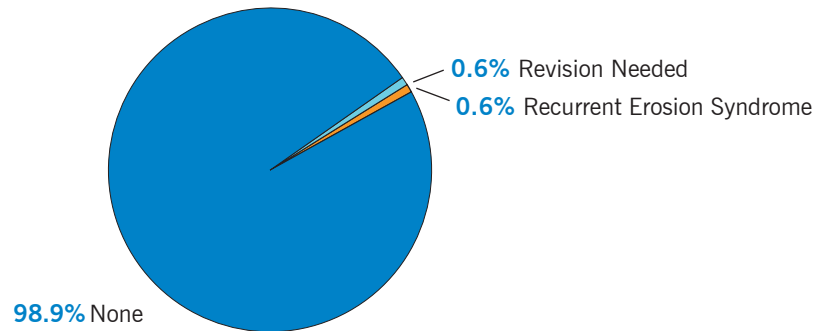
Distribution of Oculoplastic Surgeries (N = 812)

October 2009 – September 2010



Postoperative Complications - Eyelid (N = 175)

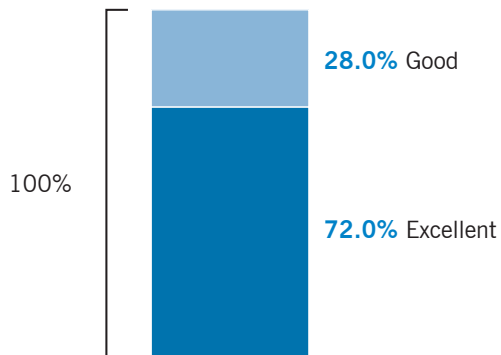
October 2009 – September 2010



Postoperative Eyelid Symmetry (N = 175)

October 2009 – September 2010

Excellent and good eyelid symmetry was defined by a marginal reflex distance (MRD) within 0.5 mm and 1.0 mm of the desired position, respectively.



Ocular Oncology Surgery

Uveal Melanoma

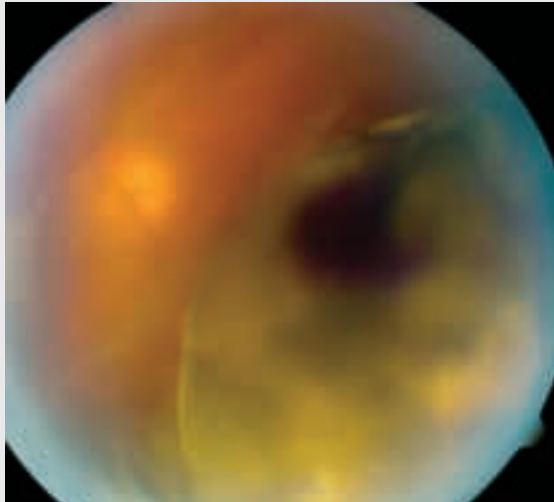
Uveal melanoma is the most common primary intraocular tumor in adults. It arises from the pigmented cells of the uvea (choroid, ciliary body and iris), and 80 to 90 percent of uveal melanomas arise in the posterior uvea and are known as choroidal melanomas. The clinical features of choroidal melanomas are varied, and multiple symptoms tend to occur sequentially. Small and medium sized tumors that are still contained by an intact Bruch's membrane are dome shaped, with a thickness equal to about one-half of their diameter. If the Bruch's membrane ruptures at the apex of the tumor, the melanoma has a "mushroom" or "collar button" shape. Diffuse melanoma constitutes a particular, infiltrative form of flat or slightly raised melanoma with predominantly horizontal growth. Melanomas are usually gray or greenish-brown, but the color can range from dark brown to white. Tumor pigmentation is sometimes heterogeneous.

Choroidal melanoma is almost always accompanied by a secondary exudative retinal detachment. Disseminated pigmented cells may also be observed in the vitreous cavity when the retina is invaded or when the tumor is situated in the ciliary body. Small melanomas frequently show confluent orange pigment. On histologic examination, the orange pigment corresponds to clumps of macrophages containing lipofuscin and melanin from retinal pigment epithelial cells.



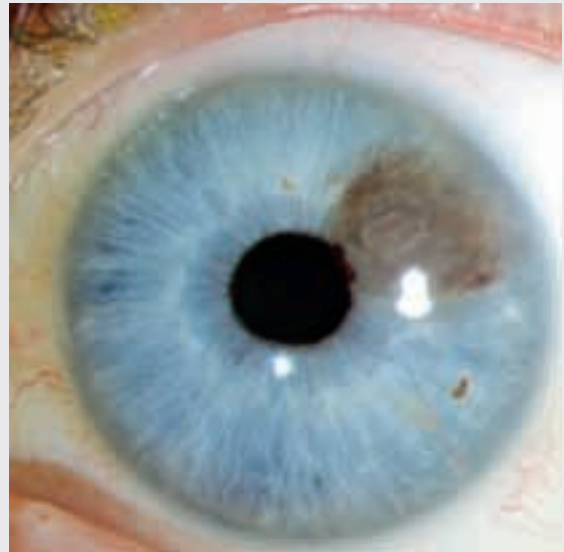
Choroidal melanoma

Ciliary body melanoma may be circumscribed or annular. Slit lamp examination, gonioscopy, transillumination and Ultrasound biomicroscopy (UBM) allow staging of the tumor to guide the most appropriate treatment.



Ciliary body melanoma

Iris melanomas tend to arise in the inferior half of the iris, and often have an irregular or rarely a smooth surface, covered by a surface plaque. In lightly pigmented tumors, the vessels are often visible. Diffuse iris melanoma can develop in two ways. The first consists of primary infiltration of the iris stroma, in which the iris is thickened without any obvious nodule formation. The second mechanism consists of seeding of tumor cells from a circumscribed iris or ciliary body melanoma.



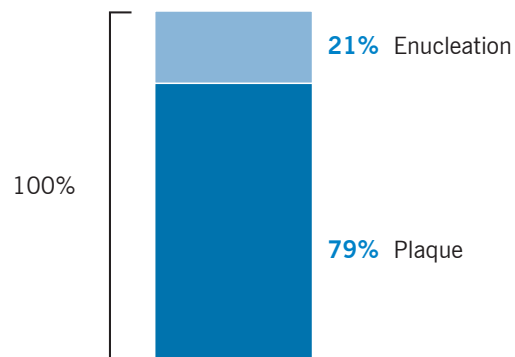
Iris melanoma



In 2010, we treated 77 patients with uveal melanoma, with most (79 percent) requiring plaque radiotherapy and the rest (21 percent) requiring enucleation.

