

Cole Eye Institute



Measuring Outcomes Promotes Quality Improvement





Measuring and understanding outcomes of medical treatments promotes quality improvement. Cleveland Clinic has created a series of Outcomes books similar to this one for its clinical institutes. Designed for a physician audience, the Outcomes books contain a summary of many of our surgical and medical treatments, with a focus on outcomes data and a review of new technologies and innovations.

The Outcomes books are not a comprehensive analysis of all treatments provided at Cleveland Clinic, and omission of a particular treatment does not necessarily mean we do not offer that treatment. When there are no recognized clinical outcome measures for a specific treatment, we may report process measures associated with improved outcomes. When process measures are unavailable, we may report volume measures; a relationship has been demonstrated between volume and improved outcomes for many treatments, particularly those involving surgical and procedural techniques.

In addition to these institute-based books of clinical outcomes, Cleveland Clinic supports transparent public reporting of healthcare quality data. The following reports are available to the public:

- Joint Commission Performance Measurement Initiative (qualitycheck.org)
- Centers for Medicare and Medicaid Services (CMS) Hospital Compare (medicare.gov/hospitalcompare), and Physician Compare (medicare.gov/PhysicianCompare)
- Cleveland Clinic Quality Performance Report (clevelandclinic.org/QPR)

Our commitment to transparent reporting of accurate, timely information about patient care reflects Cleveland Clinic's culture of continuous improvement and may help referring physicians make informed decisions.

We hope you find these data valuable, and we invite your feedback. Please send your comments and questions via email to:

OutcomesBooksFeedback@ccf.org.

To view all of our Outcomes books, please visit clevelandclinic.org/outcomes.



Dear Colleague:

Welcome to this 2016 Cleveland Clinic Outcomes book. Every year, we publish Outcomes books for 14 clinical institutes with multiple specialty services. These publications are unique in healthcare. Each one provides an overview of medical or surgical trends, innovations, and clinical data for a particular specialty over the past year. We are pleased to make this information available.

Cleveland Clinic uses data to manage outcomes across the full continuum of care. Our unique organizational structure contributes to our success. Patient services at Cleveland Clinic are delivered through institutes, and each institute is based on a single disease or organ system. Institutes combine medical and surgical services, along with research and education, under unified leadership. Institutes define quality benchmarks for their specialty services and report on longitudinal progress.

All Cleveland Clinic Outcomes books are available in print and online. Additional data are available through our online Quality Performance Reports (clevelandclinic.org/QPR). The site offers process measure, outcome measure, and patient experience data in advance of national and state public reporting sites.

Our practice of releasing annual Outcomes books has become increasingly relevant as healthcare transforms from a volume-based to a value-based system. We appreciate your interest and hope you find this information 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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Chairman's Letter

Dear Colleagues,

I appreciate your interest in Cole Eye Institute and taking the time to glance through our 2016 outcomes report. Each year we collect and analyze vital outcomes data, not only to satisfy our own curiosity, but to ensure that we are indeed improving the quality of our care by reducing complications, saving vision, improving acuity and quality of life, and decreasing costs. We remain devoted to excellence and innovation in clinical care, research, patient experience, and medical education.

Ranking in the top 10 programs for the last 5 years in the *U.S. News & World Report* annual survey reflects our reputation as one of the best ophthalmology programs in the nation.

Highlights for 2016:

- Record number of patients seen and surgeries performed
- Highest level of NIH funding in our history
- 19 clinical trials underway
- Thriving residency program
- Almost \$100 million in philanthropic gifts over the last 5 years
- Expanded use of advanced technologies, including femtosecond laser assisted cataract surgery, Argus II retinal prosthesis, intraoperative OCT, corneal cross-linking, and 3-D visualization and augmented reality for surgery
- Continued our commitment to the community through our Vision First Van. Over the last 14 years, provided free exams for more than 70,000 children at elementary schools throughout Cleveland

We welcome your feedback, questions, and ideas for collaboration. Please contact me via email at OutcomesBooksFeedback@ccf.org, and reference the Cole Eye Institute book in your message.

Sincerely,



Daniel F. Martin, MD

Chairman, Cole Eye Institute | Professor of Ophthalmology, Cleveland Clinic Lerner College of Medicine



Institute Overview

Cleveland Clinic's Cole Eye Institute is a leader in ophthalmologic care today and is committed to innovative basic, clinical, and translational research designed to transform ophthalmologic care tomorrow. Cleveland Clinic's ophthalmology program is ranked No. 8 in the country in the *U.S. News & World Report* "Best Hospitals" survey (2016-2017), and is the top-ranked program in Ohio.

The institute's staff of 72 ophthalmologists and researchers is composed almost entirely of subspecialists in cornea and external disease; glaucoma; keratorefractive surgery; neuro-ophthalmology; oculoplastics and orbital surgery; ophthalmic oncology; pediatric ophthalmology and adult strabismus; and vitreoretinal care. Comprehensive general ophthalmologists round out the program, which also includes optometrists.

The institute has advanced research laboratories and a leading-edge training facility at Cleveland Clinic's main campus, where patient care is also offered. Institute staff also provide primary, secondary, and tertiary services for patients of all ages at a growing number of family health centers and specialty care centers across Northeast Ohio.



2016 Cole Eye Institute Key Statistics

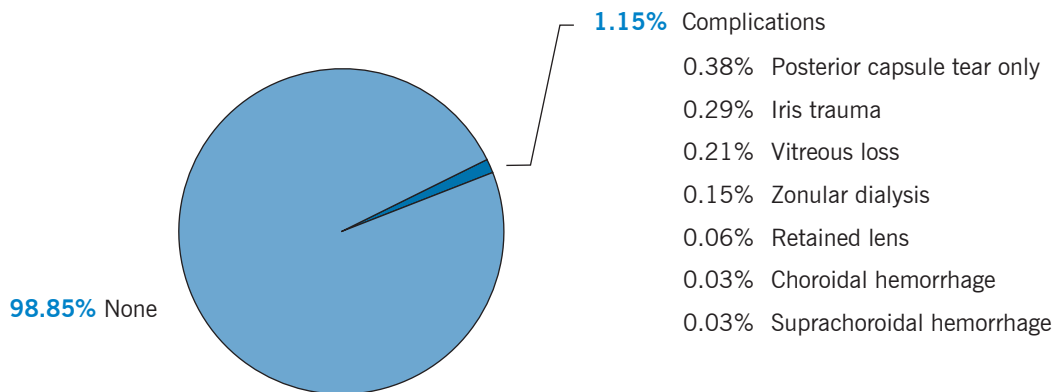
Total clinic visits	219,555
Total surgeries	10,497
Total surgical procedures (surgeries in operating rooms and all outpatient procedures)	12,999
Total laser procedures	2808
Annual research funding level	\$13,632,988 (including \$6,672,969 from federal sources)

Cataract Surgery

Cataract surgery is the most commonly performed surgical procedure in ophthalmology and thus represents a substantial proportion of the surgical caseload performed at Cleveland Clinic's Cole Eye Institute. In 2016, a total of 3412 cataract extraction procedures were performed.

Intraoperative Complications (N = 3412)

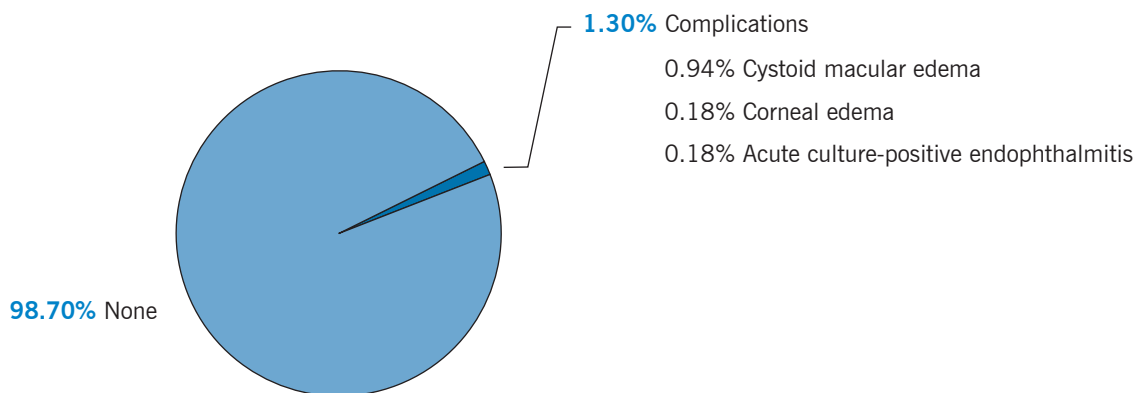
2016



Intraoperative complications during cataract surgery were uncommon, occurring in only 1.15% of patients. The most common complication was posterior capsule tear only, reported in 0.38% of patients, most of whom ended up with excellent vision.

Postoperative Complications (N = 1705)

2016



Postoperative complications were also rare, occurring in 1.30% of patients operated on at main campus and who had follow-up appointments from 1 to 12 months after surgery. These included cystoid macular edema (0.94%), corneal edema (0.18%), and acute culture-positive endophthalmitis (0.18%).

ETDRS Vision Improvement

2014 – 2016

Surgeries (%)

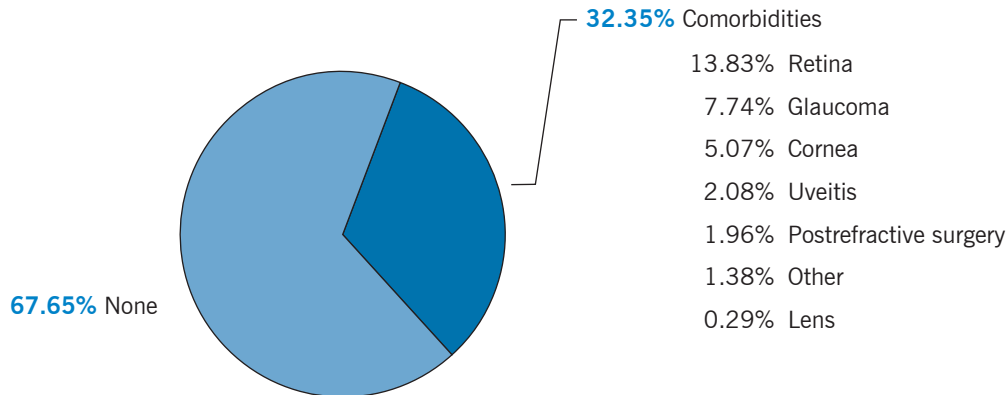


One of the goals of cataract surgery is improving visual acuity, which is accomplished for the vast majority of patients at Cole Eye Institute. Visual acuity, as measured by the ETDRS (Early Treatment Diabetic Retinopathy Study) protocol, was tracked for 1705 patients in 2016 who came back for follow-up after 1 to 12 months. There was a ≥ 15 letter improvement in ETDRS protocol refraction visual acuity in 50.5% of these patients, and 42.4% had a < 15 letter improvement. The remaining 7.1% had no change or a decrease from baseline status.

Cataract Surgery

Ocular Comorbidities (N = 3412)

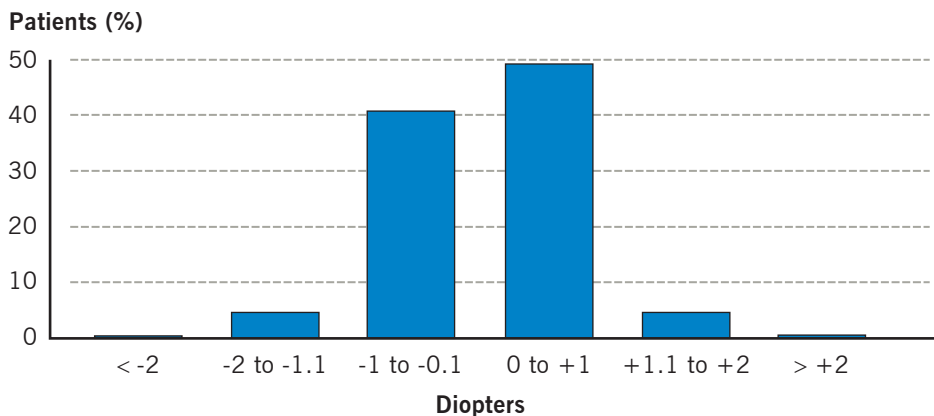
2016



Because Cole Eye Institute is a tertiary care center, patients referred for surgery often have multiple, simultaneous eye diseases that can influence visual potential and limit the ability to predict precise refractive outcome. These comorbidities may explain the limited visual improvement in some patients. Among patients undergoing cataract surgery at the institute in 2016, comorbidities affecting the retina or glaucoma were most common, followed by cornea, uveitis, postrefractive surgery, other, and lens.

Difference Between Actual and Target Refractive Error (N = 2066)

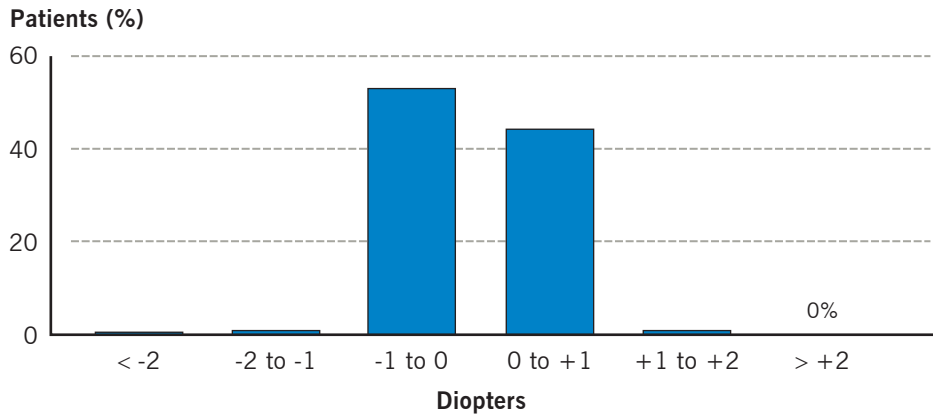
2016



Most patients achieved a refractive outcome following cataract surgery that was near the anticipated target. Despite the large number of patients with other conditions that can influence the refractive outcome, or the accuracy in measuring the final refractive error, 89.9% of patients achieved a final spherical equivalent refractive error within 1 diopter of the expected result.

