

Current Technology in Refractive Surgery

KYLE A. SANDBERG, O.D., F.A.A.O.

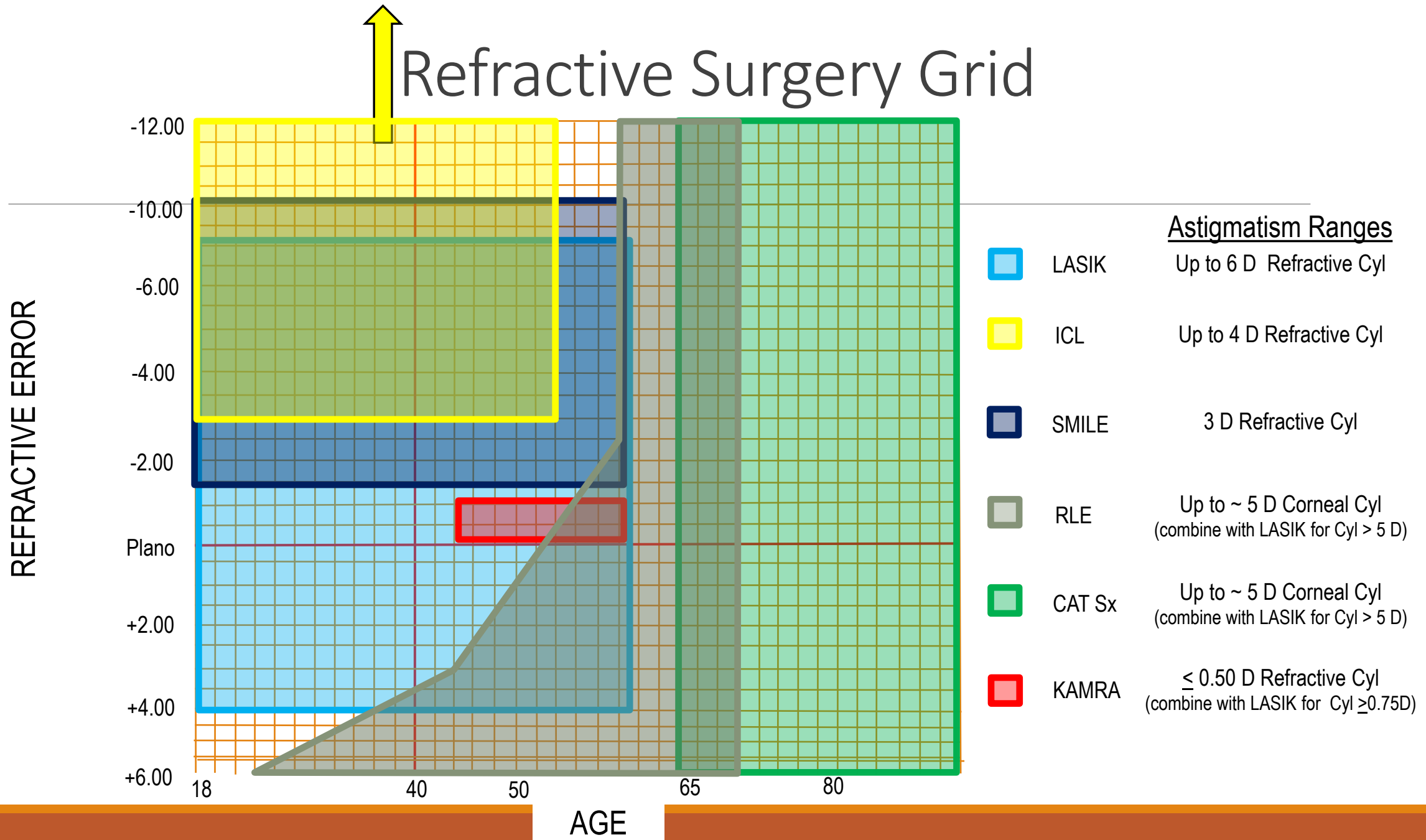
ASSISTANT PROFESSOR

CHIEF, REFRACTIVE SURGERY AND LASER SERVICES

CHIEF, OUTPATIENT SURGERY SERVICE

ROSENBERG SCHOOL OF OPTOMETRY

Refractive Surgery Grid



Today's



What are our options in refractive surgery?

Refractive Surgery is More Practical than Glasses

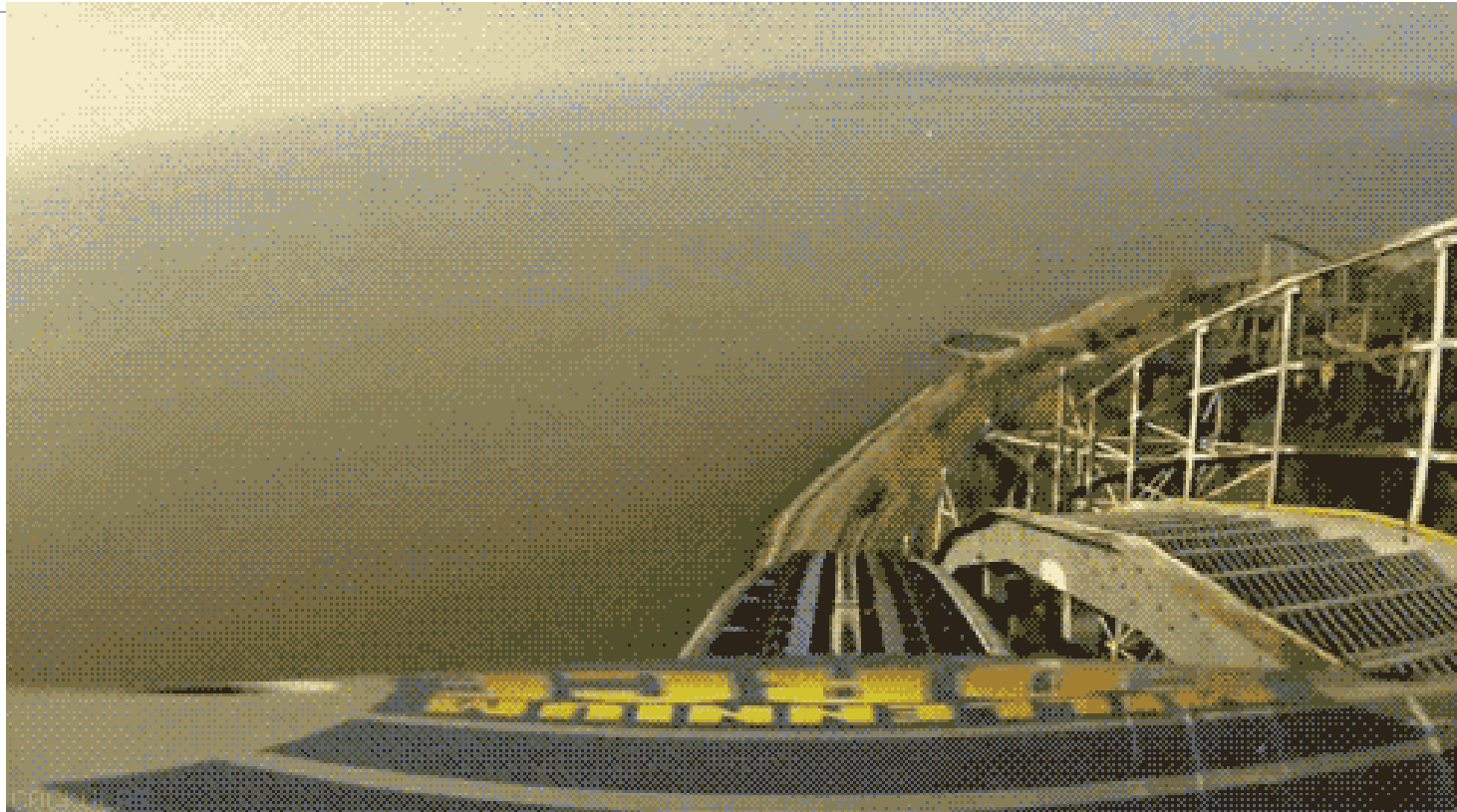
Refractive Surgery is Safer than Contact Lenses with fewer side effects

Published Results and Patient Reported Outcomes with Modern Laser Platforms

Refractive Surgery Cost Comparison

Conclusions







IMPRESSIVE THINGS

©THE LAYSEE PILLOW

A white, rectangular pillow with a slightly curved top edge is placed on a dark, tufted leather couch. The pillow is the central focus of the image. The background is dark, making the white pillow stand out.

Trying to Lay Down While Wearing Glasses...



WHAT ARE YOU SPENDING ON GLASSES AND CONTACTS?