Treatment of Uveal Melanoma (N = 77)

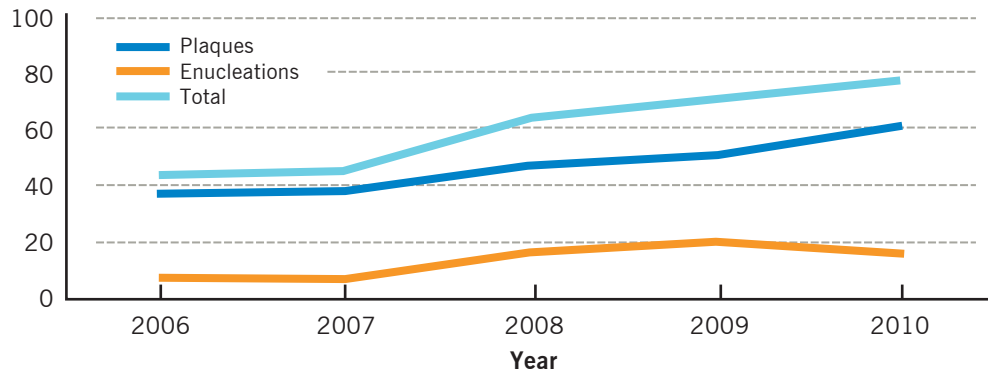
2010



Uveal Melanoma Surgeries (N = 300)

2006 – 2010

Number of Surgeries



Over the short term, we have observed initial tumor regression with preservation of vision in most cases. The total number of surgeries has increased over the past five years.



Refractive Surgery



Outcomes of laser vision correction are best summarized based on the patient's preoperative refractive status. Both the type and magnitude of refractive error affect the likelihood that uncorrected visual acuity of 20/20 or better will be achieved. Another important metric in laser vision correction outcomes is the proportion of patients whose final refractive error falls within ± 0.5 diopters of the intended result.

Below we present the collective outcomes for laser in situ keratomileusis with the femtosecond laser (IntraLASIK) and photorefractive keratectomy (PRK) using optimized ablation with a new excimer laser (WaveLight Allegretto Eye-Q). In addition, we also report the proportion of patients with an exceptional outcome (uncorrected acuity of 20/16 or better) and the proportion of patients with uncorrected acuity meeting the requirements for driving without glasses (20/40 or better). For this analysis, we included the 719 eyes treated at Cole Eye Institute in 2010.

In summary, approximately 88 percent of low to moderate myopic eyes achieved uncorrected visual acuity of 20/20 or better with IntraLASIK, and 95 percent of patients with less than 7 diopters preoperatively had 20/25 vision, which is a refractive result that fell within ± 0.5 diopters of the desired target. Almost 99 percent achieved uncorrected visual acuity of 20/40 or better, and more than one-half had an exceptional result of uncorrected visual acuity of 20/16 or better.

Approximately 75 percent of high myopic eyes achieved uncorrected visual acuity of 20/20 or better with IntraLASIK, and 88 percent of patients with greater than 7 diopters preoperatively had 20/25 vision, which is a refractive result that fell within ± 0.5 diopters of the desired target. Over 99 percent achieved uncorrected visual acuity of 20/40 or better, and almost 24 percent had an exceptional result of uncorrected visual acuity of 20/16 or better.

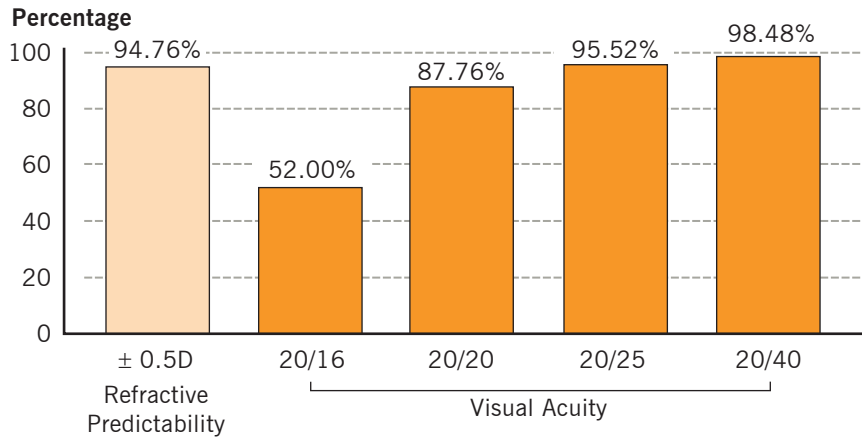
Similarly, almost 87 percent of myopic distance-only surface ablations achieved uncorrected visual acuity of 20/20 or better with IntraLASIK, and 100 percent of patients with less than 7 diopters preoperatively had a refractive result that fell within ± 0.5 diopters of the desired target. Over 99 percent achieved uncorrected visual acuity of 20/40 or better, and approximately 62 percent had an exceptional result of uncorrected visual acuity of 20/16 or better.

In hyperopic eyes, where a precise refractive outcome is known to be more difficult to achieve with laser vision correction, 67 percent of our patients still achieved uncorrected visual acuity of at least 20/20, and 91 percent had a refractive outcome within ± 0.5 diopters of the target outcome. Again, 96 percent had uncorrected visual acuity of 20/40 or better, and 20 percent of these achieved an exceptional result with uncorrected visual acuity of at least 20/16.