Difference Between Actual and Target Refractive Error for Femtosecond Laser Surgeries (N = 683)

2016



With the addition of the femtosecond laser for cataract surgery, surgeons now have a greater ability to refine refractive corrections and achieve closer proximity to target. The vast majority of patients achieved a refractive outcome following femtosecond laser-assisted cataract surgery that was near the anticipated target. In this group, 97.2% of patients achieved a final spherical equivalent refractive error within 1 diopter of the expected result.

cataract surgery

Cornea Surgery

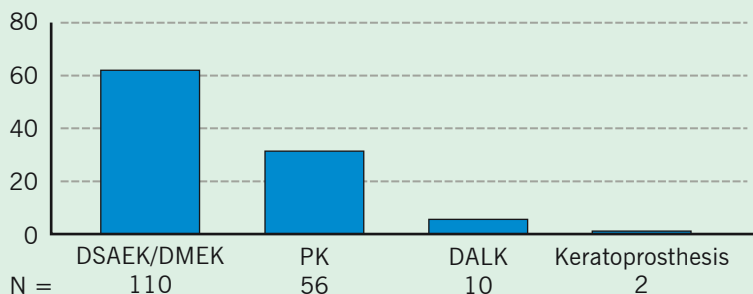
Corneal transplant surgeons at Cleveland Clinic's Cole Eye Institute perform state-of-the-art procedures for numerous conditions that distort or cloud the normally transparent cornea. Traditional full-thickness procedures, also known as penetrating keratoplasty (PK), made up the majority of the grafts performed a decade ago. Cole Eye Institute surgeons have made several key contributions to the advancement of lamellar corneal transplants, which are partial-thickness procedures in which only the diseased portion of the cornea is replaced. Using a procedure called Descemet stripping automated endothelial keratoplasty (DSAEK), surgeons selectively transplant the endothelium for conditions such as Fuchs endothelial dystrophy and pseudophakic bullous keratopathy. These patients experience faster visual recovery and more stable and predictable refractive outcomes than do patients treated with traditional PK. During 2016, 56 PKs and 110 DSAEKs were performed. This is consistent with an international trend toward less invasive corneal transplant procedures for endothelial disease.

The institute also has several years of experience with Descemet membrane endothelial keratoplasty (DMEK), a procedure that involves placement of an even thinner graft than with DSAEK. Corneal transplant surgeons at the institute are leaders in the investigation and clinical use of integrated intraoperative optical coherence tomography (iOCT), a major real-time imaging advance that allows better identification of surgical endpoints and improved outcomes of lamellar transplant surgeries such as DSAEK and deep anterior lamellar keratoplasty (DALK). The low reoperation rate on endothelial transplants in 2016, which included a significant number of DMEK procedures historically prone to higher dislocation rates, partially reflects the integration of this technology into routine use at Cole Eye Institute. The observations gained from large-scale implementation of iOCT are fueling other innovations in surgical instrumentation and technique, all with the goal of optimizing surgical safety and patient outcomes.

Corneal Transplants by Procedure (N = 178)

2016

Percent



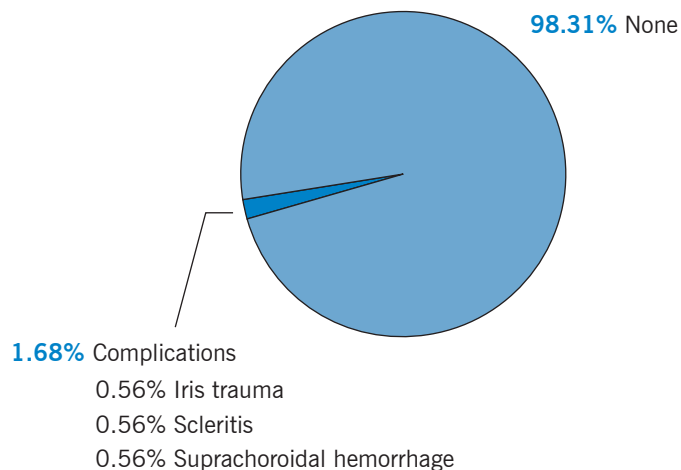
DALK = deep anterior lamellar keratoplasty, DMEK = Descemet membrane endothelial keratoplasty, DSAEK = Descemet stripping automated endothelial keratoplasty, PK = penetrating keratoplasty

After DSAEK or DMEK, 98% of grafts remained clear at 3 to 12 months. For PK patients, 100% of grafts remained clear at 3 to 12 months. Institute surgeons also performed DALK for corneal scars and keratoconus; in this procedure, the recipient's anterior cornea is replaced but the patient's healthy endothelium is retained, eliminating the risk of endothelial rejection.

Highly specialized transplants are performed in smaller numbers for uncommon sight-threatening corneal conditions. For end-stage corneal disease in patients who were not candidates for other forms of transplantation, synthetic corneas (Boston keratoprotheses) were implanted to allow them to regain some visual function.

Intraoperative Complications (N = 178)

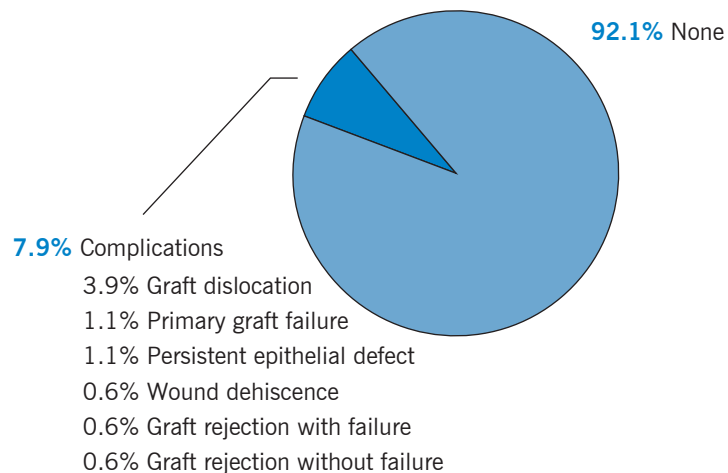
2016



The only intraoperative complications were 1 case each of iris trauma, scleritis, and suprachoroidal hemorrhage.

Postoperative Complications (N = 178)

2016

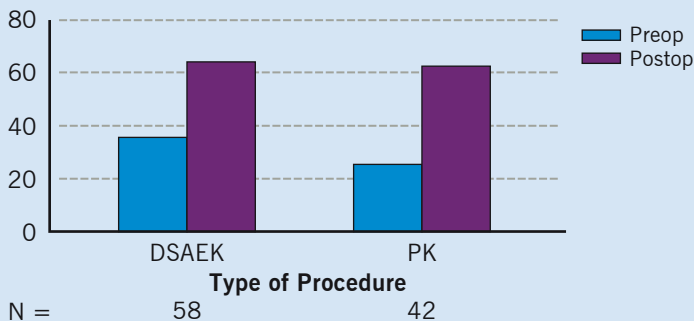


At 3 to 12 months, the postoperative complication rate was 7.9%. These included 7 cases of graft dislocation (in endothelial keratoplasty cases) that were all resolved within 4 to 6 weeks postoperatively, 2 primary graft failures, 2 persistent epithelial defects, and 1 case each of wound dehiscence, graft rejection with failure, and graft rejection without failure.

Change in Visual Acuity by Procedure (N = 100)

2016

Mean ETDRS Visual Acuity Score



The mean improvement in ETDRS visual acuity score in DSAEK patients was 28.46 letters, corresponding to an improvement of > 5 lines of visual acuity. PK patients had worse preoperative vision than DSAEK patients and gained a mean of 37.07 letters, equivalent to 7 lines of visual acuity. N = patients who completed 3 to 12 months of follow-up after DSAEK or PK.

DSAEK = Descemet stripping automated endothelial keratoplasty, ETDRS = Early Treatment Diabetic Retinopathy Study, PK = penetrating keratoplasty

Glaucoma Surgery

Glaucoma is the second most common cause of irreversible blindness in the United States, after age-related macular degeneration. While visual loss from glaucoma cannot be reversed, adequate control of intraocular pressure (IOP) can halt or slow the progressive loss of vision.

Medications such as eye drops can help patients avoid the need for laser treatment or surgery, but these entail long-term cost and some potential for local and systemic side effects. Laser treatment for glaucoma is generally quick, safe, and convenient, but in many patients it has only a relatively small effect in reducing IOP and the effect may wear off over time. For some patients, surgery to control IOP, and prevent glaucoma progression, is the best option.

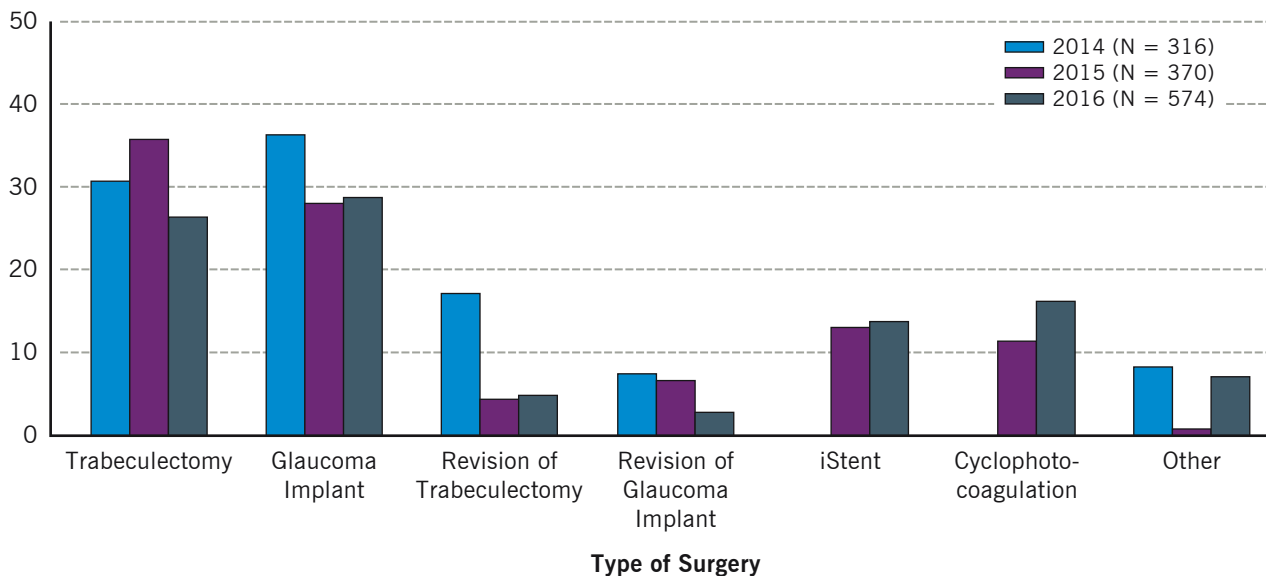
Trabeculectomies and glaucoma implants continue to be the mainstay of glaucoma surgery at Cole Eye Institute. In addition, 2 minimally invasive procedures (iStent[®] trabecular micro-bypass and cyclophotocoagulation) are being performed more frequently.

glaucoma

Volume of Glaucoma Surgeries

2014 – 2016

Surgeries (%)



During 2016, 152 trabeculectomies and 165 glaucoma implant surgeries were performed at the institute. Due to the increased frequency of iStent (79 surgeries) and cyclophotocoagulation (94 surgeries), these 2 procedures are now being tracked and presented separately.

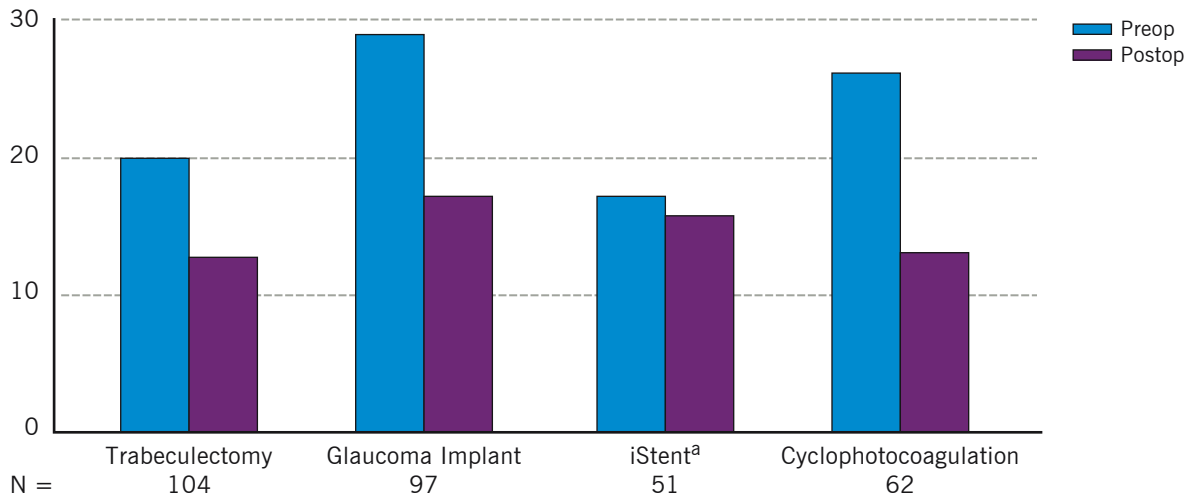
surgery

Glaucoma Surgery

Change in IOP at 3- to 12-Month Follow-Up (N = 314)

2016

Mean IOP (mm Hg)



IOP = intraocular pressure

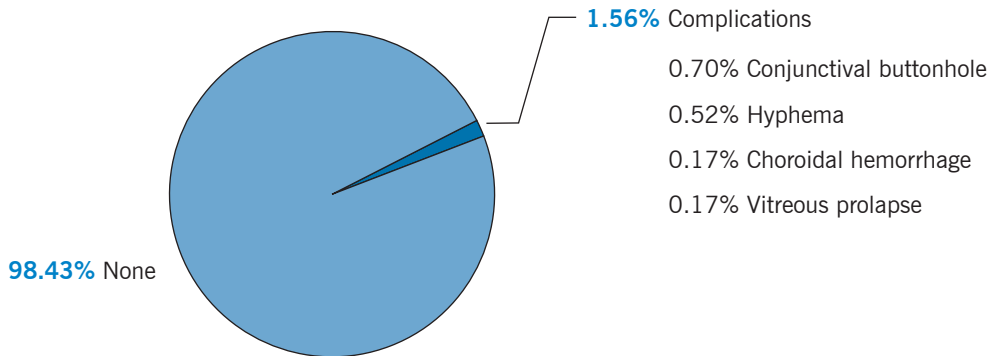
^aiStent was combined with phacoemulsification.