- VISIAN ICL: IMPLANTABLE CONTACTS
- SMILE LASER SURGERY
- LASIK VS EYEGLASSES
- LASIK VS CONTACT LENSES
- LASIK SAVINGS CALCULATOR

Starting age:

25

Pairs of glasses purchased in a year:

2

Average cost of perscription glasses and lenses:

\$200

Boxes of contacts purchased in a year:

4

Cost of a box of contact lenses:

\$50



Read what others are saying about their results!

LASIK & VISION CORRECTION Surgery



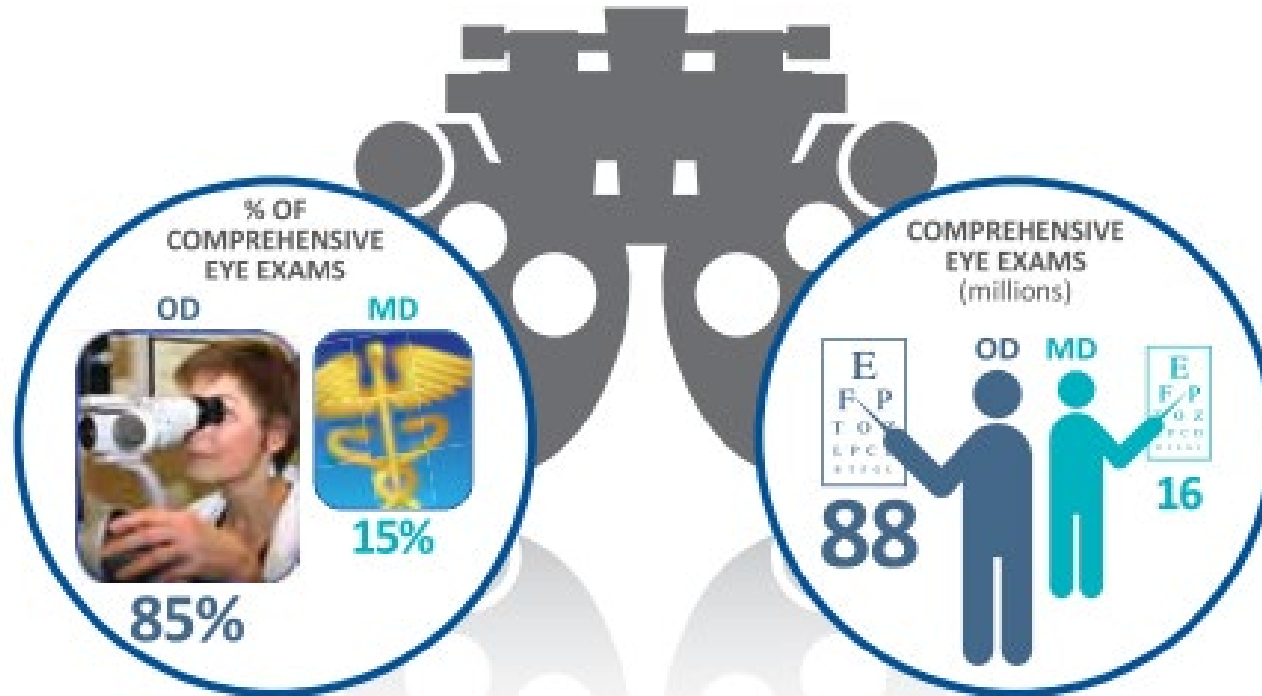
LASER CATARA [Ask Us a Question](#)

What do ODs Do?

ODS BY PRIMARY PRACTICE SETTING		
	NUMBER	%
INDEPENDENT PRACTICE	22,800	57%
OPTICAL CHAIN AFFILIATION	9,600	24%
OPHTHALMOLOGY PRACTICE	3,300	8%
OTHER MEDICAL	2,000	5%
GOVERNMENT	1,900	5%
OTHER	400	1%
TOTAL	40,000	

Source: AOA

WHAT DO ODs DO?



Source: PAA estimates

Note: OD exams include those performed by ODs working in ophthalmology practices.

OD's prescribe at least 90% of vision correction devices¹



¹State of the Optometric Profession 2013: https://www.aoa.org/Documents/news/state_of_optometry.pdf

Traditionally...



KEY MARKET TRENDS: GROWING ADOPTION OF REFRACTIVE SURGERY

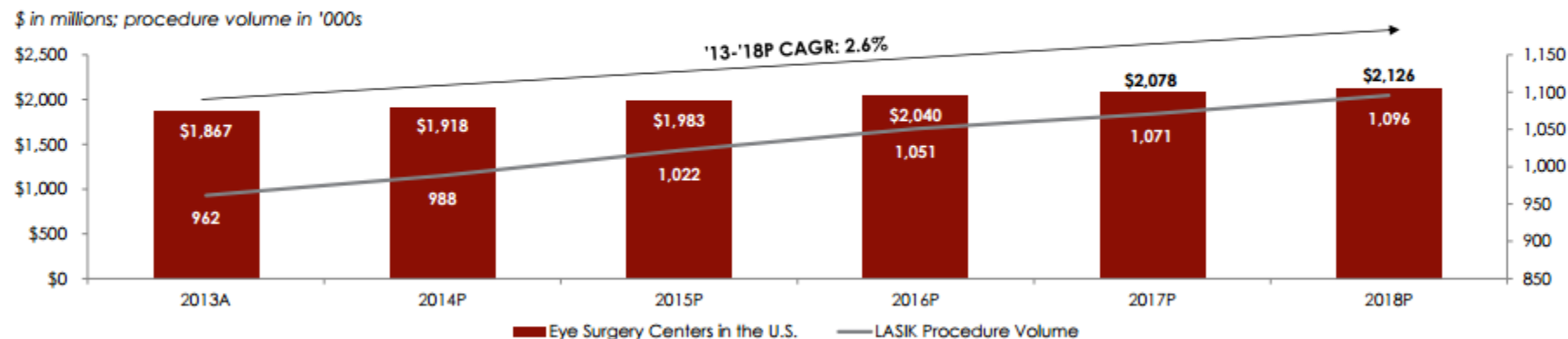
Vision correction surgery will continue to serve as only a mild demand deterrent for traditional vision care services as some potential patients are removed from the population.

U.S. VISION CORRECTION SURGERY OVERVIEW

- The maturation of refractive surgery has not dramatically impacted demand for eye exams or corrective devices.
- Potential refractive surgery market size of 10+ million individuals;¹ expected to grow 2.6% annually to \$2.1 billion by 2018.
- Corrective eye surgery (i.e. LASIK) is removing 500K patients annually from the 150 million vision correction population.
 - Surgery volume to increase as quality improves and price continues to decrease (19 million LASIK surgeries through 2012 in the U.S.)
 - Consumers beginning to view refractive surgery as a safe and reliable procedure to address their refractive errors
 - Ophthalmologists continue to experience steady business growth
- Growing popularity of corrective eye surgery would lead to higher patient pre/post-operative care volume for optometrists.
- Optometrists currently seeking to expand scope of service to include vision correction surgery.

0.33%

U.S. VISION CORRECTION SURGERY INDUSTRY GROWTH^{2,3}



Online sales

How good are online sales??

- A recent AOA study¹ had 10 individuals order 20 pairs of glasses (2 from each of the 10 most popular retailers)
- 154 of 200 pairs were actually received
- 44.8% had incorrect prescriptions or safety issues
- 29% of children's lenses failed impact testing

¹https://www.aoa.org/documents/public/A_Closer_Look_at_Ordering_Eyeglasses_Online.pdf



Patient came into the office after buying bifocals online. CC: reading is fine but distance is blurry therefore I got the Rx wrong...



[Redacted name]

and 1.4K others

147 Comments

Online sales

Zenni Optical has about 50% market share in online eyeglass sales.