Refractive Surgery

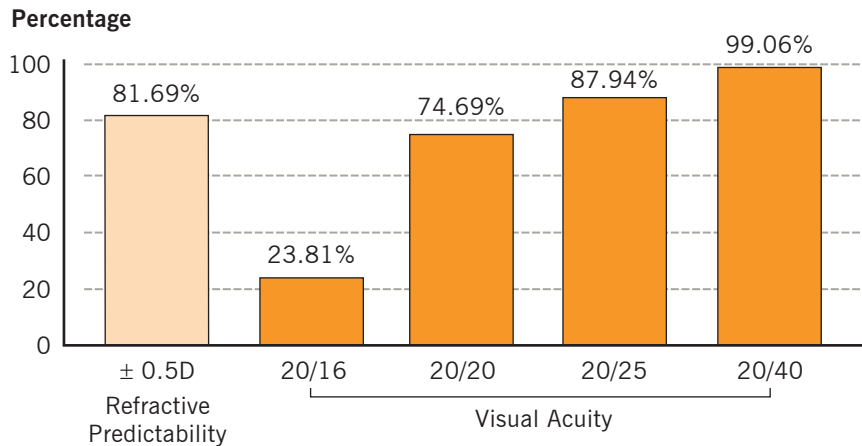
Low to Moderate Myopia (0 to -7 Diopters Sphere with Cylinder < 3 Diopters)
(N = 513 at ≥ 3 Months)

2010

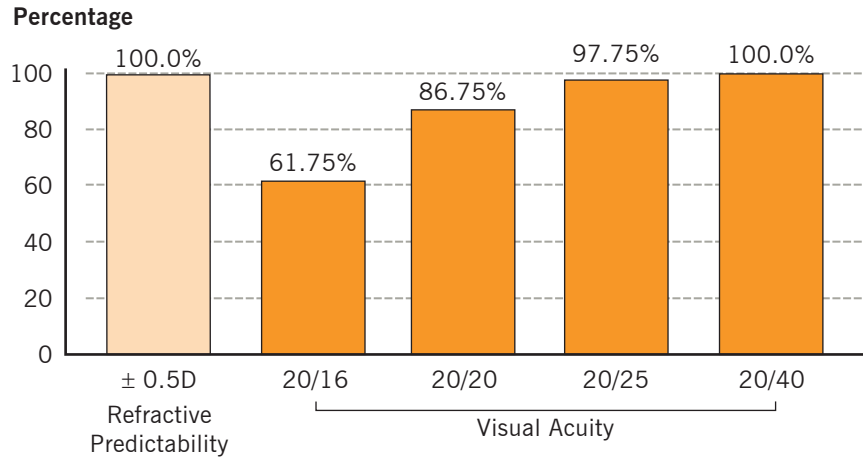


High Myopia (> -7 Diopters Sphere with Cylinder < 3 Diopters)
(N = 99 at ≥ 3 Months)

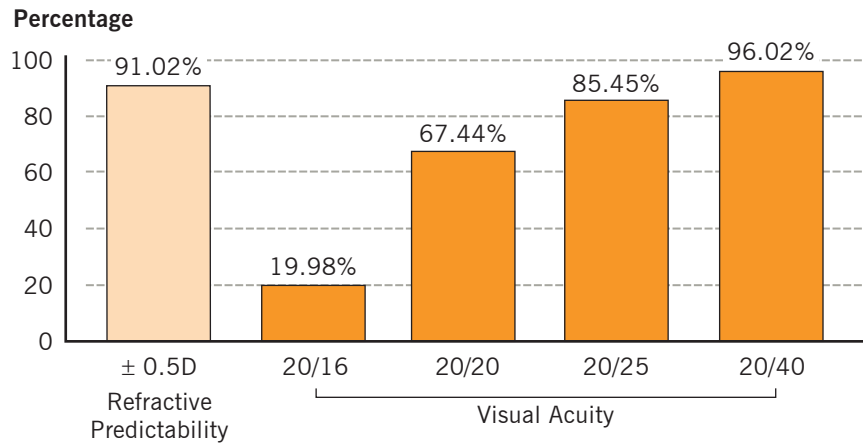
2010



Myopic PRK Surface Ablation Distance Only (N = 52 at ≥ 3 Months)
2010



Hyperopic LASIK Distance Only (N = 55 at ≥ 3 Months)
2010



Vitreoretinal Surgery

The Vitreoretinal Department at Cleveland Clinic Cole Eye Institute has assembled a dedicated surgical team of surgeons, nurses and skilled technicians to deliver world-class care for our patients. This team has developed several new surgical procedures that are now used worldwide in diseases such as retinal detachment, diabetic macular edema, diabetic traction retinal detachments, myopic macular holes, as well as in microincision surgery and pediatric retinal surgery. Members of the team have also helped develop the next generation of vitreoretinal surgical devices including microincision surgical instruments and techniques. Finally, the Ophthalmic Imaging Center at Cole Eye Institute is a leader in the new field of intraoperative optical coherence tomography (OCT), developing new uses for this pioneering technology.

In 2010, the team performed 710 surgical procedures, an increase of 27 percent from 2009. As in previous years, emergency cases or situations where ETDRS protocol visual acuity could not be performed at baseline or where patients received postoperative care at another facility were excluded from the analysis.

The vitreoretinal team performed 108 surgeries to close a macular hole for which detailed efficacy outcomes were available. Similar to 2009, anatomic closure of the macular hole was achieved in all cases (100 percent closure rate vs. 97.2 percent closure rate in 2008). Vision improved ≥ 3 ETDRS lines in 53 percent of cases, with an average improvement in vision of +16.0 ETDRS letters, or ≥ 3 lines. One patient lost vision after surgery (within one line of baseline).

Another common macular procedure was removal of an epiretinal membrane, with detailed efficacy outcomes available in 70 cases. The mean visual acuity improvement after membrane peeling surgery was +9.5 ETDRS letters with 35 percent of patients having a ≥ 3 line gain in vision. This is an improvement over 2009 when 23 percent gained ≥ 3 lines of vision after surgery.

Primary rhegmatogenous retinal detachments are common, and primary retinal detachment repair was performed in 171 patients. The mean change in vision after primary retinal detachment repair was an improvement of +14.6 ETDRS letters or 3 lines, with an improvement in vision of ≥ 3 lines in 40 percent of cases.

Cole Eye Institute is a tertiary care facility and the vitreoretinal team is called on by patients and other physicians to assist in difficult cases. This is especially true with cases of giant retinal tears, complicated retinal detachments that have proliferative vitreoretinopathy (PVR) and diabetic traction retinal detachment reoperations that are referred to our facility, often after previous vitreoretinal surgeries at other hospitals. Detailed efficacy outcomes for these types of surgery are available for 136 patients in 2010. Although most patients had a previous retinal surgery, the reattachment rate in these complicated patients was 96 percent. This was an improvement over both 2008 and 2009 values (83 percent and 85 percent, respectively). The average improvement in vision after PVR retinal detachment repair was +12.4 ETDRS letters. A ≥ 3 line improvement in vision occurred in 41 percent of cases, while a ≥ 3 line loss in vision occurred in 15 percent of cases. This is an improvement in visual outcomes over our numbers in 2009, when a ≥ 3 line improvement in vision occurred in 26 percent of cases, and a ≥ 3 line loss in vision occurred in 22 percent of cases.