In patients treated at the institute during 2016, trabeculectomy reduced IOP from a mean of 20.1 mm Hg to 12.52 mm Hg, and glaucoma implant surgery reduced IOP from a mean of 29.2 mm Hg to 17.17 mm Hg. For the 2 newer procedures, iStent (combined with phacoemulsification) reduced IOP from a mean of 16.87 mm Hg to 15.63 mm Hg, and cyclophotocoagulation reduced IOP from 26.29 mm Hg to 13.25 mm Hg. A normal range of IOP is approximately 10 mm Hg to 21 mm Hg. N = number of patients who returned for a follow-up visit and had IOP measured.

glaucoma

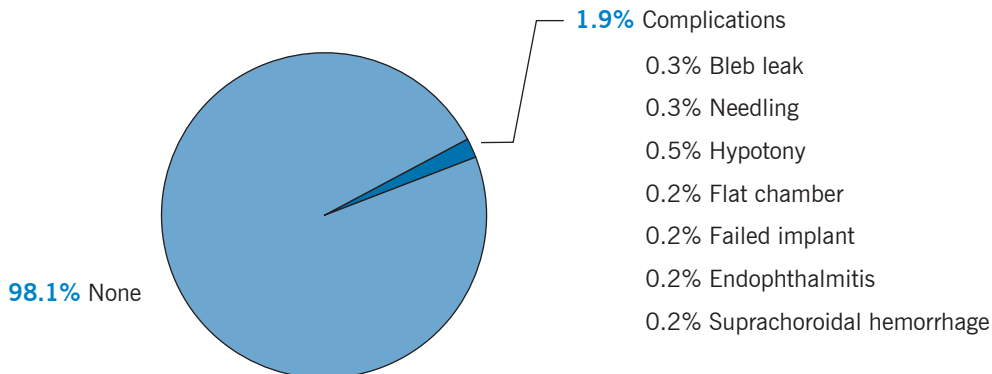
Intraoperative Complications (N = 574)

2016



Postoperative Complications at 3-Month Follow-Up (N = 574)

2016



The total postoperative complication rate was 1.9%, which included mainly bleb leak, needling, and hypotony (IOP < 5 mm Hg). N = number of patients who returned for a follow-up visit.

surgery

Ocular Oncology Surgery

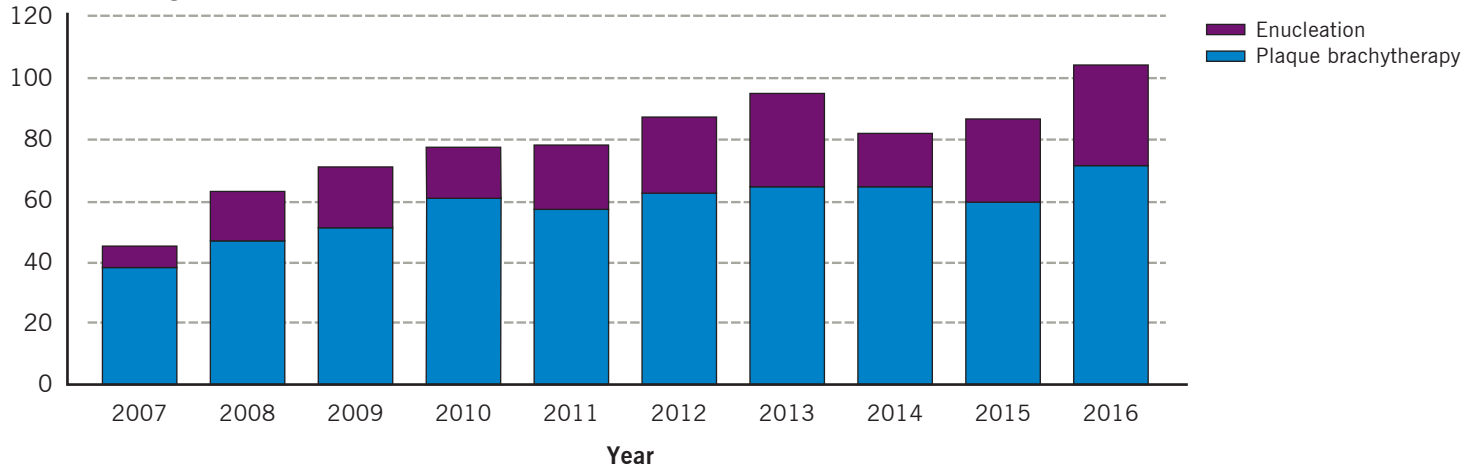
The mean incidence of uveal melanoma in the United States is 5.1 per million, with most cases (97.8%) occurring in the white population. Increasingly, uveal melanoma patients are being treated with radiation.

Several outcome measures can be considered when assessing treatment benefits of plaque radiation therapy. These include tumor specific mortality, local tumor control, globe salvage rate, and vision preservation. The recurrence rates following brachytherapy with plaque radiation therapy range from 10% to 15% in the published studies in the United States. Because the outcome events of interest are likely to occur after the first year following primary therapy, Cole Eye Institute has conducted a comprehensive 10-year outcomes study.¹

Uveal Melanoma Surgeries (N = 788)

2007 – 2016

Number of Surgeries



N = 45 63 71 77 78 87 95 82 86 104

The number of uveal melanoma surgeries performed at Cleveland Clinic has more than doubled in 10 years, from 45 in 2007 to 104 in 2016.

Reference

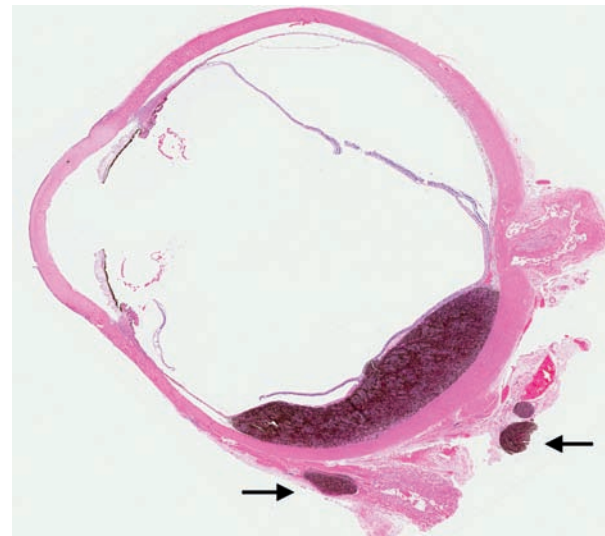
1. Bellerive C, Aziz HA, Bena J, Wilkinson A, Suh JH, Plesec T, Singh AD. Local failure after episcleral brachytherapy for posterior uveal melanoma: patterns, risk factors, and management. *Am J Ophthalmol*. 2017 Feb 2 (In Press).

Uveal Melanoma Recurrence Patterns (N = 375)

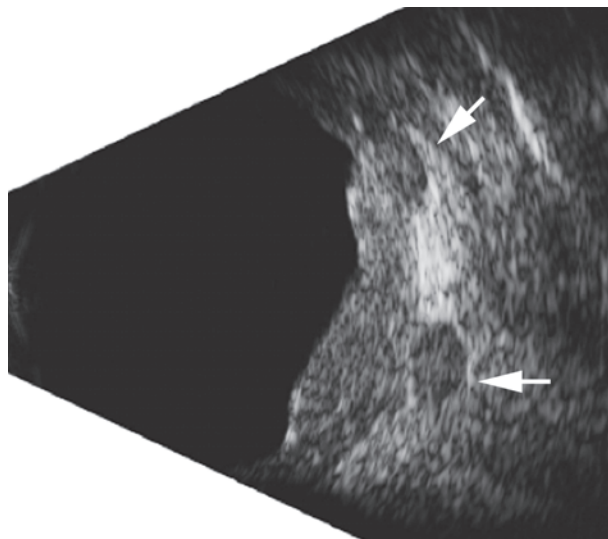
2007 – 2016

Recurrences	21 (5.6%)
Median time to recurrence	18 months (range, 4–156)
Recurrence site/type	
Tumor margin	12 (57.1%)
Central	3 (14.3%)
Diffuse	3 (14.3%)
Ciliary body	2 (9.5%)
Extraocular extension	1 (4.9%)

In a group of 375 patients with posterior uveal melanoma treated with brachytherapy alone between January 2004 and December 2014, recurrence was uncommon, with a 5-year estimated recurrence rate of 6.6%.



Histopathologic correlation after enucleation.



Multifocal extraocular recurrence noted on B scan ultrasonography, 12 months after brachytherapy.

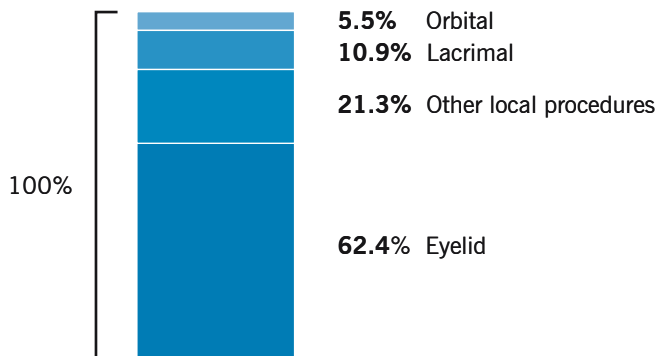
Oculoplastic Surgery

Oculoplastic surgery outcomes were divided into 3 categories: eyelid surgery, lacrimal surgery, and orbital surgery. A total of 1058 oculoplastic surgeries were performed at Cleveland Clinic Cole Eye Institute in 2016.

There were 660 eyelid, 115 lacrimal, and 58 orbital procedures performed during this period. The remaining 225 procedures represent eyelid lesions and other local procedures. No intraoperative complications were reported, and the postoperative outcomes are displayed below.

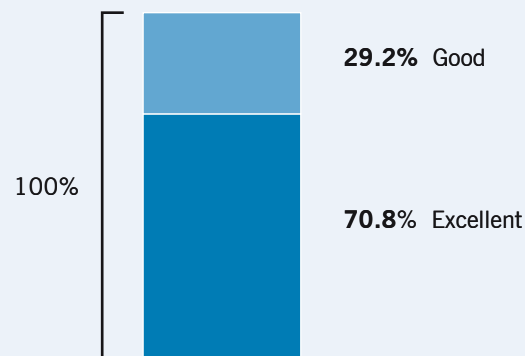
Distribution of Oculoplastic Surgeries (N = 1058)

2016



Eyelid Surgery: Postoperative Eyelid Symmetry (N = 456)

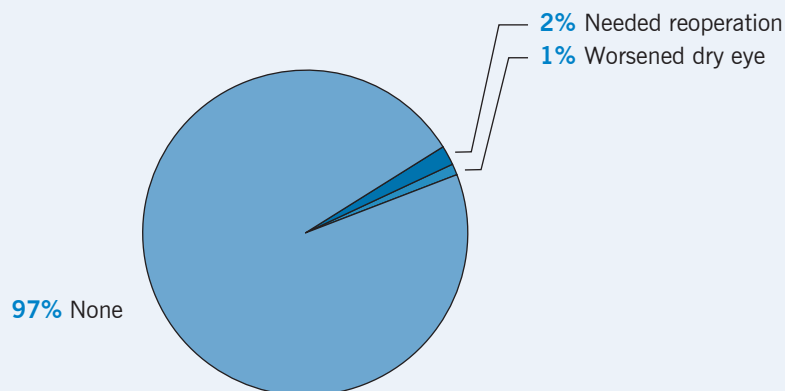
2016



Postoperative eyelid symmetry was excellent in 70.8% of cases and good in the remaining 29.2%. Excellent and good eyelid symmetries were defined by a marginal reflex distance within 0.5 mm and 1.0 mm of the desired position, respectively. N = patients who returned for a follow-up visit.