- In 2017 the company sold 4 million pairs of Rx glasses with a total revenue of \$176 million¹

In 2019, 9.3% of Prescription eyewear was sold online⁵ (up from ~4.2% in 2017)

Online eyewear is expected to hit \$505.4 million by 2025 and continue to grow³

¹Kestenbaum, R. "Buying Glasses Online is Becoming the Norm"; 4.24.18;

Accessed 3.7.19 <https://www.forbes.com/sites/richardkestenbaum/2018/04/24/online-eyeglasses-has-explosive-growth-ahead-of-it/#58ac443627c8>

² <https://www.statista.com/statistics/256799/percentage-of-eyewear-sold-online-in-the-us-by-type>

³<https://www.prnewswire.com/news-releases/us-online-eyewear-market-size-worth-usd-5054-million-by-2025-hexa-research-678739483.html>

Eyewear Market Size, Share & Trends Analysis Report By Product (Contact Lenses, Spectacles, Sunglasses), By Distribution Channel, By Region, And Segment Forecasts, 2022 - 2030

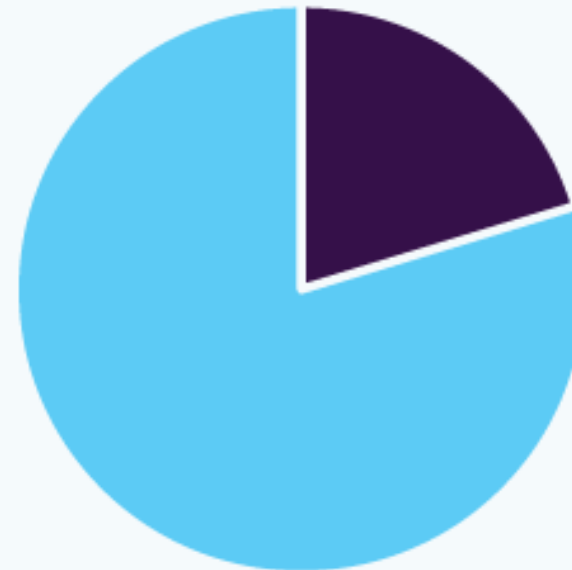
•Report ID: 978-1-68038-018-7

PDF

Market
Analysis
Report

Global Eyewear Market

share, by distribution channel, 2021 (%)



● E-Commerce ● Brick & Mortar



GRAND VIEW RESEARCH

\$157.9B

Global Market Size,
2021

Source:
www.grandviewresearch.com

Competition from elsewhere?

Wow, Essilor. Calling it a "vision correction number" instead of a "prescription?" Let's all work to de-emphasize the doctor's role in the process. Sleep number, vision correction number... what's the difference? Just go buy whatever the heck you or your favorite website think you need.

and 27 others

19 Comments

VSP.....YOU PIECE OF SHIT

How dare you form partnerships with us (Private Practice) to service clients and then blanket them with ICONIC emails to double dip and steal market share from the very ones you were created by. Come out and defend this you sleazy rats!!!!

When Patients asked me what vision plans were the best I would say VSP had the best options, not anymore. Change your tactics because we can and will slowly destroy you!!!!

#shotsfired

and 236 others

140 Comments

Like Comment

I saw this ad in the Santa Barbara Sentinel... good luck with that...

BETTER VISION...AREN'T YOU WORTH IT?

New treatment for degenerative eye diseases in SBI
Non-Surgical intervention now available at
Healing Heart Herbs & Acupuncture

Treated Conditions Include:

- Dry Eyes
- Diabetic Retinopathy
- Floaters
- Retinitis Pigmentosa
- Glaucoma
- Macular Degeneration

How It Works:
Unique points on hands & feet are stimulated with acupuncture to stimulate the brain to send more blood flow via optic nerve to feed nutrients and oxygen to the eye. This stimulates dormant eye cells to wake up and become active again.

"After third treatment, noticed blind spot in lateral vision was greatly diminished."

Call 805-450-2891
for more details and to schedule

BEST ACUPUNCTURIST **healingheart** **BEST HOLISTIC PRACTITIONER**

The surprising truth...

**Optometrists supply 85% of the US with their
comprehensive eye care**

BUT...

**Only about 20% of refractive surgery patients are referred
by optometrists**

~~Referrals~~

~~Comanagement~~

Collaborative Care

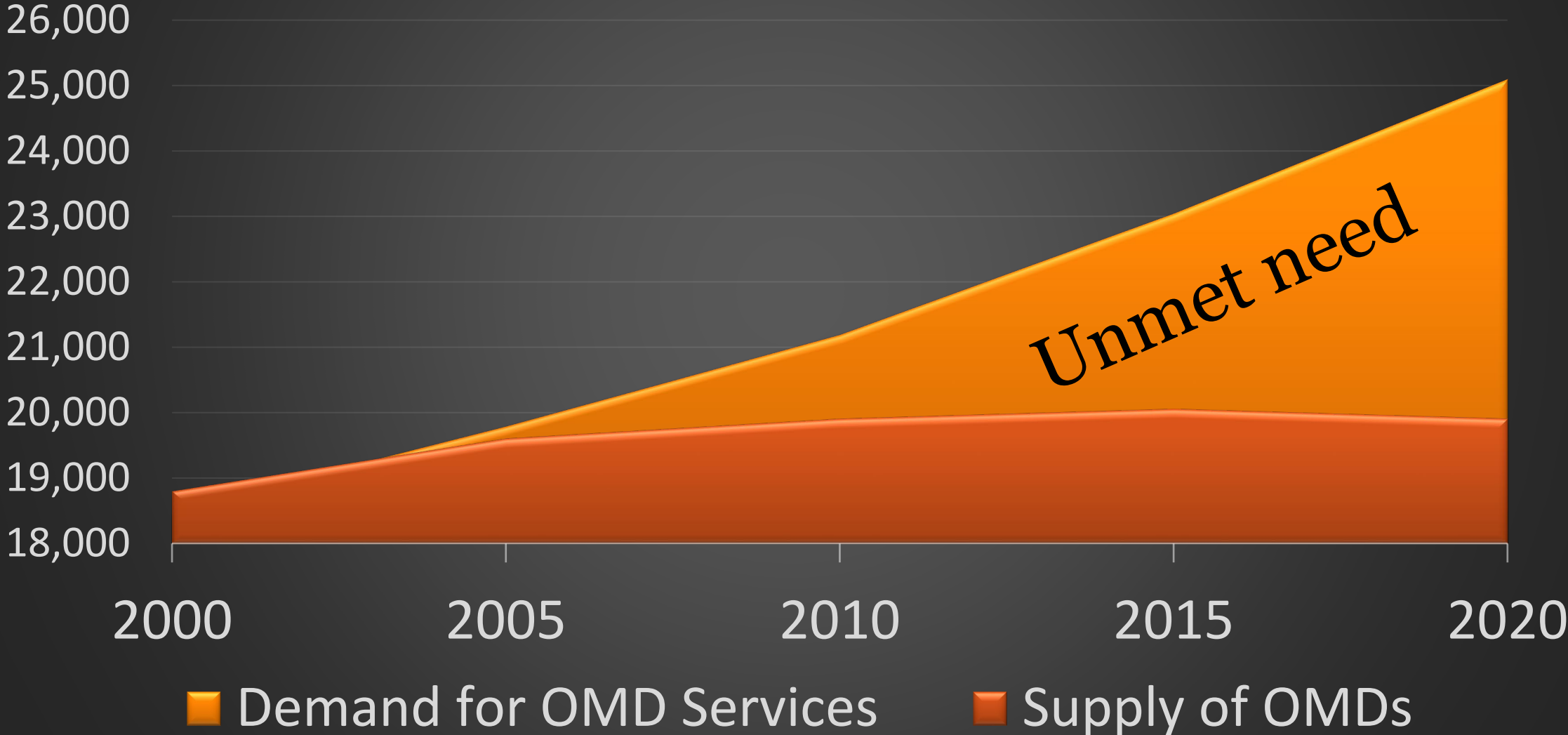
Participating in collaborative care is good for you, for the profession and most importantly for the patient.

The patient benefits most of all when everyone works as a peri-operative team

The current retail climate offers a huge opportunity for optometry to be involved in medical eye care

“There is no more profitable use of my time than comanaging a LASIK patient”

Supply and Demand of Ophthalmological Services Through 2020¹



¹US Department of Health and Human Services Publication – Physician Supply Projections to 2020

What do ODs Do?

MEDICAL EYECARE SERVICES HAVE BECOME A LARGER SOURCE OF OD REVENUE, BUT MOST ODS HAVE NOT FULLY DEVELOPED THIS REVENUE SOURCE.



Source: PAA estimates

Note: Excludes visits to ODs in ophthalmology practices. Excludes follow-up visits related to vision correction devices.