Diabetic vitrectomy surgery is among the most complex surgeries performed by a vitreoretinal surgeon. The vitreoretinal team has developed new techniques for diabetic surgery including pioneering the use of small-gauge surgery. In 2010, detailed efficacy outcomes analysis was available in 67 cases. In cases with traction retinal detachment, the mean improvement in visual acuity was +3.5 ETDRS letters, with 46 percent having a ≥ 3 line gain in vision and 13 percent having a ≥ 3 line loss in vision. In comparison, the mean change in vision in 2009 was +6.8 ETDRS letters, with 28 percent having a ≥ 3 line gain in vision and 28 percent having a ≥ 3 line loss in vision. When looking at the visual outcomes after surgery for diabetics consisting of mainly vitreous hemorrhage, the mean change in vision was +24.7 ETDRS letters, or 4.9 lines, with 33 percent having a ≥ 3 line gain in vision and two patients having a ≥ 3 line loss in vision. This is worse than our outcomes in 2009, when the mean improvement was +39.1 ETDRS letters or a 7.8 line gain. It is important to remember that many of these patients had severe loss of vision from the vitreous hemorrhage before surgery, which explains these dramatic improvements in vision.



Vitreoretinal Surgery

Category Definitions

- DR 1** • Diabetic Retinopathy (DR)
 - Macular edema due to posterior hyaloidal traction
- DR 2** • Complicated Diabetic Retinopathy
 - Anterior hyaloidal fibrovascular proliferation
 - Traction retinal detachment (TRD)
 - Combined TRD and rhegmatogenous retinal detachment (RRD)
- RRD 1** • Rhegmatogenous retinal detachment (RRD)
- RRD 2** • Complicated rhegmatogenous retinal detachment (RRD)
 - Recurrent retinal detachment

Vitreous Hemorrhage (VH)

Giant Retinal Tear (GRT)

Macular Hole (MH)

Epiretinal Membrane (EM)

Groupings for Graphs

Group 1: Diabetic Retinopathy (DR1 and Diabetic VH)

Group 2: Complicated Diabetic Retinopathy

Group 3: Primary Rhegmatogenous Retinal Detachment

Group 4: Complicated Rhegmatogenous Retinal Detachment & GRT

Group 5: Macular Hole

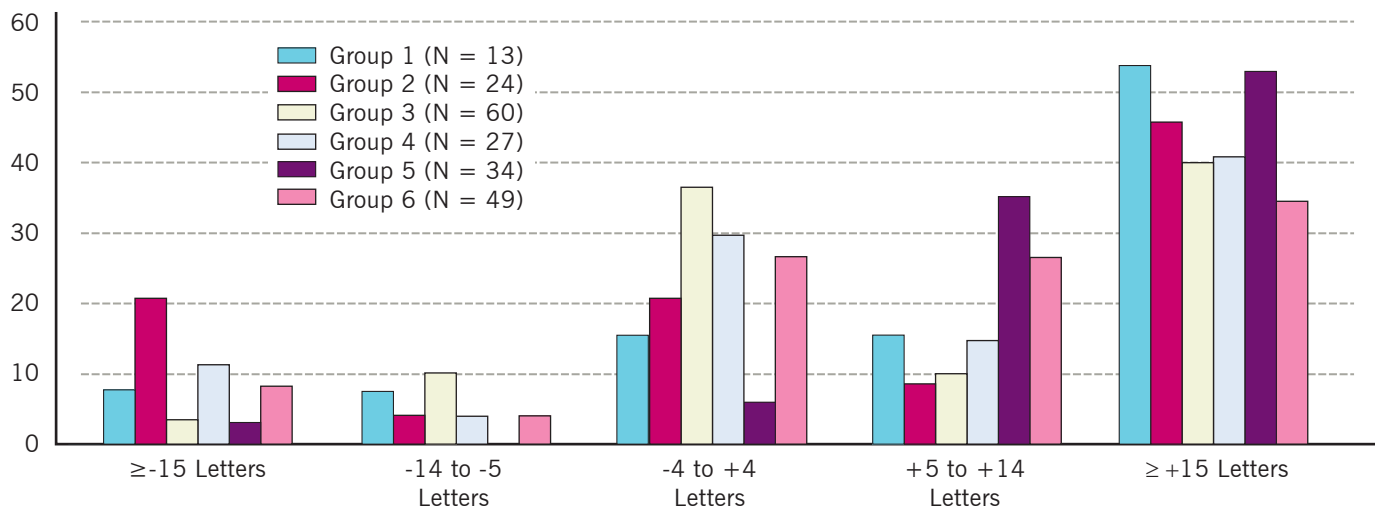
Group 6: Epiretinal Membrane

Note: For most emergency cases, especially RRD1, preoperative baseline ETDRS visual acuity cannot be performed and therefore the outcome results are not included in this analysis.

Vision Improvement by Indication for Surgery

October 2009 – September 2010

Percentage



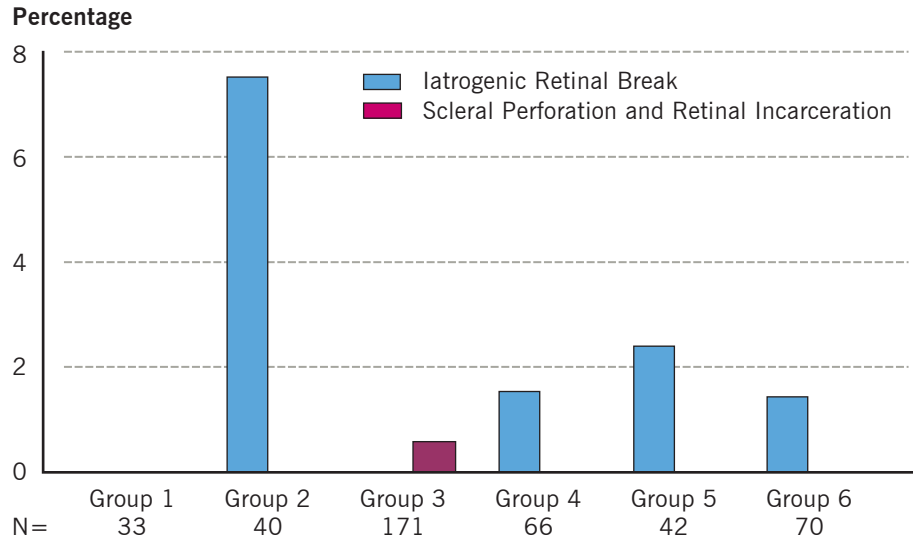
Postoperative Complications
October 2009 – September 2010