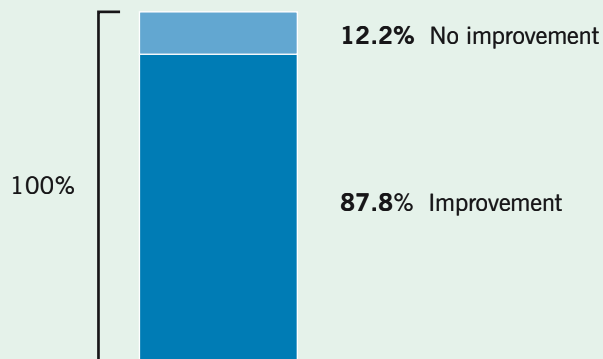
Eyelid Surgery: Postoperative Complications (N = 456)

2016



Lacrimal Surgery Outcomes (N = 82)

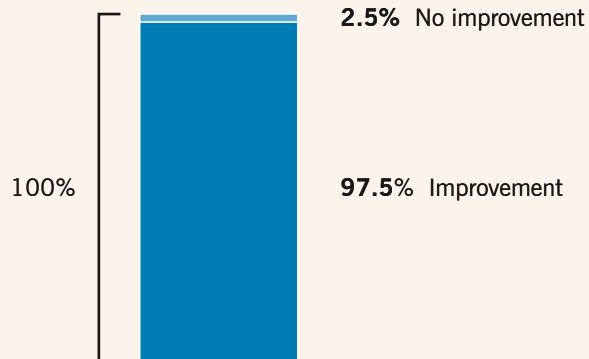
2016



Following lacrimal surgery, 88% of patients had improvement in epiphora. N = patients who returned for a follow-up visit.

Orbital Surgery Outcomes (N = 40)

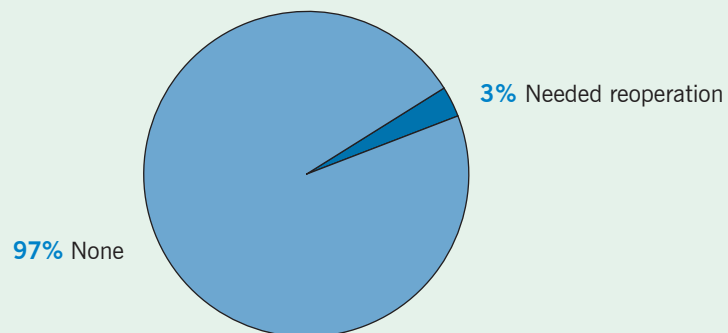
2016



Following orbital surgery, 98% of patients had improvement in orbital signs and symptoms. N = patients who returned for a follow-up visit.

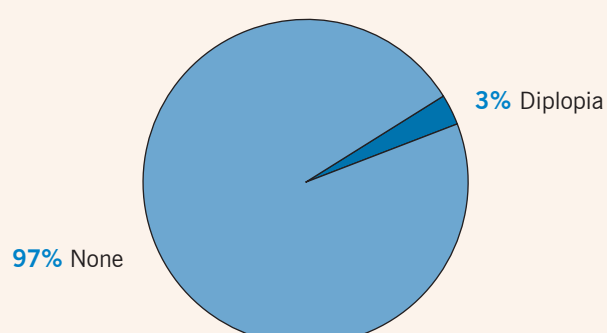
Lacrimal Surgery: Postoperative Complications (N = 82)

2016



Orbital Surgery: Postoperative Complications (N = 40)

2016



Refractive Surgery

Surgeons at Cole Eye Institute use 3 laser platforms: the WaveLight® Refractive Suite: Allegretto Wave® Eye-Q and FS200 Femto Laser, the VISX™ Star S4 excimer laser, and the ZEISS VisuMax® for making flaps or performing a new procedure called SMILE (small incision lenticular extraction), for which results are not yet available. Outcomes are subdivided based on the type of surgery and the patient's preoperative refractive status (low/moderate myopia [0 to -7.00 diopters (D)], high myopia [> -7.00 D], and hyperopia [0 to +6.00 D]). Both the type and magnitude of refractive error can affect the likelihood that uncorrected visual acuity (UCVA) of 20/20 or better will be achieved. Another important metric in assessing laser vision correction outcomes is the proportion of patients whose final refractive error falls within ± 0.5 D of the intended result.

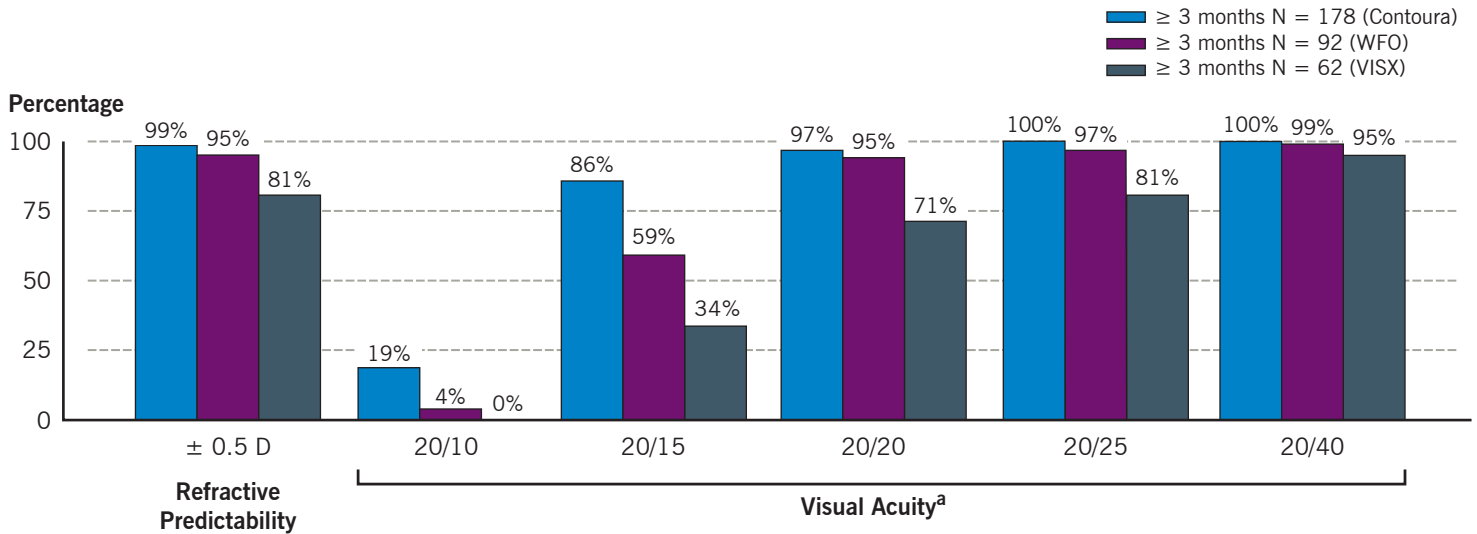
This section documents outcomes for laser in situ keratomileusis (LASIK) with a femtosecond laser (FS200) flap (FemtoLASIK) and photorefractive keratectomy (PRK) (i.e., surface ablation) using the wavefront optimized (WFO) ablation profile of the WaveLight Allegretto Wave Eye-Q excimer laser along with the VISX Star S4 platform, which is all-inclusive of customized and standard ablation profiles. In 2016, surgeons at the institute began using a new topography-guided profile of laser treatment called Contoura™ Vision. Contoura Vision can be applied with LASIK or PRK and uses the WaveLight platform. Outcomes are reported as the percentages of eyes with UCVA of 20/20 or 20/25, eyes with an exceptional outcome (UCVA of 20/15 or even 20/10), and eyes with UCVA meeting the requirements for driving without glasses (20/40 or better). This analysis includes the outcomes of 420 eyes treated in 2016 with the WaveLight platform (including 225 using Contoura Vision) and 98 eyes treated with the VISX platform.

Overall, the Contoura Vision profile of the WaveLight laser showed superior results to those of the WFO profile and the VISX Star S4 laser in most categories. The latter 2 platforms, however, are used by a different subgroup of surgeons and this may play a role in the difference in outcomes between the 3 laser treatment profiles.

refractive

Distance-Only LASIK for Low to Moderate Myopia (0 to -7 D Sphere With Cylinder < 3 D) (N = 332)

2016



WFO = wavefront optimization

^aPercentages are cumulative.

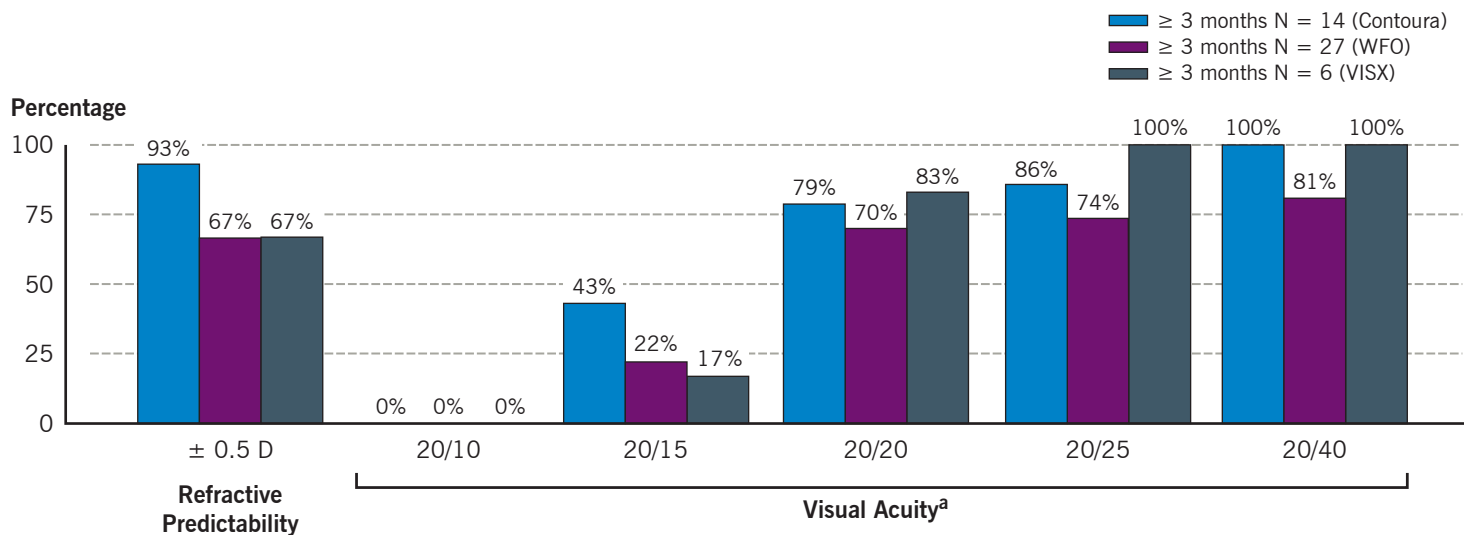
Following FemtoLASIK to treat low to moderate myopia, 97% of eyes treated with WaveLight/Contoura, 95% with WaveLight/WFO, and 71% with VISX achieved UCVA of 20/20 or better, and 100%, 97%, and 81%, respectively, achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 99%, 95%, and 81% within ± 0.5 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 100%, 99%, and 95% of eyes, and 86%, 59%, and 34% had an exceptional visual outcome of 20/15 or better, with 19%, 4%, and 0% even achieving UCVA of 20/10.

surgery

Refractive Surgery

Distance-Only LASIK for High Myopia (> -7 D Sphere With Cylinder < 3 D) (N = 47)

2016



WFO = wavefront optimization

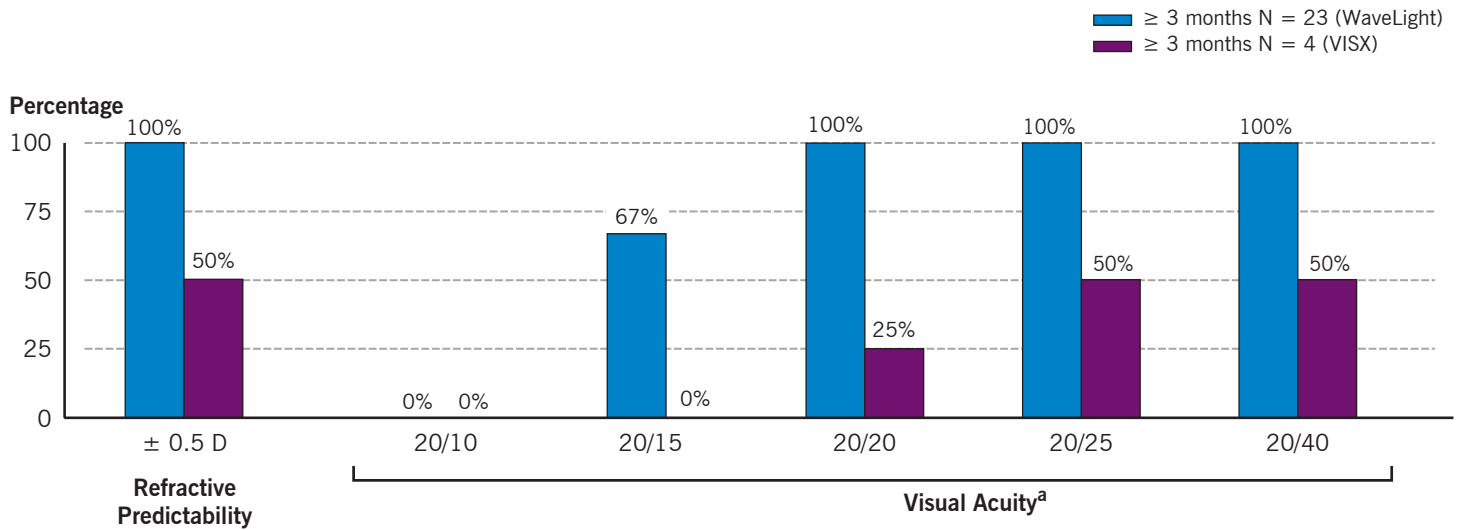
^aPercentages are cumulative.