Collaborative Care in Refractive
Surgery IS Medical Eyecare

Some patients are best served by refractive surgery

Contact Lens Abusers

First Responders

High Anisometropia

Military

High Refractive Errors

Athletes

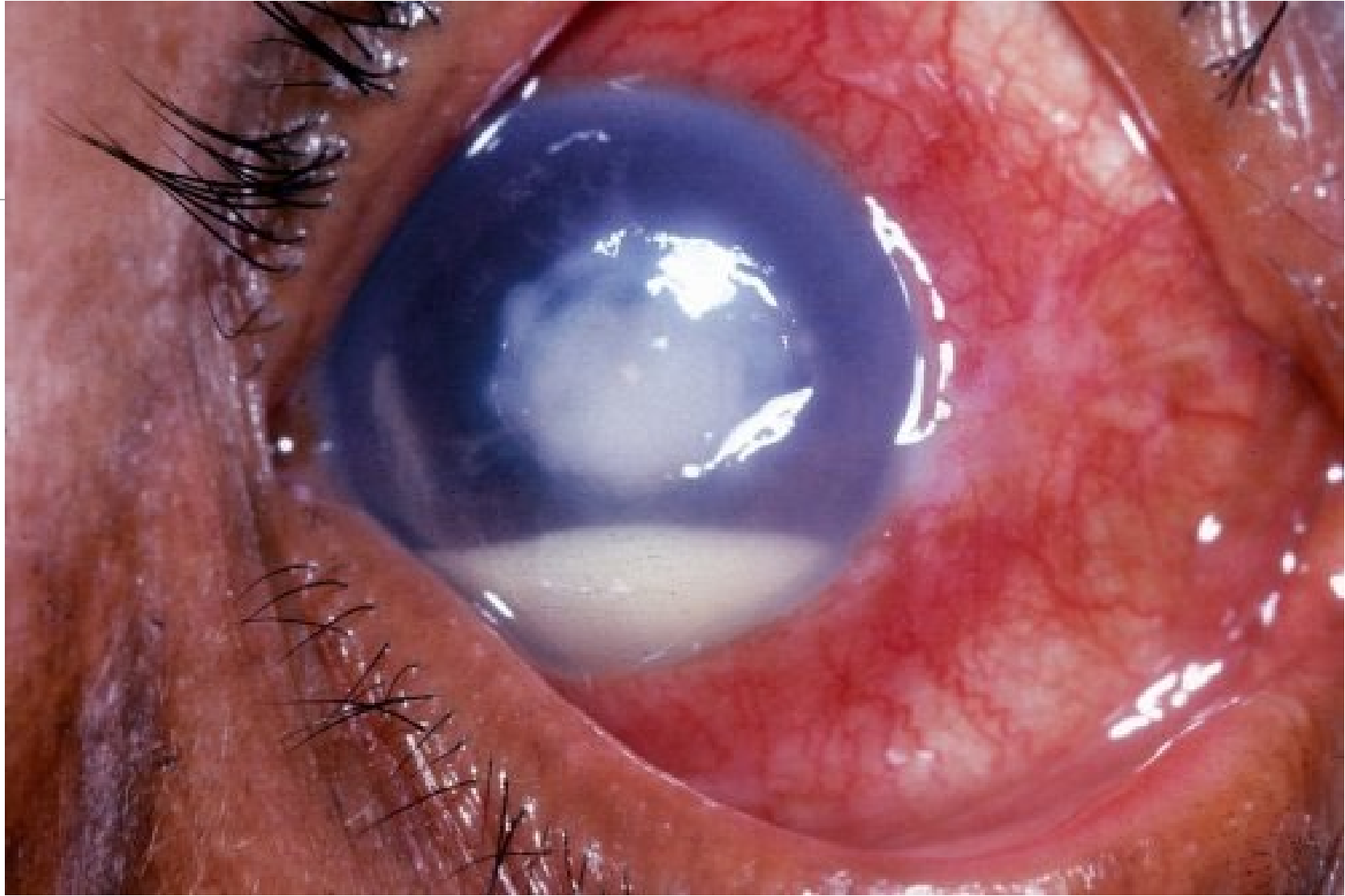
Physical Limitations

Metal Disability

Frequent Travelers

Let's consider the alternative prosthetic device





Risk for microbial keratitis: Comparative metaanalysis of contact lens wearers and post-laser in situ keratomileusis patients

Presented as a poster at the ASCRS Symposium on Cataract, IOL and Refractive Surgery, New Orleans, Louisiana, USA, May, 2016.

[Jordan Masters, MD](#), [Mehmet Kocak, PhD](#), [Aaron Waite, MD](#)

From the Department of Ophthalmology (Masters, Waite), Hamilton Eye Institute, and the Department of Preventive Medicine (Kocak), University of Tennessee Health Science Center, Memphis, Tennessee, USA



DOI: <http://dx.doi.org/10.1016/j.jcrs.2016.10.022> | CrossMark



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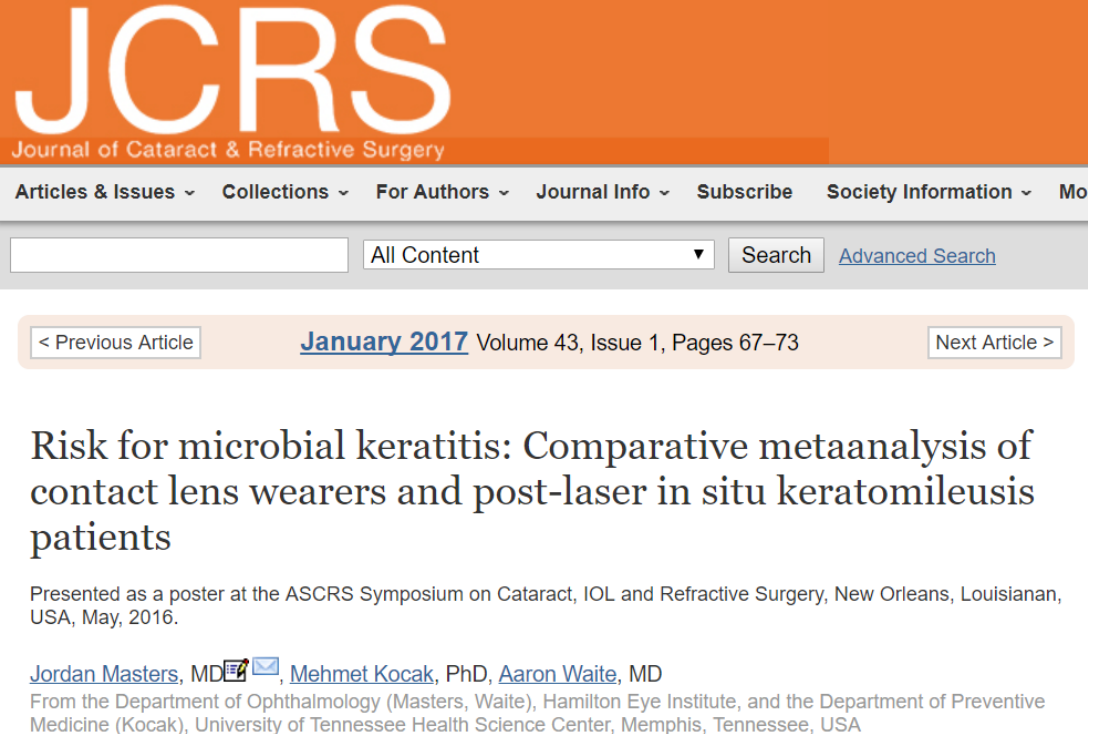
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The study showed that one year of using extended wear soft contacts led to considerably more cases of microbial keratitis than LASIK.

SAFETY: Lasik vs Contact Lens Infection Risk

Sight affecting corneal microbial infections are **10 times higher** in long term DWSCCL patients than after Lasik.

And **34 times higher** in EWSCCL patients than after Lasik.



JCRS
Journal of Cataract & Refractive Surgery


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< Previous Article [January 2017](#) Volume 43, Issue 1, Pages 67–73 Next Article >

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From the Department of Ophthalmology (Masters, Waite), Hamilton Eye Institute, and the Department of Preventive Medicine (Kocak), University of Tennessee Health Science Center, Memphis, Tennessee, USA

Prevalence of laser vision correction in ophthalmologists who perform refractive surgery



Guy M. Kezirian, MD, MBA, Gregory D. Parkhurst, MD,
Jason P. Brinton, MD, Richard A. Norden, MD

PURPOSE: To determine the prevalence of laser corneal refractive surgery (laser vision correction [LVC]) among ophthalmologists who perform these procedures and to assess the willingness of these ophthalmologists to recommend LVC to immediate family members.

SETTING: Online survey with results analyzed at Surgivision Consultants, Inc., Scottsdale, Arizona, USA.

DESIGN: Prospective randomized questionnaire study.

METHODS: The 22-question Global Survey on Refractive Surgery in Refractive Surgeons was sent by e-mail to 250 ophthalmologists randomly selected from a database of 2441 ophthalmologists known to have performed LVC at some point in the past decade. Responses were solicited by e-mail, with subsequent telephone reminders to nonresponders.

RESULTS: Responses were received from 248 (99.2%) of 250 queried individuals, of which 232 (92.8%) met the protocol criteria of currently working as refractive surgeons. Of the 232 subjects, 161 (69.4%) reported that they had refractive errors potentially amenable to treatment with LVC, not including presbyopia. Of the 161 ophthalmologists with treatable refractive errors, 54 (33.5%) reported they were not candidates for LVC for a variety of reasons and 107 (66.5%) reported they were candidates for LVC. Of the LVC candidates, 62.6% reported that they had an LVC procedure in their own eyes. Of the overall 232 subjects, more than 90% recommend LVC for adult members of their immediate family.