	Group 1 (N = 17)	Group 2 (N = 34)	Group 3 (N = 103)	Group 4 (N = 40)	Group 5 (N = 39)	Group 6 (N = 66)
IOP Spike > 30 mm Hg		3%	3%	3%		
New Retinal Breaks			1%			2%
Choroidal Detachment						2%
Corneal Opacification			1%			
Hypotony						2%
Visually Significant Cataract	6%			3%		
Corneal Abrasion	6%	3%		3%		
Optic Pallor				3%		
Glaucoma - Neovascular		3%				
Vitreous Hemorrhage		3%				
Retinal Detachment					3%	

An analysis of postoperative complications in patients for whom there were at least three months of follow-up revealed that 92 percent of cases did not have any postoperative complications. The most prevalent postoperative complications were intraocular pressure (IOP) spike > 30 mm Hg (1.7 percent), cataract formation (1 percent), hypotony (1 percent) and new retinal tear (0.6 percent).

Vitreoretinal Surgery

Intraoperative Complications October 2009 – September 2010



Analysis of intraoperative complications for all surgical procedures revealed no complications in 98.6 percent of cases. This is an improvement over our intraoperative complication rate of 97.9 percent in 2009. Intraoperative retinal tears were the most common intraoperative complication, recorded in 1.4 percent of cases. This is similar to the 1.7 percent rate seen in 2009 and is half the rate in 2008.

Strabismus Surgery

Cole Eye Institute considers a good outcome of surgery for strabismus in adults to be the disappearance of diplopia and/or anomalous head position in primary position of gaze or, in the absence of diplopia or anomalous head position, a constant deviation of less than 10 prism diopters.

In children, a good outcome is defined as a constant deviation of less than 10 prism diopters in primary position or the disappearance of anomalous head position in those for whom the surgery was done for that purpose, such as patients with a fourth nerve palsy, Brown syndrome or Duane syndrome. We only reviewed the follow-up visits during October 2009 to September 2010. For this period, some patients have no follow-up and we do not provide long-term outcomes.

For the above-mentioned period, 260 strabismus procedures were performed by two surgeons; 158 procedures were on children and 102 were done on patients aged 16 and over (classified as adults). Ninety-four procedures were for esotropia, 90 for exotropia, 13 for thyroid eye disease, 27 for fourth nerve palsy, 13 for dissociated vertical deviations, seven for hypertropia, one for sixth nerve palsy, seven for Duane syndrome, two for Brown syndrome, two for a face turn for nystagmus, two for Moebius syndrome, one for third nerve palsy and one for a blow-out fracture.

Seventy-seven children and 17 adults had esotropia. Outcomes were good in 64 children, and 10 children had a poor outcome. No follow-up information was available on three children. Of the adults, 12 had a good outcome, and three had a poor outcome. No follow-up results were available on two adults.

Fifty children and 40 adults had exotropia. Outcomes were good in 45 children, and five had a poor outcome. Of the adults, 32 had a good outcome, and eight had a poor one.

Thirteen adults had procedures done for thyroid eye disease. Good outcomes occurred in 10, and three had a poor outcome.

Six children and 21 adults were operated on for a fourth nerve palsy. All of them had a good outcome.

Twelve children had surgery for dissociated deviations or hypertropia. Nine children had good results, and two had a poor outcome. One patient was lost to follow-up. Seven adults had surgery for hypertropia. Good outcomes occurred in five patients, and two had poor outcomes. One adult had a good outcome from surgery done for a dissociated vertical deviation.

One adult had surgery for sixth nerve palsy and did not return for any follow-up.

Seven children had surgery for Duane syndrome. Three had a good outcome, three had a poor outcome and one was lost to follow-up.

Two children had surgery for Brown syndrome. Both had a good outcome.

Two children with nystagmus and two with Moebius syndrome had surgery. The outcomes for nystagmus were both good. One of the Moebius patients had a good outcome, and one had a poor outcome.

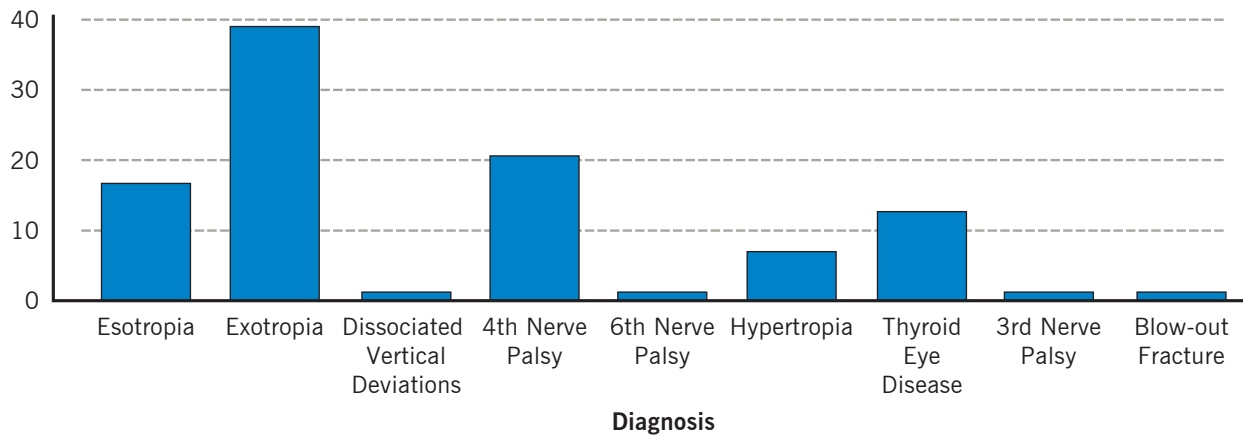
There was one procedure on each of two adults for third nerve palsy and a blow-out fracture. Both had good results.