Following FemtoLASIK to treat high myopia, 79% of eyes treated with WaveLight/Contoura, 70% with WaveLight/WFO, and 83% with VISX achieved UCVA of 20/20 or better, and 86%, 74%, and 100%, respectively, achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 93%, 67%, and 67% within ± 0.50 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 100%, 81%, and 100% of eyes, and 43%, 22%, and 17% had an exceptional visual result of 20/15 or better.

refractive

Distance-Only LASIK for Hyperopia (N = 27)

2016



WFO = wavefront optimization

^aPercentages are cumulative.

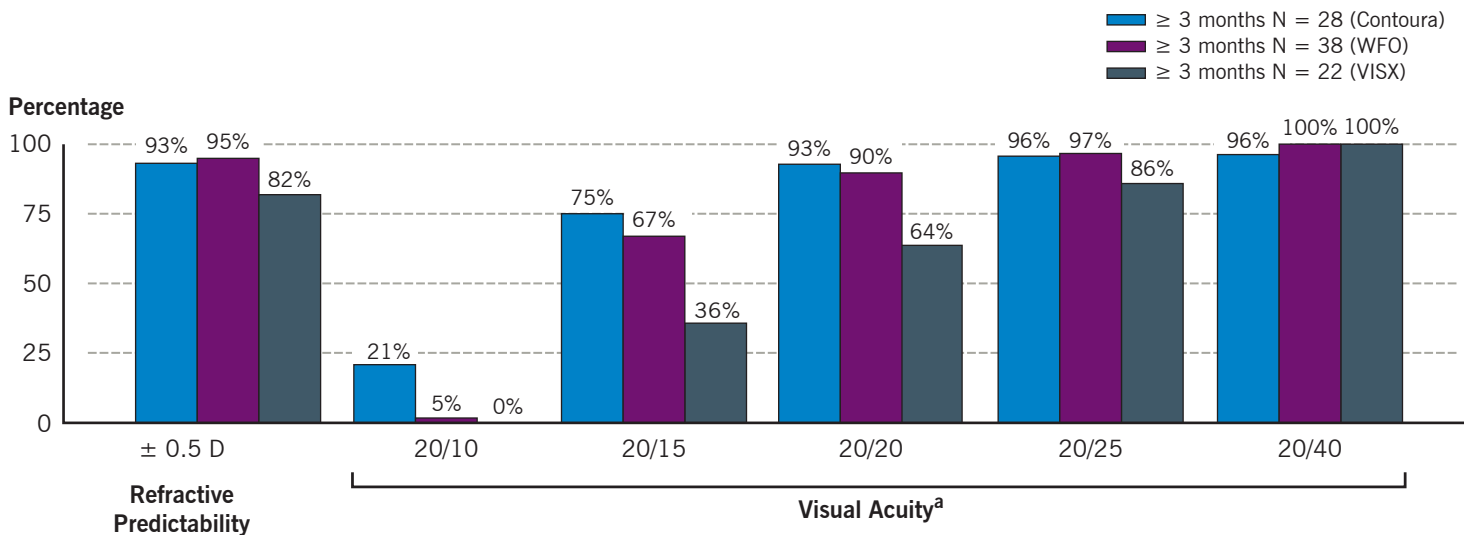
Following FemtoLASIK in hyperopic eyes, where a precise refractive outcome is known to be more difficult to achieve, 100% of eyes treated with WaveLight but only 25% treated with VISX achieved UCVA of at least 20/20, and 100% and 50%, respectively, achieved 20/25 or better. The refractive accuracy in achieving these visual outcomes is 100% and 50% within ± 0.5 D of the target outcome. UCVA of 20/40 or better (legal driving vision) was achieved in 100% and 50% of eyes, and 67% treated with WaveLight achieved an exceptional result with an uncorrected visual acuity of 20/15 or better. Contoura Vision is not approved for use in hyperopic eyes.

surgery

Refractive Surgery

Distance-Only PRK Surface Ablation for Low to Moderate Myopia (0 to -7 D Sphere With Cylinder < 3 D) (N = 88)

2016



WFO = wavefront optimization

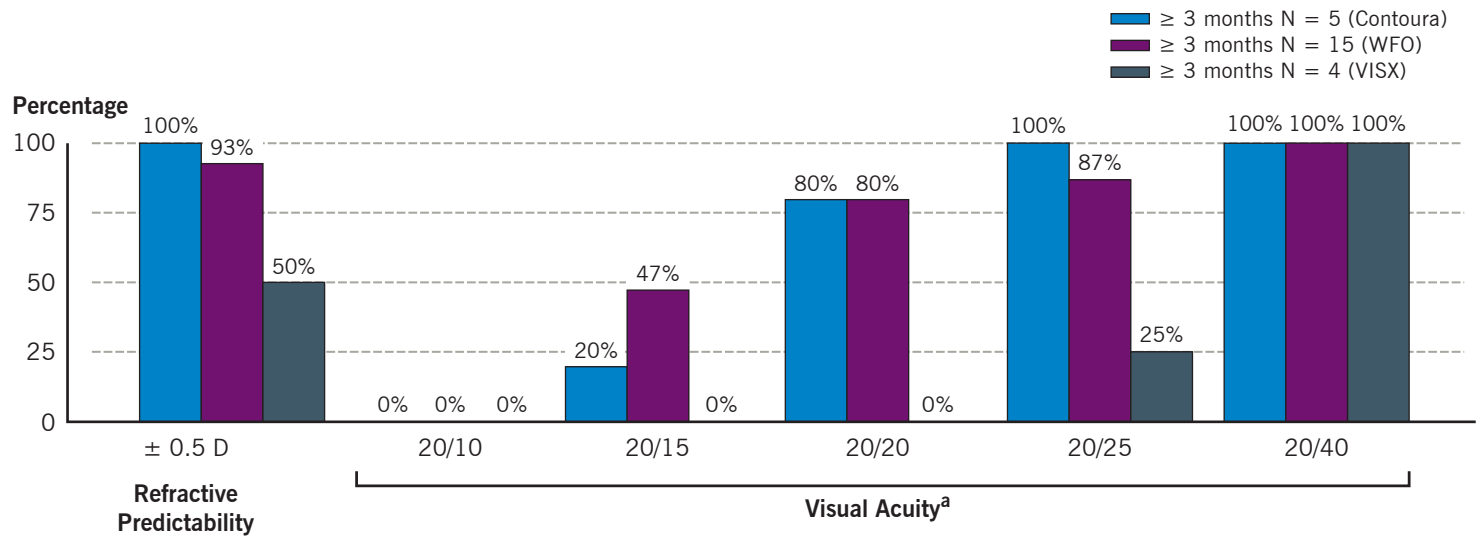
^aPercentages are cumulative.

Following PRK to treat low to moderate myopia, 93% of eyes treated with WaveLight/Contoura, 90% with WaveLight/WFO, and 64% with VISX achieved UCVA of 20/20 or better, and 96%, 97%, and 86%, respectively, achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 93%, 95%, and 82% within ± 0.50 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in 96%, 100%, and 100% of eyes, and 75%, 67%, and 36% had an exceptional visual result of 20/15 or better, with 21%, 5%, and 0% even achieving UCVA of 20/10.

refractive

Distance-Only PRK Surface Ablation for High Myopia (> -7 D Sphere With Cylinder < 3 D) (N = 24)

2016



WFO = wavefront optimization

^aPercentages are cumulative.

Following PRK to treat high myopia, 80% of eyes treated with WaveLight/Contoura, 80% with WaveLight/WFO, and 0% with VISX achieved UCVA of 20/20 or better, and 100%, 87%, and 25%, respectively, achieved 20/25 or better. The refractive accuracy in achieving these excellent visual outcomes is 100%, 93%, and 50% within ± 0.50 D of the desired target. UCVA of 20/40 or better (legal driving vision) was achieved in all eyes, and 20%, 47%, and 0% had an exceptional visual result of 20/15 or better.

surgery

Strabismus Surgery

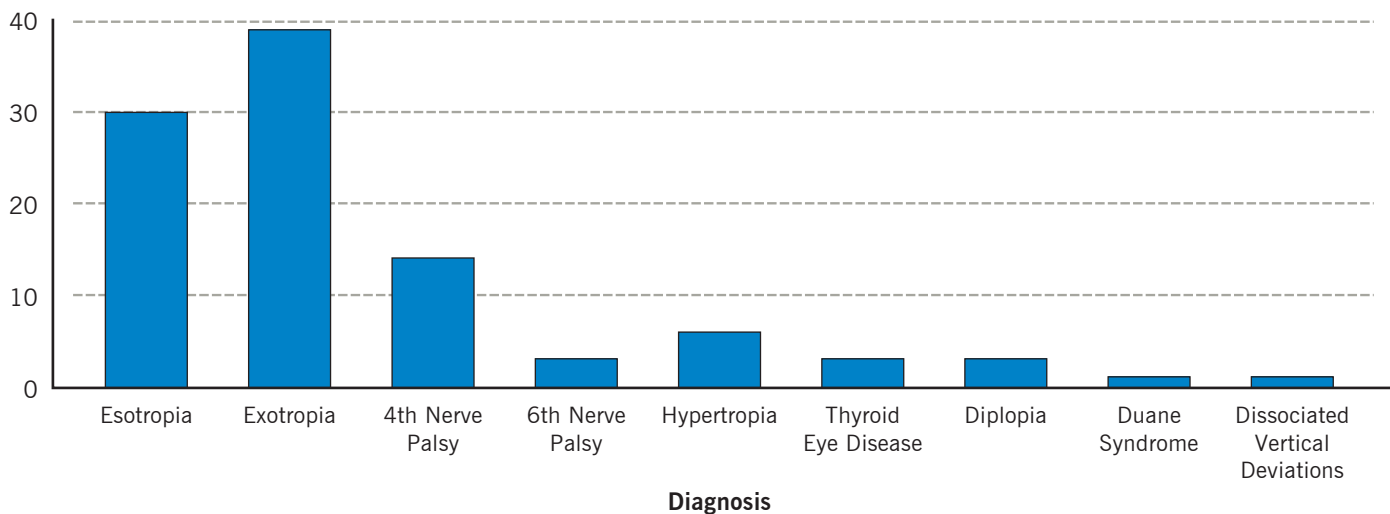
Cole Eye Institute considers the outcome of surgery for strabismus in adults to be good if there is: (1) disappearance of diplopia and/or anomalous head position in primary position of gaze or (2) in the absence of diplopia or anomalous head position, a constant deviation of < 10 prism diopters (D). In children, a good outcome is defined as: (1) a constant deviation of < 10 prism D in primary position or (2) the disappearance of anomalous head position for those in whom the surgery was done for that purpose, such as patients with a 4th nerve palsy, Brown syndrome, or Duane syndrome. The results shown reflect reviews of follow-up visits during each calendar year. Hence, follow-up data for some patients are not included here, nor are long-term outcomes.

Between January and December 2016, 296 strabismus procedures were performed by 5 surgeons; 181 procedures were performed on children and 115 on adults (defined as age 16 years or older).

Adult Strabismus Cases (N = 115)

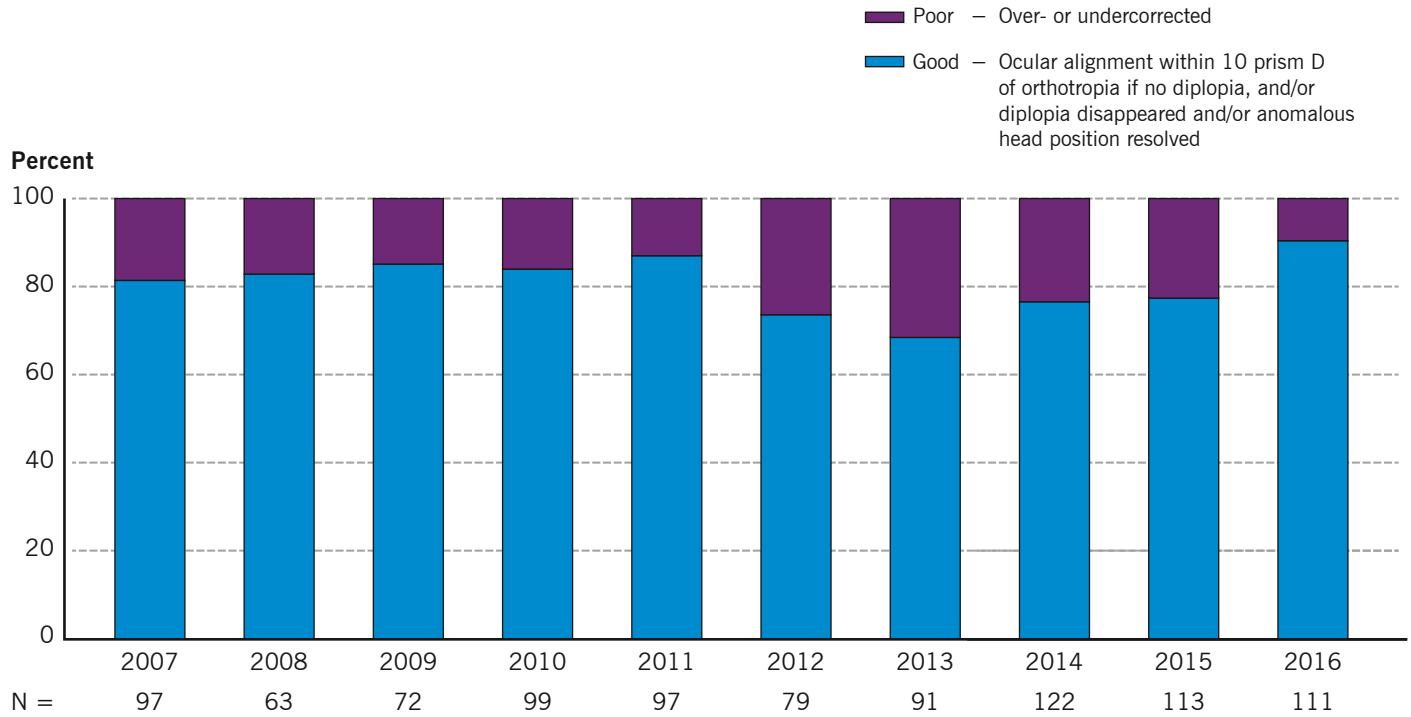
2016

Surgeries (%)