CONCLUSIONS: Ophthalmologists who perform LVC were significantly more likely than the general population to have LVC in their own eyes. The prevalence of refractive errors was significantly higher among ophthalmologists performing refractive surgery than in the general population.

Financial Disclosure: No author has a financial or proprietary interest in any material or method mentioned.

J Cataract Refract Surg 2015; 41:1826–1832 © 2015 ASCRS and ESCRS

Laser vision correction (LVC) has been available in the United States since the first excimer laser received U.S. Food and Drug Administration approval for photorefractive keratotomy (PRK) in 1995.¹ Reports of satisfaction with the procedure are high. Metaanalysis of the world's literature on laser in situ keratomileusis (LASIK)² suggests that satisfaction rates average 95.4% worldwide, ranging from 87.2% to 100%. Studies report similar rates of LVC acceptance rates among active-duty U.S. Navy aviators,³ physicians,⁴ astronauts,⁵ and individuals likely to be driving in mesopic and high-glare conditions.⁶

As of 2014, estimates put the number of patients who had LVC procedures at only 16.2 million in the United States, for an overall penetration rate of 13.1% of appropriate candidates.⁷ Reasons cited for low penetration range from general economic conditions to concerns about safety and the availability of alternate treatments for refractive errors. All these and other reasons may play a role.

Prior surveys have attempted to quantify the prevalence of LVC among members of the International Society of Refractive Surgery (ISRS)⁸ and suggest that approximately 40% of all refractive surgeons

Refractive Surgeons who were candidates for LVC are 4x more likely to have already undergone LVC

Is Infection Risk the Only Thing We should Consider Regarding Safety?

2 Main Side Effects The General Public Think of When They Hear the Word LASIK?

- Dry Eye
- Night Vision Disturbances

Modern Refractive Surgery: Where are our outcomes today?

CLINICAL TRIAL RESULTS



Patient Reported Outcomes – PROs

In refractive surgery we focus on objective measures to evaluate success

- Uncorrected vision / Best corrected vision
- Predictability / Stability
- Contrast sensitivity / aberrations

Patients care about how they see, not what we measure

Measuring success has to include PROs

5 Important Studies with PROs Using Modern Equipment (Patient Reported Outcomes) >3,000 Total Subjects

AMO iDesign Myopia/Astigmatism Studies

- 334 Subjects
- Sponsored by Abbott Medical Optics

Wavelight Topography Guided Myopia/Astigmatism Studies

- 212 Subjects
- Sponsored by Alcon/Novartis

PROWL Phase I and Phase II Studies

- PROWL I - 246 subjects PROWL 2 – 312 subjects
- Sponsored by FDA and NIH

ZEISS ReLEX[®] SMILE Procedure for the Correction of Myopia PMA Study

Three-year longitudinal survey comparing visual satisfaction with LASIK and contact lenses

- 1800 Subjects
- Independent, no funding from industry or government

AMO STAR S4 iDesign Advanced CustomVue Treatments for Myopia PMA Study

Study design: Prospective, non-randomized, multi center study for myopia with and without astigmatism

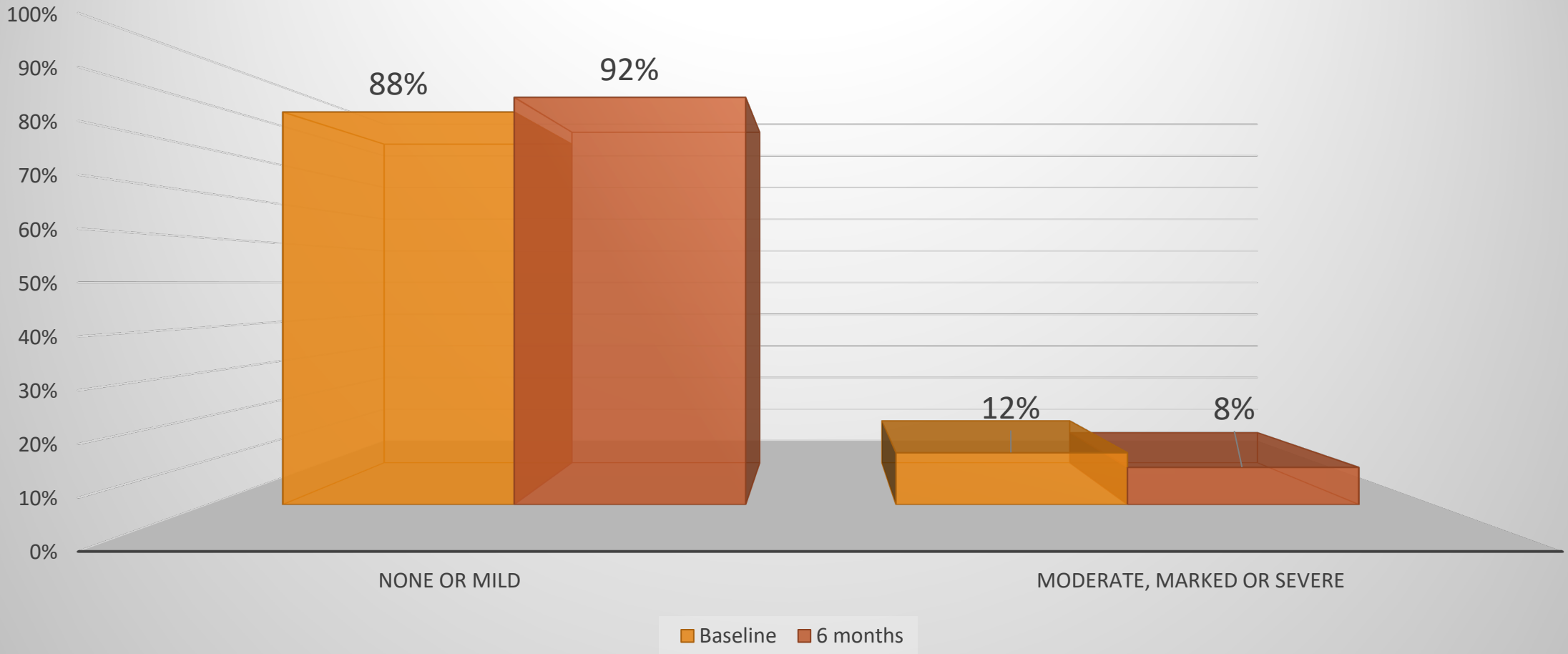
- 12 centers
- 334 eyes
- 12 month follow up
- No enhancements
- Self administrated patient symptom questionnaire