Strabismus Surgery

Adult Strabismus Cases (N = 102)

October 2009 – September 2010

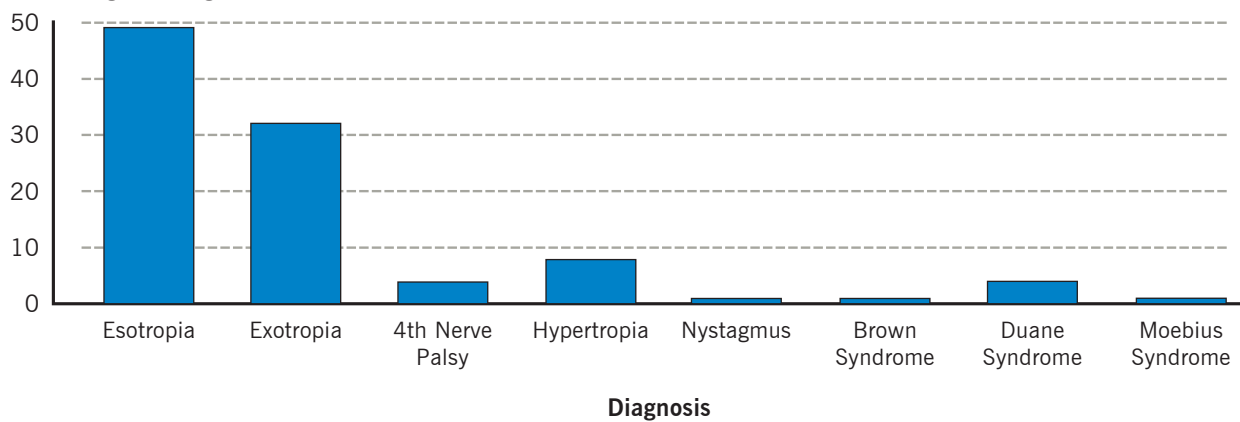
Percentage of Surgeries



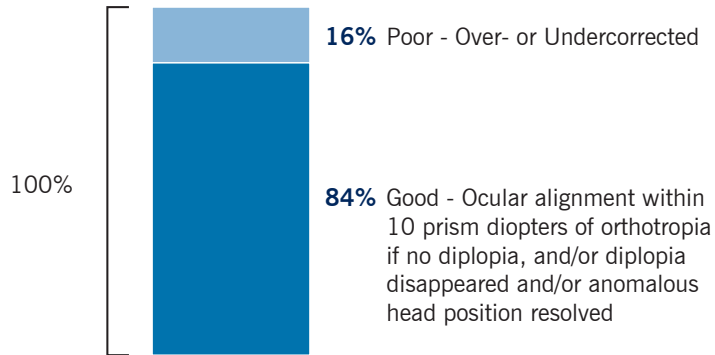
Pediatric Strabismus Cases (N = 158)

October 2009 – September 2010

Percentage of Surgeries

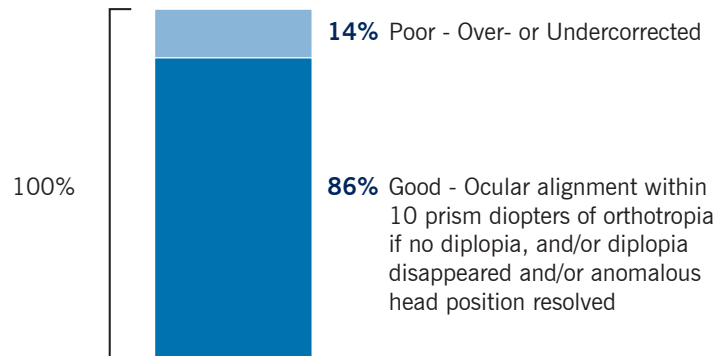


Adult Outcomes (N = 99)
October 2009 – September 2010



This graph excludes three patients on whom follow-up is not available.

Pediatric Outcomes (N = 153)
October 2009 – September 2010



This graph excludes eight patients on whom follow-up is not available.

Patient Experience

“Patients First” is the guiding principle of Cleveland Clinic. Patient experience is a key component of Cleveland Clinic’s strategic plan to achieve a coordinated delivery model that integrates patient- and family-centered care with clinical outcomes, quality, safety and employee experience.

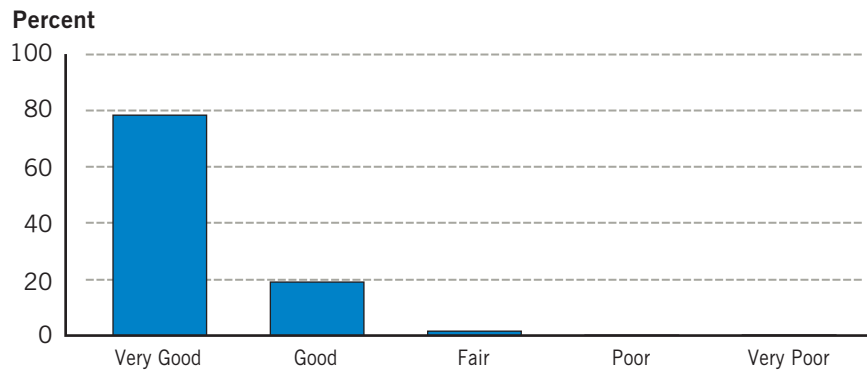
The Office of Patient Experience’s mission is to ensure consistent, patient-centered care by partnering with caregivers to exceed the expectations of patients and families. Programs and services include:

- Expertise for critical initiatives throughout the organization to ensure the consistent delivery of patient-centered care
- Patient satisfaction data analysis, HCAHPS education and resources
- Identification and sharing of sustainable best practices
- Support of employee experience and recognition initiatives

- Customer service education programs, including the Respond with H.E.A.R.T.® service recovery program, to positively impact the Cleveland Clinic culture and support caregivers in providing outstanding service to patients, families and colleagues
- Personalized, holistic Healing Services for patients, families and employees including light massage, Reiki, Healing Touch™, reflexology, personal aromatherapy, guided imagery, spiritual support, Code Lavender first-response holistic care service and others
- Health literacy education and solutions
- Voice of the Patient Advisory Councils, an advisory resource that empowers patients and families to take an active role in improving the patient experience by providing real-time feedback and creative solutions to specific challenges
- Ombudsman Office, which serves as a centralized complaint center