Adult Strabismus Outcomes

2007 – 2016

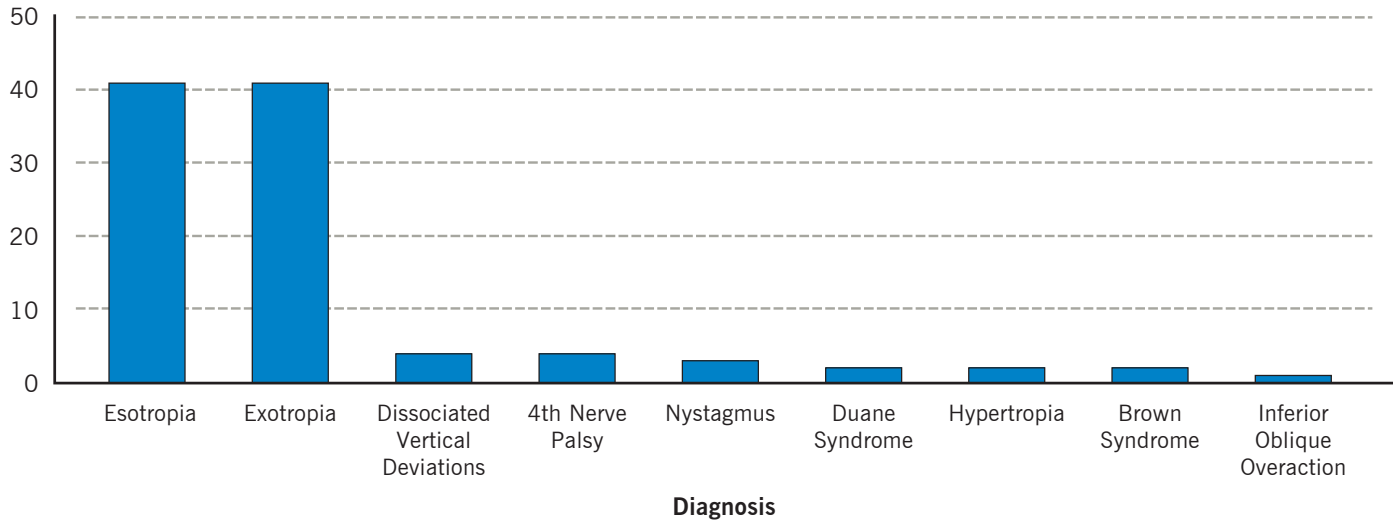


Strabismus Surgery

Pediatric Strabismus Cases (N = 181)

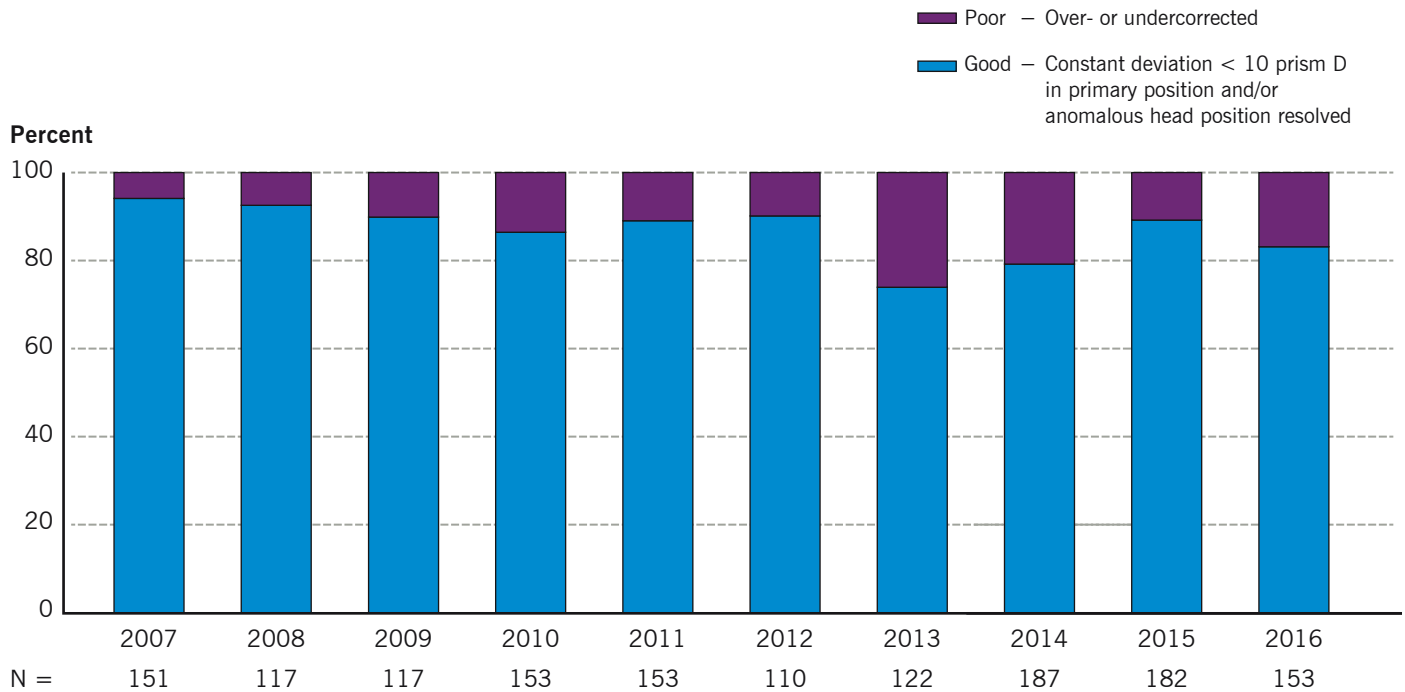
2016

Surgeries (%)



Pediatric Strabismus Outcomes

2007 – 2016



Vitreoretinal Surgery

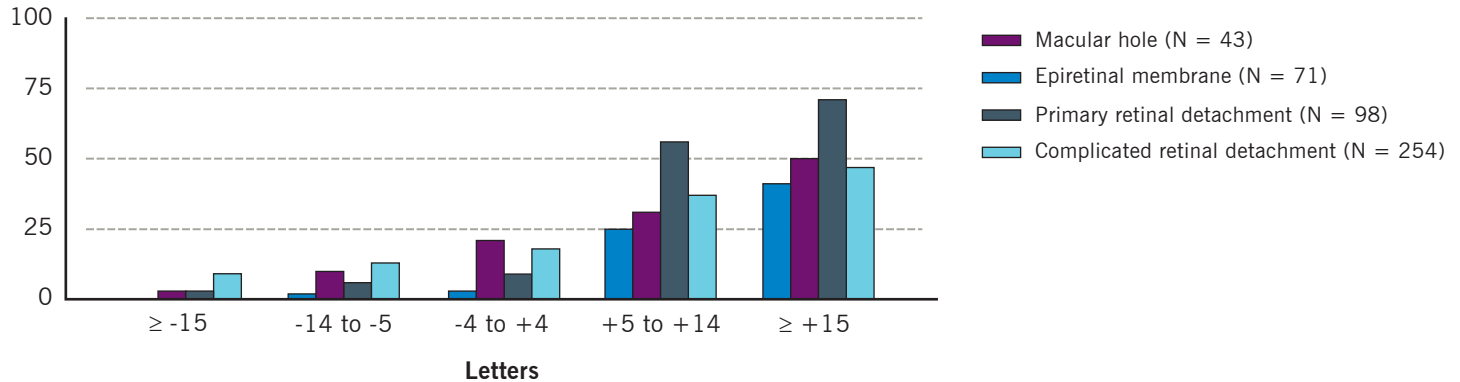
The Vitreoretinal Department at Cleveland Clinic's Cole Eye Institute has assembled a dedicated surgical team of surgeons, nurses, and skilled technicians to deliver superior care to its patients. This team has developed several new surgical procedures that are now used worldwide to treat conditions such as retinal detachment, diabetic macular edema, diabetic traction retinal detachments, and myopic macular holes, and for 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, developing new uses for this pioneering technology.

The team performed 956 surgical procedures in 2016. Detailed outcomes were tracked on 691 of these procedures. As in previous years, this analysis excludes emergency cases, situations in which ETDRS (Early Treatment Diabetic Retinopathy Study) protocol visual acuity could not be performed at baseline, and patients who received postoperative care at another facility.

Vision Improvement by Procedure (N = 466)

2016

Percentage



Preoperative and postoperative ETDRS visual acuity was available for 466 patients, whose outcomes are shown in the graph above categorized by type of surgery.

Vitreoretinal Surgery Success Rates

2013 – 2016

	2013	2014	2015	2016
Macular hole closure rate	96.9% (N = 65)	96.5% (N = 57)	96.1% (N = 77)	100% (N = 54)
Primary retinal detachment repair rate	82.4% (N = 34)	98.5% (N = 45)	98.4% (N = 84)	98.2% (N = 112)
Complicated retinal detachment rate	90.8% (N = 274)	86.25% (N = 240)	92.5% (N = 267)	97.3% (N = 298)

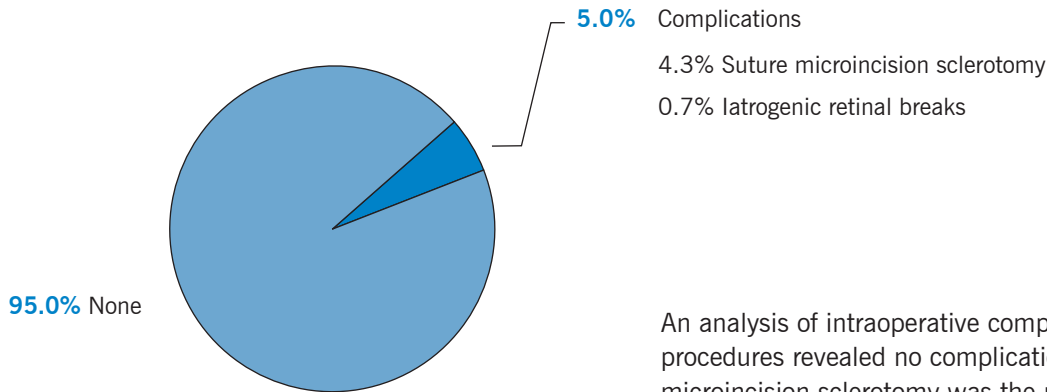
In 2016, detailed efficacy outcomes were available for full thickness macular holes in 54 cases. Anatomic closure of the macular hole was achieved in 100% of cases. Vision improved ≥ 3 ETDRS lines in 65% of patients, with an average improvement in vision of + 17.4 ETDRS letters, or ≥ 3 lines. Of the 85 cases involving removal of an epiretinal membrane for which detailed efficacy outcomes were available, mean visual acuity improvement was + 12.5 ETDRS letters, with 38% of patients having a ≥ 3 line gain in vision. Detailed outcomes analysis was performed on 112 patients who underwent primary retinal detachment repair in 2016. In 98.2% of cases, the retina was reattached with 1 surgery. The mean change in vision was an improvement of + 16.2 ETDRS letters, with 62% of patients having a ≥ 3 line gain in vision.

As a tertiary care facility, Cole Eye Institute is called on to assist in difficult cases, such as giant retinal tears and complicated retinal detachments that have proliferative vitreoretinopathy (PVR), where often numerous surgeries have preceded the patients' evaluation at the institute. Detailed efficacy outcomes for these types of surgery were available for 298 patients in 2016. Although most patients had a previous retinal surgery, the reattachment rate in these difficult cases was 97.3%. Eight patients had to go back to the operating room for additional complicated retinal detachment repair. The mean improvement in vision after PVR retinal detachment repair was +15.3 ETDRS letters, with 40% of patients having a ≥ 3 line improvement in vision and 7.2% having a ≥ 3 line loss in vision.

Vitreoretinal Surgery

Intraoperative Complications (N = 691)

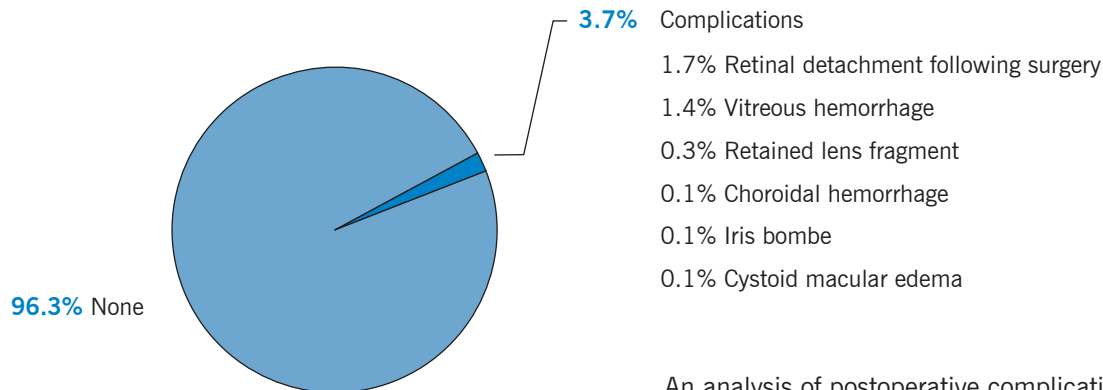
2016



An analysis of intraoperative complications for all surgical procedures revealed no complications in 95% of cases. Suture microincision sclerotomy was the most common intraoperative complication, recorded in 4.3% of cases.