Data source: FDA Website

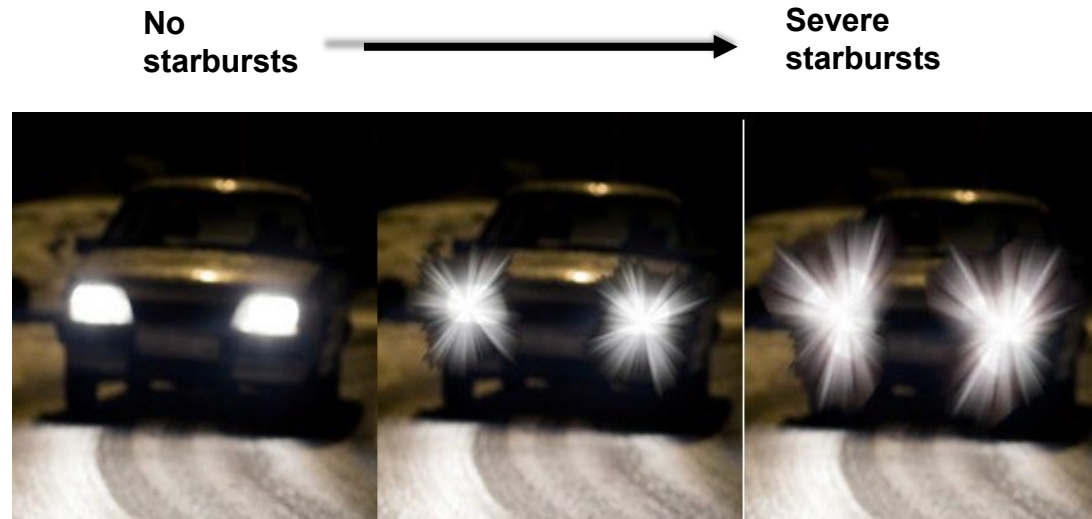
Courtesy: Dan Durrie MD

AMO iDesign FDA Study

Patient Reported Dryness



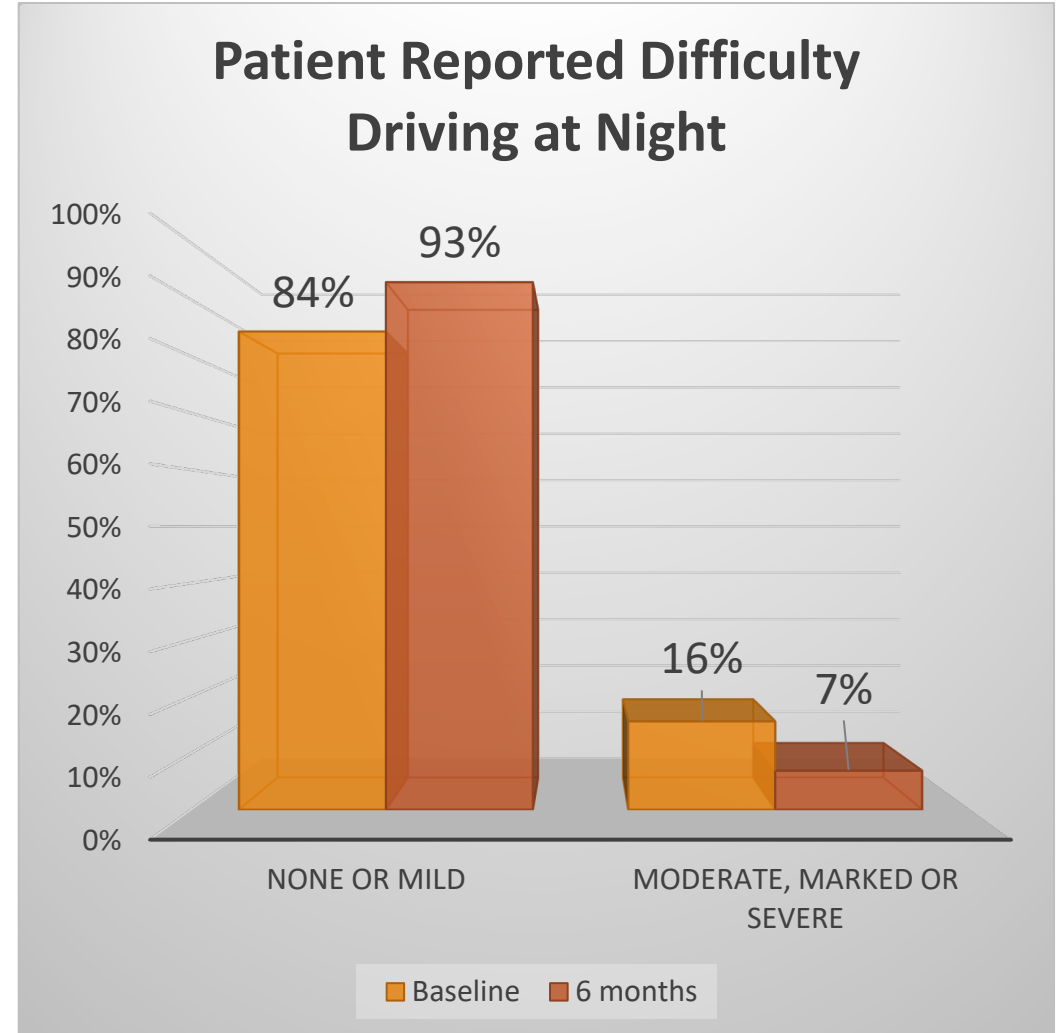
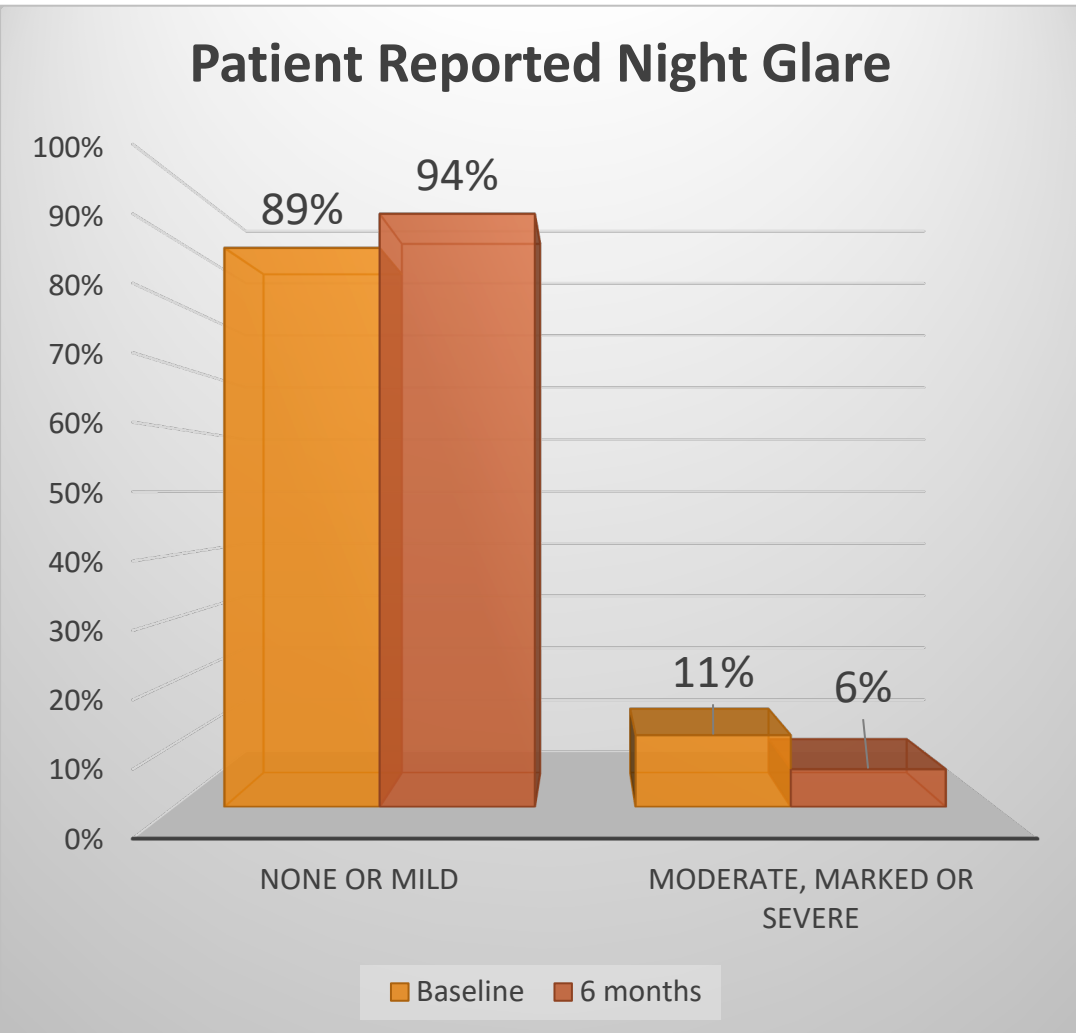
Example of Visual Aberration



In the last 7 days, have you seen any **starbursts**?

1. Yes, but ONLY when NOT wearing glasses or contact lenses
2. Yes, but ONLY when wearing glasses or contact lenses
3. Yes, when wearing AND when not wearing glasses or contact lenses
4. No, not at all

AMO iDesign FDA Study



Wavelight Wave Eye-Q Topography Guided Treatments

Study design: Prospective, non-randomized, multi center study for myopia with and without astigmatism