Outpatient – Cole Eye Institute

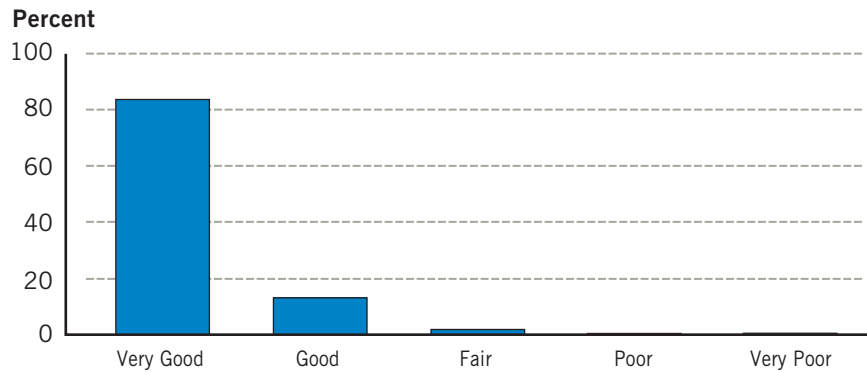
Overall Rating of Outpatient Care and Services During Outpatient Visit (N = 2,934) 2010



Source: Press Ganey, a national hospital survey vendor

Rating of Outpatient Care Provider (N = 2,934)

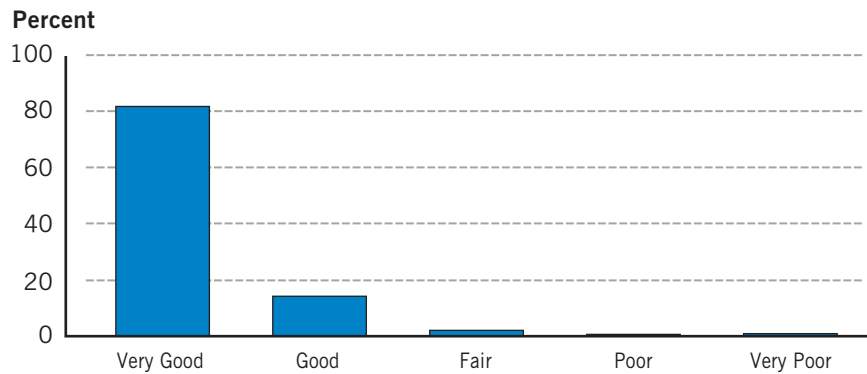
2010



Source: Press Ganey, a national hospital survey vendor

Likelihood of Recommending Outpatient Care Provider (N = 2,934)

2010



Source: Press Ganey, a national hospital survey vendor

Canaloplasty

Canaloplasty, a new procedure for reducing intraocular pressures in glaucoma patients, offers reduced complication rates, faster visual recovery and fewer postoperative visits than trabeculectomy.

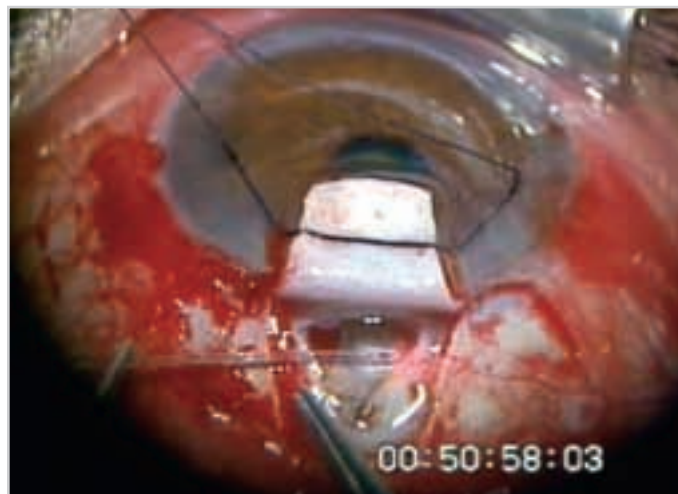
Jonathan Eisengart, MD, of Cole Eye Institute, became the first and only ophthalmologist in the Cleveland area to perform canaloplasty in 2010, and had done 10 procedures as of March 2011 with promising results. He continues to evaluate the results of this procedure and will report on them in next year's book.

Canaloplasty employs a nonpenetrating surgical technique to achieve decreased IOPs for its glaucoma recipients. This nonpenetrating approach has been associated with lower complication rates than trabeculectomy, with the added advantage of not requiring fistulas or blebs to reroute the aqueous outflow system.

Instead, canaloplasty restores the trabeculocanalicular outflow pathway by dilating the entire length of Schlemm's canal with a microcatheter and interring a trabecular tensioning suture. Aqueous humor then flows from the anterior chamber, into and around the canal by way of the trabecular meshwork and formed Descemet window, and out through collecting channels.

Successful canaloplasty surgery requires that the patient have an open angle and no history of surgery that may have interrupted the angle architecture. Canaloplasty can typically achieve IOPs in the range of 14 to 17, so it may not be appropriate for people with advanced glaucoma. Because it can easily be done in conjunction with cataract surgery, patients with POAG (primary open angle glaucoma), PXF (pseudoexfoliation) or pigmentary glaucoma who require cataract surgery are potentially excellent candidates.

Canaloplasty might also be a good option for patients who wear contact lenses and need glaucoma surgery. Other possible applications being investigated include the procedure's use in uveitic glaucoma and post-corneal transplant patients.



A superficial scleral flap is seen reflected anteriorly under the traction suture, and the deep flap has been excised, creating a "trabeculodescemet window." A lighted microcatheter is prepared to be introduced into Schlemm's canal.

Advancements in Intraoperative Optical Coherence Tomography

Optical coherence tomography (OCT) is a non-contact imaging modality that provides high-resolution cross-sectional and three-dimensional information on tissue architecture. OCT has revolutionized ophthalmology in the clinic setting, but its translation to the operating room is still in the early stages.

A major limitation for the use of OCT in the operating room is the lack of a commercially available microscope-integrated system. Currently, a hand-held probe or a modified table unit must be used to perform scanning in the operating room. Since these devices are not built into the surgical microscope, the operative procedure must be halted to perform scans. This prevents the surgeon from receiving real-time feedback and from visualizing the intraocular interactions of the instruments and tissues involved.

Cole Eye Institute Retina Service staff member Justis P. Ehlers, MD, in collaboration with Cynthia A. Toth, MD, at the Duke Eye Center, has optimized and tested a prototype operating microscope-integrated OCT system. This represents a critical development in progress toward seamless incorporation of OCT into the operating room. Using this system, intraoperative maneuvers and manipulations could be visualized in model eyes, and OCT characteristics and the features of various intraocular instruments could be described for the first time [Ehlers 2011 IOVS E-pub Jan].