Postoperative Complications (N = 691)

2016



An analysis of postoperative complications in patients who had follow-up of at least 3 to 12 months revealed that 96.3% did not have any postoperative complications. The most prevalent postoperative complications were retinal detachment following surgery (1.7%) and vitreous hemorrhage (1.4%).

Patient Experience — Cole Eye Institute

Keeping patients at the center of all that Cleveland Clinic does is critical. Patients First is the guiding principle at Cleveland Clinic. Patients First is safe care, high-quality care, in the context of patient satisfaction, and high value. Ultimately, caregivers have the power to impact every touch point of a patient's journey, including their clinical, physical, and emotional experience.

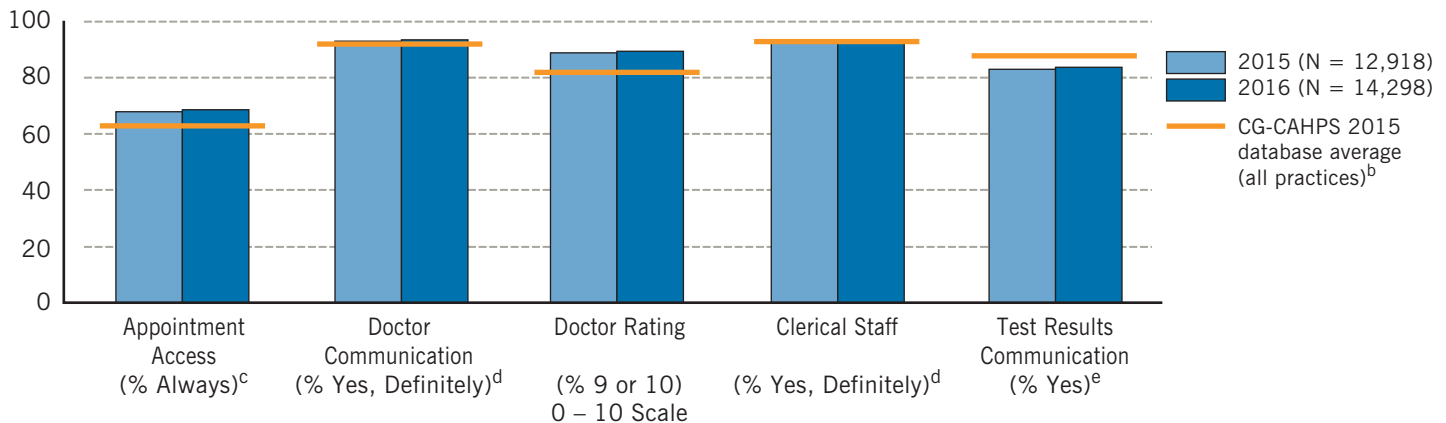
Cleveland Clinic recognizes that patient experience goes well beyond patient satisfaction surveys. Nonetheless, sharing the survey results with caregivers and the public affords opportunities to improve how Cleveland Clinic delivers exceptional care.

Outpatient Office Visit Survey — Cole Eye Institute

CG-CAHPS Assessment^a

2015 – 2016

Percent Best Response



^aIn 2013, Cleveland Clinic began administering the Clinician and Group Practice Consumer Assessment of Healthcare Providers and Systems surveys (CG-CAHPS), standardized instruments developed by the Agency for Healthcare Research and Quality (AHRQ) and supported by the Centers for Medicare & Medicaid Services for use in the physician office setting to measure patients' perspectives of outpatient care.

^bBased on results submitted to the AHRQ CG-CAHPS database from 2829 practices in 2015

^cResponse options: Always, Usually, Sometimes, Never

^dResponse options: Yes, definitely; Yes, somewhat; No

^eResponse options: Yes, No

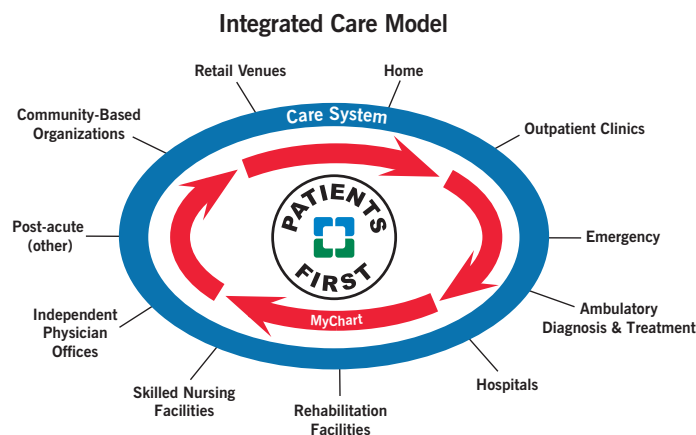
Source: Press Ganey, a national hospital survey vendor

Cleveland Clinic — Implementing Value-Based Care

Focus on Value

Cleveland Clinic has developed and implemented new models of care that focus on “Patients First” and aim to deliver on the Institute of Medicine goal of **Safe, Timely, Effective, Efficient, Equitable, Patient-centered** care. Creating new models of Value-Based Care is a strategic priority for Cleveland Clinic. As care delivery shifts from fee-for-service to a population health and bundled payment delivery system, Cleveland Clinic is focused on concurrently improving patient safety, outcomes, and experience.

What does this new model of care look like?



The Cleveland Clinic Integrated Care Model (CCICM) is a value-based model of care, designed to improve outcomes while reducing cost. It is designed to deliver value in both population health and specialty care.

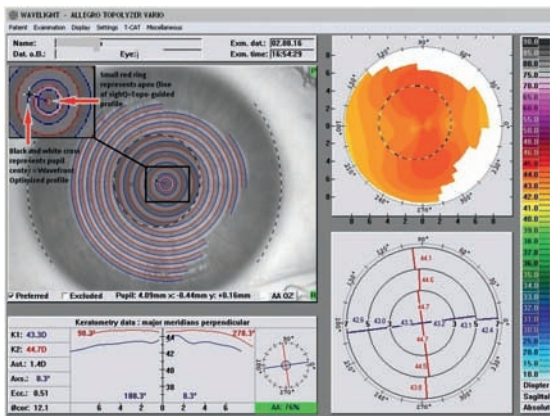
- The patient remains at the heart of the CCICM.
- The blue band represents the care system, which is a seamless pathway that patients move along as they receive care in different settings. The care system represents integration of care across the continuum.
- Critical competencies are required to build this new care system. Cleveland Clinic is creating disease- and condition-specific care paths for a variety of procedures and chronic diseases. Another facet is implementing comprehensive care coordination for high-risk patients to prevent unnecessary hospitalizations and emergency department visits. Efforts include managing transitions in care, optimizing access and flow for patients through the CCICM, and developing novel tactics to engage patients and caregivers in this work.
- Measuring performance around quality, safety, utilization, cost, appropriateness of care, and patient and caregiver experience is an essential component of this work.

WaveLight Topography-Guided Refractive Surgery

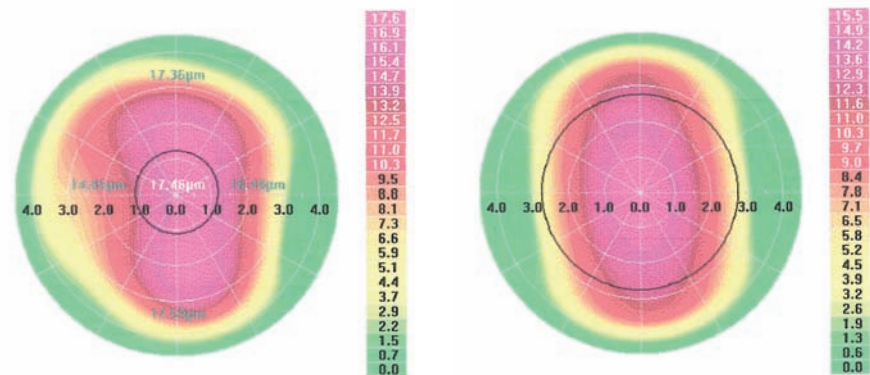
Cole Eye Institute's Department of Refractive Surgery is the first ophthalmology center in Ohio to offer patient-specific, topography-guided Contoura™ Vision correction. Corneal topography maps the corneal shape and irregularities unique to each patient, offering the potential to improve vision beyond that of glasses and contact lenses. This technology also shows statistically significant reductions in visual symptoms associated with LASIK, such as glare, light sensitivity, and difficulty driving at night.¹



Contoura Vision measures and treats the corneal irregularities that limit the sharpest vision. Treatment is centered on the patient's line of sight, rather than the pupil center, and the placement of the laser pulses is customized based on the unique shape of the patient's cornea.



Overview display of WaveLight® Topolyzer™ VARIO™ topographic mapping



Topography-guided laser correction customizes the exact cornea profile (left), which differentiates it from the Wavefront Optimized® profile derived from the glasses prescription only (right).

Reference

1. Stulting RD, Fant BS; T-CAT Study Group. Results of topography-guided laser in situ keratomileusis custom ablation treatment with a refractive excimer laser. *J Cataract Refract Surg.* 2016 Jan;42(1):11-18.

Contact Information

Cole Eye Institute Appointments

216.444.2020 or
800.223.2273, ext. 42020

Cole Eye Institute Referrals

855.REFER.123

On the Web at clevelandclinic.org/eye

Staff Listing

For a complete listing of Cleveland Clinic's Cole Eye Institute staff, please visit clevelandclinic.org/staff.

Publications

Cole Eye Institute staff authored **82** publications in 2016 as indexed within Web of Science.

Locations

For a complete listing of Cole Eye Institute locations, please visit clevelandclinic.org/ColeEye.





Additional Contact Information

General Patient Referral

24/7 hospital transfers or physician consults

800.553.5056

General Information

216.444.2200

Hospital Patient Information

216.444.2000

General Patient Appointments

216.444.2273 or 800.223.2273

Referring Physician Center and Hotline

855.REFER.123 (855.733.3712)

Or email refdr@ccf.org or visit clevelandclinic.org/refer123

Request for Medical Records

216.444.2640 or
800.223.2273, ext. 42640

Same-Day Appointments

216.444.CARE (2273)

Global Patient Services/ International Center

Complimentary assistance for international patients and families

001.216.444.8184 or visit clevelandclinic.org/gps

Medical Concierge

Complimentary assistance for out-of-state patients and families

800.223.2273, ext. 55580, or email medicalconcierge@ccf.org

Cleveland Clinic Abu Dhabi

clevelandclinicabudhabi.ae

Cleveland Clinic Canada

888.507.6885

Cleveland Clinic Florida

866.293.7866

Cleveland Clinic Nevada

702.483.6000

For address corrections or changes, please call

800.890.2467

About Cleveland Clinic

Overview

Cleveland Clinic is an academic medical center offering patient care services supported by research and education in a nonprofit group practice setting. More than 3500 Cleveland Clinic staff physicians and scientists in 140 medical specialties and subspecialties care for more than 7.1 million patients across the system annually, performing nearly 208,000 surgeries and conducting more than 652,000 emergency department visits. Patients come to Cleveland Clinic from all 50 states and 185 nations. Cleveland Clinic's CMS case-mix index is the second-highest in the nation.

Cleveland Clinic is an integrated healthcare delivery system with local, national, and international reach. The main campus in midtown Cleveland, Ohio, has a 1400-bed hospital, outpatient clinic, specialty institutes, labs, classrooms, and research facilities in 44 buildings on 167 acres. Cleveland Clinic has more than 150 northern Ohio outpatient locations, including 10 regional hospitals, 18 full-service family health centers, 3 health and wellness centers, an affiliate hospital, and a rehabilitation hospital for children. Cleveland Clinic also includes Cleveland Clinic Florida; Cleveland Clinic Nevada; Cleveland Clinic Canada; Cleveland Clinic Abu Dhabi, UAE; Sheikh Khalifa Medical City (management contract), UAE; and Cleveland Clinic London (opening in 2020). Cleveland Clinic is the largest employer in Ohio, with more than 51,000 employees. It generates \$12.6 billion of economic activity a year.

Cleveland Clinic supports physician education, training, consulting, and patient services around the world through representatives in the Dominican Republic, Guatemala, India, Panama, Peru, Saudi Arabia, and the United Arab Emirates. Dedicated Global Patient Services offices are located at Cleveland Clinic's main campus, Cleveland Clinic Abu Dhabi, Cleveland Clinic Canada, and Cleveland Clinic Florida.