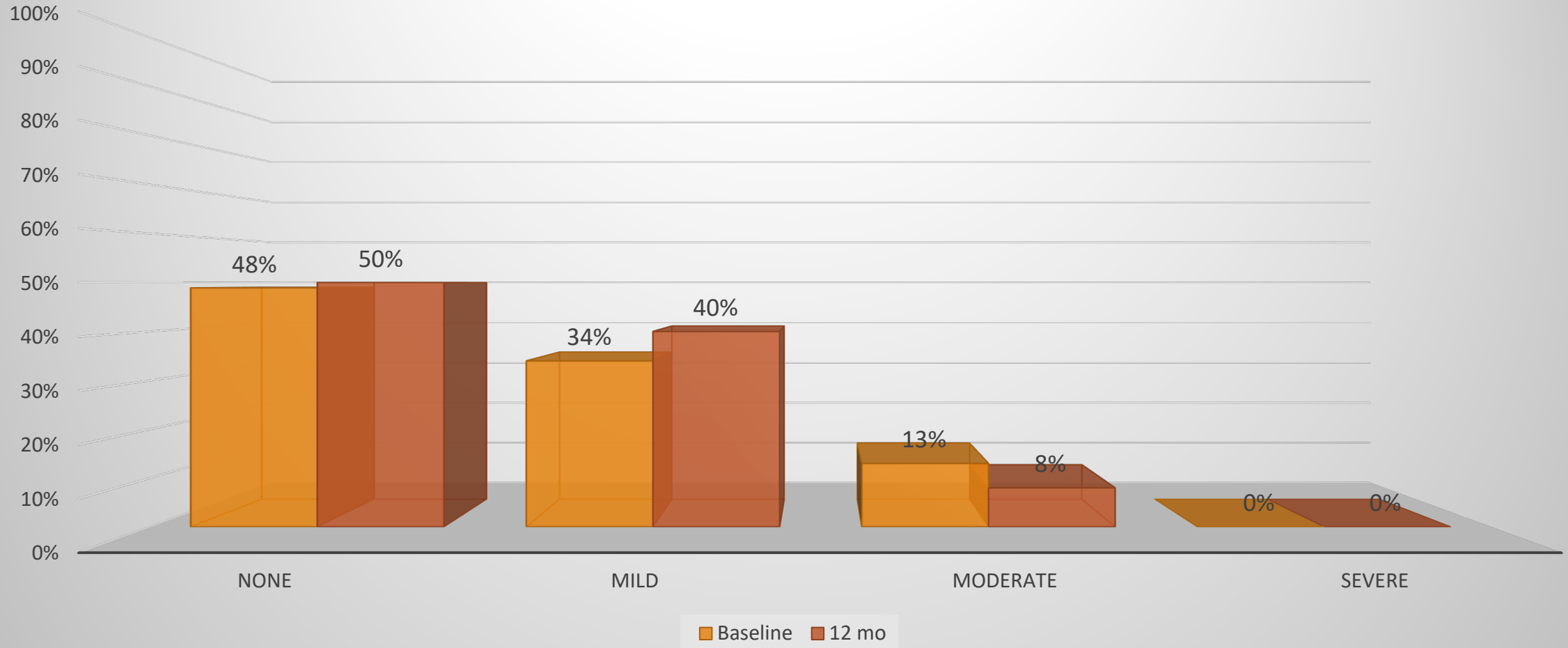
- 9 centers
- 249 eyes
- 12 month follow up
- No enhancements
- Self administered patient symptom questionnaire

Data source: FDA Website

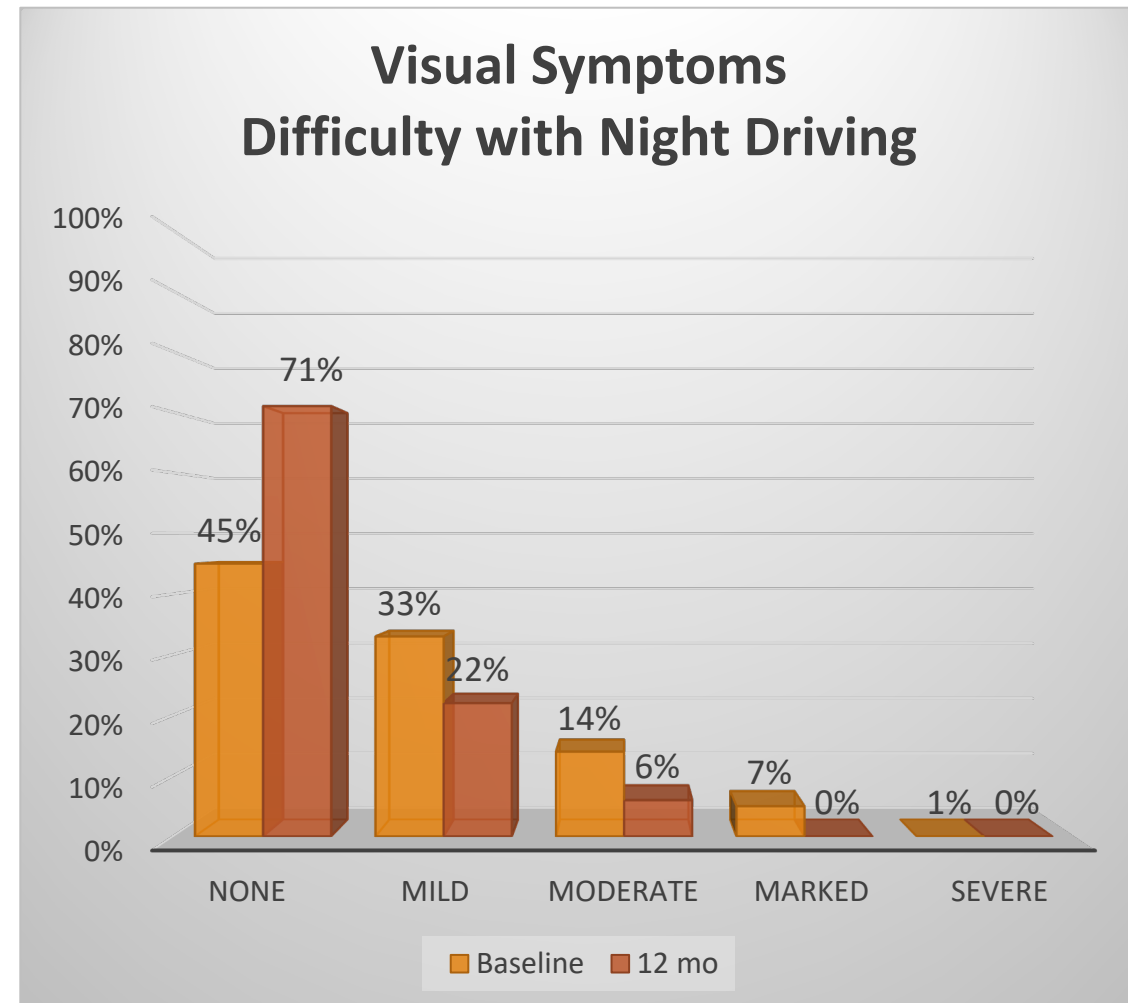
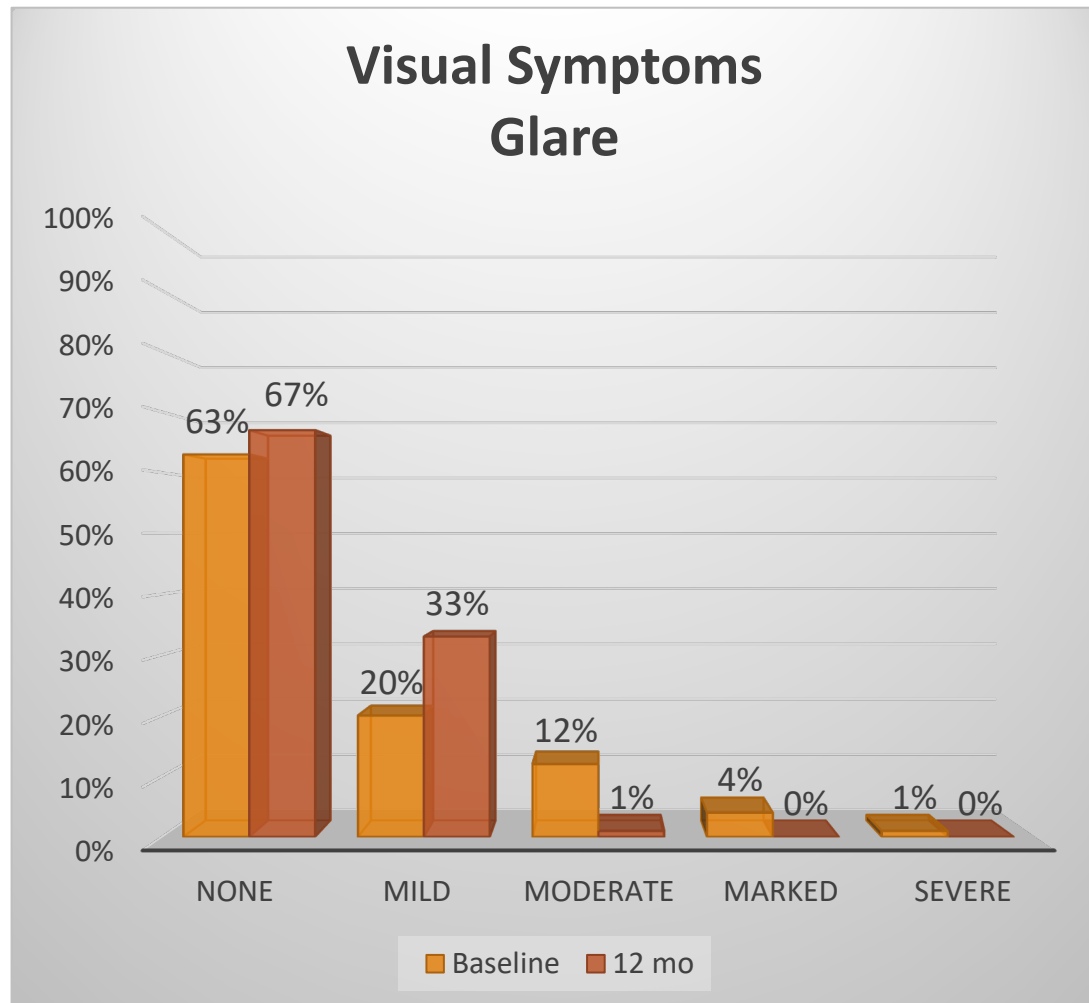
Courtesy: Dan Durrie MD