Using this research as a foundation, Sunil K. Srivastava, MD, another physician on our Retina Service staff, and Dr. Ehlers are developing new instruments specifically designed to optimize OCT characteristics for intraocular use. The new instrumentation will allow visualization of microstructural interactions between instruments and intraocular tissues during surgery. Additionally, preliminary research with intraoperative OCT suggests that it may play an important role in revealing the pathophysiology of vitreoretinal surgical diseases such as optic pit maculopathy. Intraoperative OCT may also provide critical information regarding the impact of surgical maneuvers on tissues of interest, such as epiretinal membrane peeling [Srivastava 2010 AAO Subspecialty Day].

In collaboration with Cole Eye Institute's vitreoretinal surgeons and anterior segment surgeons, Drs. Srivastava and Ehlers are furthering the understanding of the role of intraoperative OCT and its ability to improve surgical outcomes for patients.

Small Incision Internal Resection and Gentle Aspiration

Minimally invasive techniques have been adopted in many areas of surgery to reduce patient morbidity, allowing for faster recovery following surgical procedures. A recent analysis of data from the Nationwide Inpatient Sample (the largest nationwide all-payer database) from 1993 to 2007 demonstrated a major increase in minimally invasive surgery with a corresponding sharp decline in its open counterpart over the same period.

Arun D. Singh, MD, Director of Ophthalmic Oncology at Cleveland Clinic Cole Eye Institute, has developed a novel surgical technique for internal resection of an iris tumor called "small incision internal resection and gentle aspiration," which was published in a recent issue of *Ophthalmology*. The surgical technique combines resection of a circumscribed iris tumor through multiple small corneal incisions with gentle Healon aspiration. Iridectomy — indicated for excision of suspected malignant iris tumors that are circumscribed (less than four clock hours) — necessitates a large corneoscleral incision. In contrast, the small incision technique for removal of a malignant lesion avoids the potential morbidity associated with a large corneoscleral incision, allowing for rapid visual recovery. However, it does carry an increased theoretical risk of tumor dissemination and seeding of the anterior chamber if increased tissue manipulation is required.

In a recently performed case, the patient's visual acuity was 20/15 on postoperative day 1, with minimal anterior segment inflammation and without hyphema. The corneal wounds were well-opposed and intraocular pressure was 20 mm Hg. At two months' postoperative follow-up, visual acuity remained 20/15, and the iris defect was well-opposed without evidence of tumor recurrence.

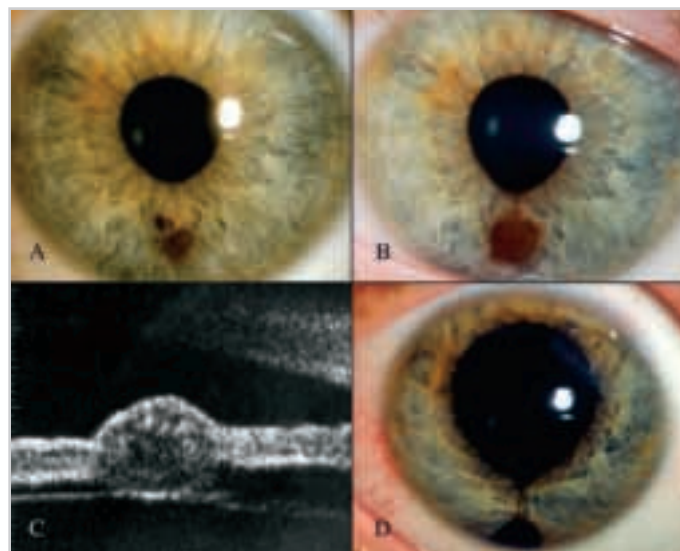


Figure 1. Pigmented iris lesion at presentation in a 17-year-old boy (A). Comparison to photograph taken five years earlier demonstrates growth (B). Ultrasound biomicroscopy revealed isolated iris involvement with lesion thickness of 1.3 mm (C). On postop day 1, after excision of the lesion, visual acuity was 20/15-2 with normal intraocular pressure (D). Note minimal irregularity of the pupil with a residual small inferior iridectomy.

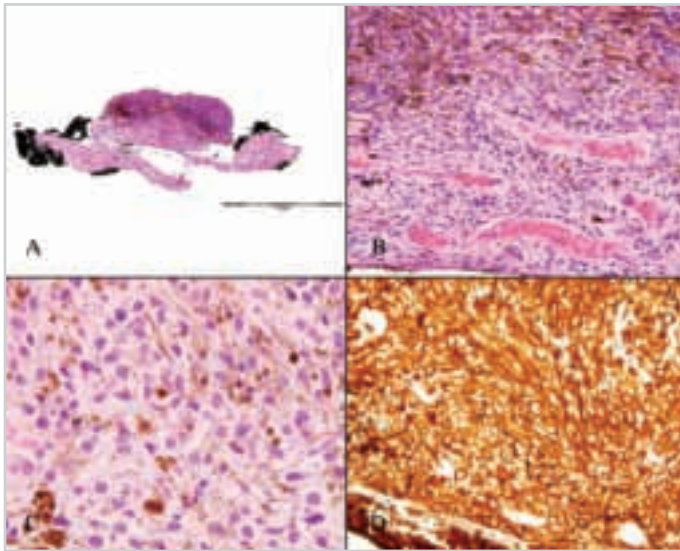


Figure 2. Iris with pigmented tumor distorting anterior surface (**A**), Hematoxylin and eosin. 4X magnification). The tumor was classified as a mixed cell type melanoma (**B**), Hematoxylin and eosin. 40X magnification) with a small component of epithelioid cells (**C**), Hematoxylin and eosin. 100X magnification). Immunoperoxidase stain for Melan A showed strong diffuse positivity in the neoplastic cells (**D**).

Reproduced with permission from Hood CT, Schoenfield LR, Torres V, Singh AD. Iris melanoma. *Ophthalmology*. 2011 Jan;118(1):221-2.

Selected Publications



*Cole Eye Institute staff
authored more than
100 publications
in 2010.*

For a complete list go to
clevelandclinic.org/quality/outcomes.



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This project would not have been possible without the commitment and expertise of a team led by Peter K. Kaiser, MD, and Monica Jain, MBBS, MHA.



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