The Cleveland Clinic Model

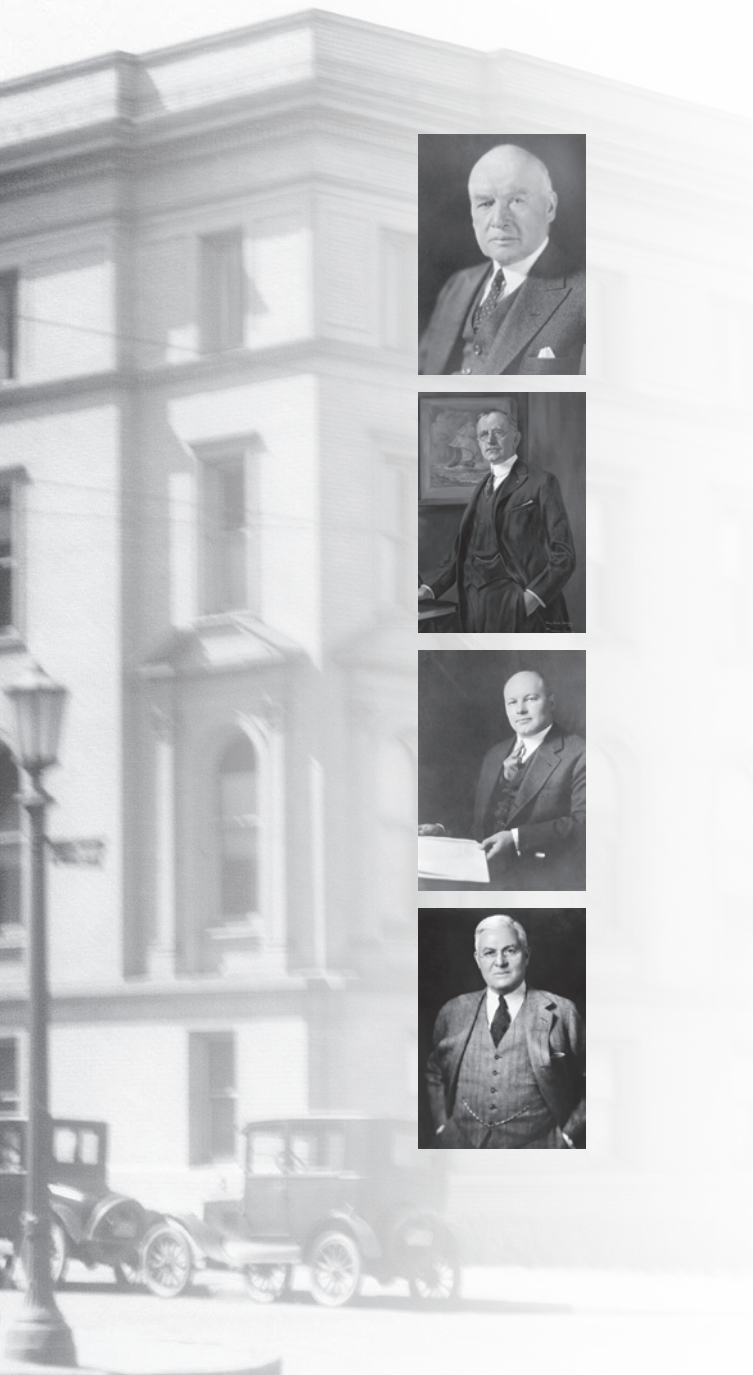
Cleveland Clinic was founded in 1921 by 4 physicians who had served in World War I and hoped to replicate the organizational efficiency of military medicine. The organization has grown through the years by adhering to the nonprofit, multispecialty group practice they established. All Cleveland Clinic staff physicians receive a straight salary with no bonuses or other financial incentives. The hospital and physicians share a financial interest in controlling costs, and profits are reinvested in research and education.

Cleveland Clinic Florida was established in 1987. Cleveland Clinic began opening family health centers in surrounding communities in the 1990s. Marymount Hospital joined Cleveland Clinic in 1995, followed by regional hospitals including Euclid Hospital, Fairview Hospital, Hillcrest Hospital, Lutheran Hospital, Medina Hospital, South Pointe Hospital, and affiliate Ashtabula County Medical Center. In 2015, the Akron General Health System joined the Cleveland Clinic health system.

Internally, Cleveland Clinic services are organized into patient-centered integrated practice units called institutes, each institute combining medical and surgical care for a specific disease or body system. Cleveland Clinic was among the first academic medical centers to establish an Office of Patient Experience, to promote comfort, courtesy, and empathy across all patient care services.

A Clinically Integrated Network

Cleveland Clinic is committed to providing value-based care, and it has grown the Cleveland Clinic Quality Alliance into the nation's second-largest, and northeast Ohio's largest, clinically integrated network. The network comprises more than 6300 physician members, including both Cleveland Clinic staff and independent physicians from the community. Led by its physician members, the Quality Alliance strives to improve quality and consistency of care; reduce costs and increase efficiency; and provide access to expertise, data, and experience.



Cleveland Clinic Lerner College of Medicine

Lerner College of Medicine is known for its small class sizes, unique curriculum, and full-tuition scholarships for all students. Each new class accepts 32 students who are preparing to be physician investigators. In 2015, Cleveland Clinic broke ground on a 477,000-square-foot multidisciplinary Health Education Campus. The campus, which will open in July 2019, will serve as the new home of the Case Western Reserve University (CWRU) School of Medicine and Cleveland Clinic’s Lerner College of Medicine, as well as the CWRU School of Dental Medicine, the Frances Payne Bolton School of Nursing, and physician assistant and allied health training programs.

Graduate Medical Education

In 2016, nearly 2000 residents and fellows trained at Cleveland Clinic and Cleveland Clinic Florida in our continually growing programs.

U.S. News & World Report Ranking

Cleveland Clinic is ranked the No. 2 hospital in America by *U.S. News & World Report* (2016). It has ranked No. 1 in heart care and heart surgery since 1995. In 2016, 3 of its programs were ranked No. 2 in the nation: gastroenterology and GI surgery, nephrology, and urology. Ranked among the nation’s top five were gynecology, orthopaedics, rheumatology, pulmonology, and diabetes and endocrinology.

Cleveland Clinic Physician Ratings

Cleveland Clinic believes in transparency and in the positive influence of the physician-patient relationship on healthcare outcomes. To continue to meet the highest standards of patient satisfaction, Cleveland Clinic physician ratings, based on nationally recognized Press Ganey patient satisfaction surveys, are published online at clevelandclinic.org/staff.

Referring Physician Center and Hotline

Call us 24/7 for access to medical services or to schedule patient appointments at 855.REFER.123 (855.733.3712), email refdr@ccf.org, or go to clevelandclinic.org/Refer123. The free Cleveland Clinic Physician Referral App, available for mobile devices, gives you 1-click access. Available in the App Store or Google Play.

Remote Consults

Anybody anywhere can get an online second opinion from a Cleveland Clinic specialist through our MyConsult service. For more information, go to clevelandclinic.org/myconsult, email myconsult@ccf.org, or call 800.223.2273, ext. 43223.

Request Medical Records

216.444.2640 or 800.223.2273, ext. 42640

Track Your Patients' Care Online

Cleveland Clinic offers an array of secure online services that allow referring physicians to monitor their patients' treatment while under Cleveland Clinic care and gives them access to test results, medications, and treatment plans. my.clevelandclinic.org/online-services

DrConnect (online access to patients' treatment progress while under referred care): call 877.224.7367, email drconnect@ccf.org, or visit clevelandclinic.org/drconnect.

MyPractice Community (affordable electronic medical records system for physicians in private practice): 216.448.4617.

eRadiology (teleradiology consultation provided nationwide by board-certified radiologists with specialty training, within 24 hours or stat): call 216.986.2915 or email starimaging@ccf.org.

Medical Records Online

Patients can view portions of their medical record, receive diagnostic images and test results, make appointments, and renew prescriptions through My**Chart**, a secure online portal. All new Cleveland Clinic patients are automatically registered for My**Chart**. clevelandclinic.org/mychart

Access

Cleveland Clinic is committed to convenient access, offering virtual visits, shared medical appointments, and walk-in urgent care for your patients. clevelandclinic.org/access

Critical Care Transport Worldwide

Cleveland Clinic's fleet of ground and air transport vehicles is ready to transfer patients at any level of acuity anywhere on Earth. Specially trained crews provide Cleveland Clinic care protocols from first contact. To arrange a transfer for STEMI (ST-elevation myocardial infarction), acute stroke, ICH (intracerebral hemorrhage), SAH (subarachnoid hemorrhage), or aortic syndrome, call 877.379.CODE (2633). For all other critical care transfers, call 216.444.8302 or 800.553.5056.

CME Opportunities: Live and Online

Cleveland Clinic's Center for Continuing Education operates the largest CME program in the country. Live courses are offered in Cleveland and cities around the nation and the world. The center's website (ccfcme.org) is an educational resource for healthcare providers and the public. It has a calendar of upcoming courses, online programs on topics in 30 areas, and the award-winning virtual textbook of medicine, The Disease Management Project.

Clinical Trials

Cleveland Clinic is running more than 2200 clinical trials at any given time for conditions including breast and liver cancer, coronary artery disease, heart failure, epilepsy, Parkinson disease, chronic obstructive pulmonary disease, asthma, high blood pressure, diabetes, depression, and eating disorders. Cancer Clinical Trials is a mobile app that provides information on the more than 200 active clinical trials available to cancer patients at Cleveland Clinic. clevelandclinic.org/cancertrialapp

Healthcare Executive Education

Cleveland Clinic has programs to share its expertise in operating a successful major medical center. The Executive Visitors' Program is an intensive, 3-day behind-the-scenes view of the Cleveland Clinic organization for the busy executive. The Samson Global Leadership Academy is a 2-week immersion in challenges of leadership, management, and innovation taught by Cleveland Clinic leaders, administrators, and clinicians. Curriculum includes coaching and a personalized 3-year leadership development plan. clevelandclinic.org/executiveeducation

Consult QD Physician Blog

A website from Cleveland Clinic for physicians and healthcare professionals. Discover the latest research insights, innovations, treatment trends, and more for all specialties. consultqd.clevelandclinic.org

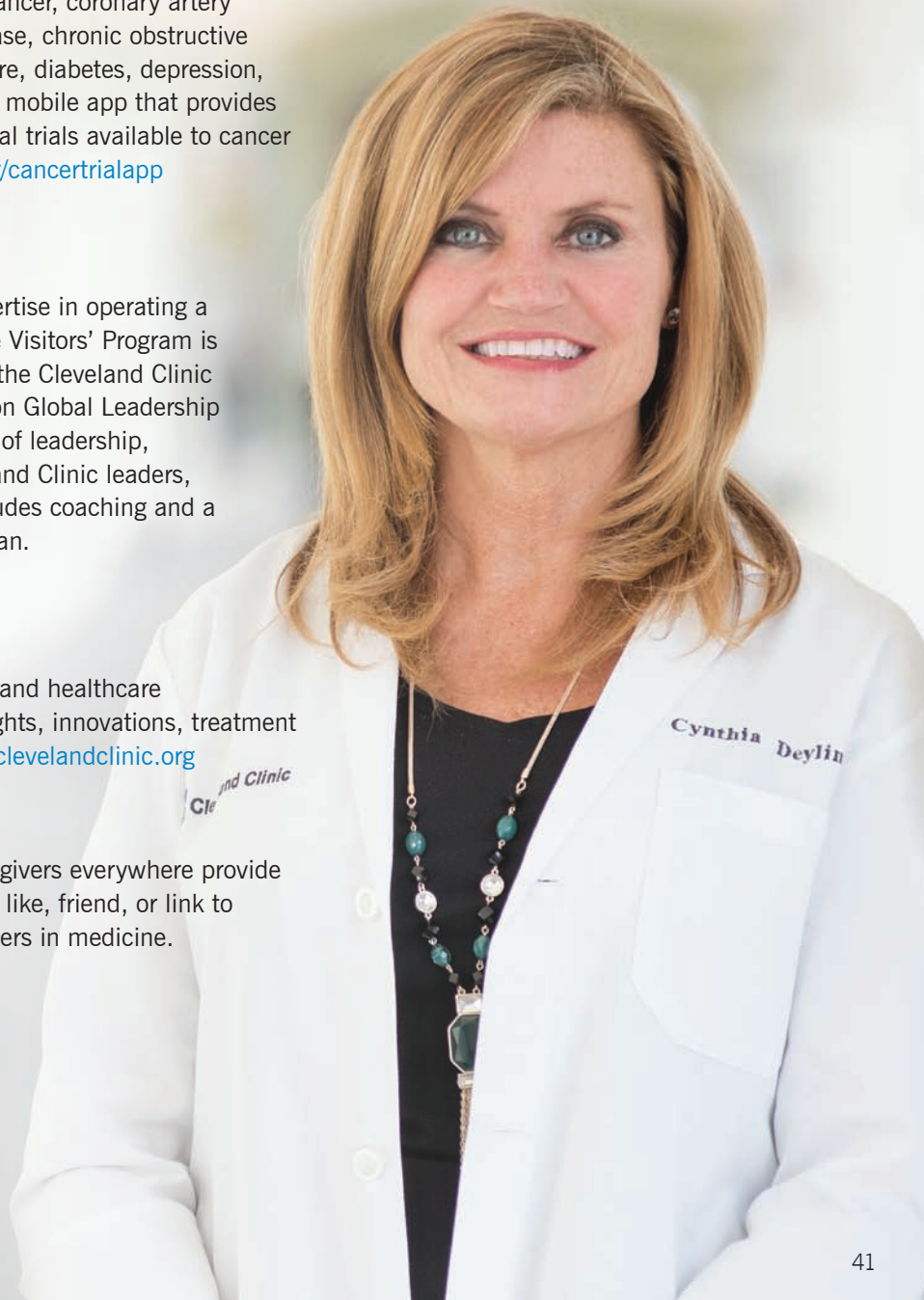
Social Media

Cleveland Clinic uses social media to help caregivers everywhere provide better patient care. Millions of people currently like, friend, or link to Cleveland Clinic social media — including leaders in medicine.

Facebook for Medical Professionals
facebook.com/CMEclevelandclinic

Follow us on Twitter
[@cleclinicMD](https://twitter.com/cleclinicMD)

Connect with us on LinkedIn
clevelandclinic.org/MDlinkedin





Every life deserves world class care.

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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