Wavelight Topoguided FDA Study

Patient Reported Dryness



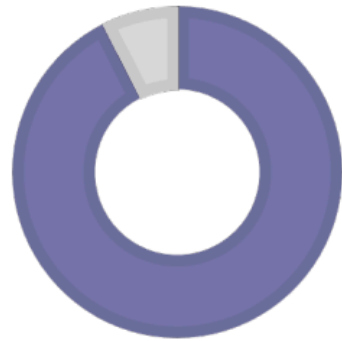
Wavelight Topoguided FDA Study



Redefining Quality of Vision



- 1 20/200
- 2 20/100
- 3 20/70
- 4 20/50
- 5 20/40
- 6 20/30
- 7 20/25
- 8 **20/20**
- 9 **20/16**
- 10 **20/12.5**



92.6%

20/20 UCVA*



64.8%

20/16 UCVA*



34.4%

20/12.5 UCVA*

Reference: 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;42(1):11-18. Study description: Prospective, nonrandomized, multicenter study of 249 eyes with myopia (up to -9D) or myopic astigmatism of 6.0 D or less. Outcome measures included manifest refraction, UDVA, CDVA and visual symptoms up to 12 months.

Benefits of CONTOURA[®] Vision Treatments

CONTOURA[®] Vision helps to alleviate many of the visual symptoms associated with glasses and contact lenses.



Light
sensitivity
5.2% decrease



Difficulty driving
at night
8% decrease



Difficulty
reading
8.7% decrease



Glare
complaints
4.8% decrease



Starbursts
in vision
2.8% decrease



Halos
in vision
3.2% decrease

SMILE

SMALL INCISION LENTICULE EXTRACTION





From the FDA...

The VisuMax Femtosecond Laser is indicated for use in the SMILE procedure for the reduction or elimination of nearsightedness with or without astigmatism in patients who are **22 years of age or older** and has:

nearsightedness of **-1.00 to -10.00** diopter in power,

astigmatism of **-0.75 to -3.00** diopter in power,

a maximum of total prescription (nearsightedness plus half of the astigmatism) of no more than -10.00 diopters in power; and

stable nearsightedness and astigmatism that has changed by no more than 0.50 diopter in power in the year before surgery

SMILE



FIGURE 1 After being separated from the stromal cap and from the stromal bed, the lenticule is extracted with forceps via a 2.25-mm incision. (Photo courtesy of Dan Z. Reinstein, MD.)

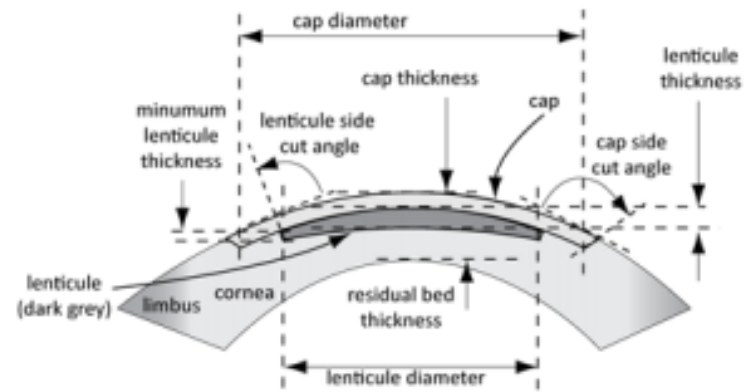


Figure 2. Schematic depiction of cut geometry for the SMILE procedure performed with the VisuMax Femtosecond Laser

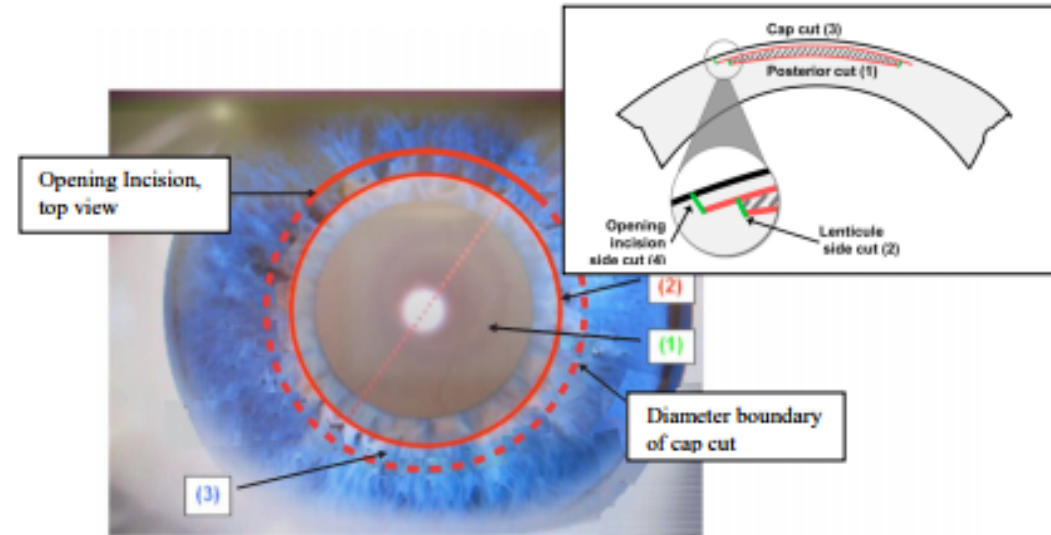
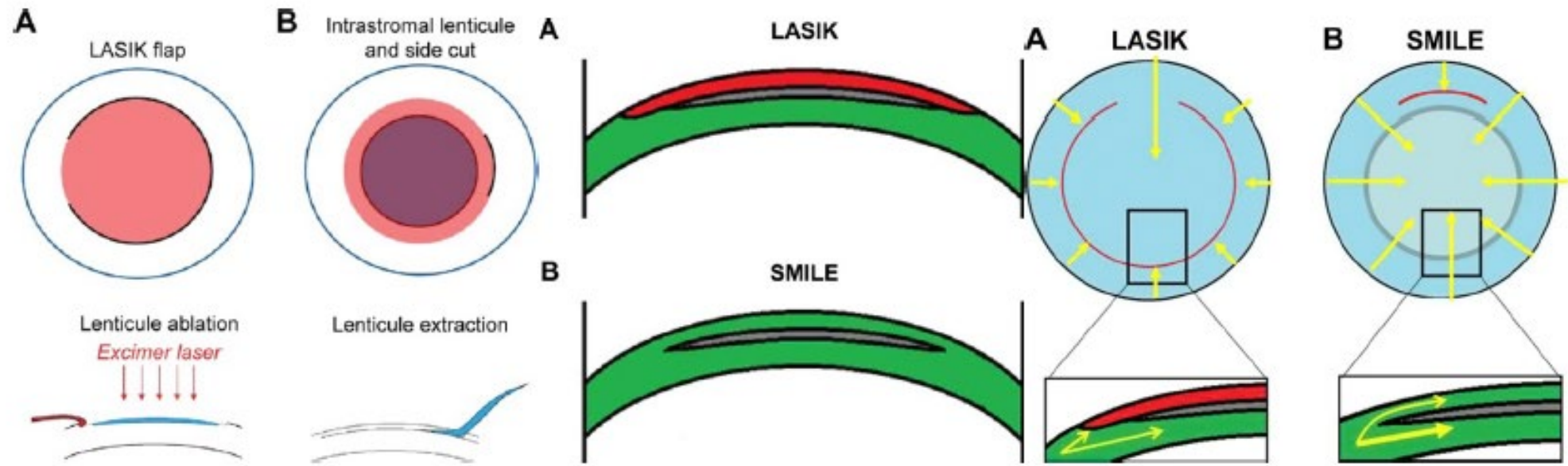


Figure 3. Planning view from VisuMax Femtosecond Laser graphical user interface (GUI) of a SMILE procedure (left graphic) and schematic of lenticule and attached cap cuts (top right graphic).

The number labels (1-4) depict the planned cuts. These cuts are:

- (1) Lenticule posterior surface cut (horizontal plane)
- (2) Lenticule side cut (vertical plane)
- (3) Lenticule anterior surface cut/cap cut (horizontal plane)
- (4) Opening incision side cut (vertical plane)

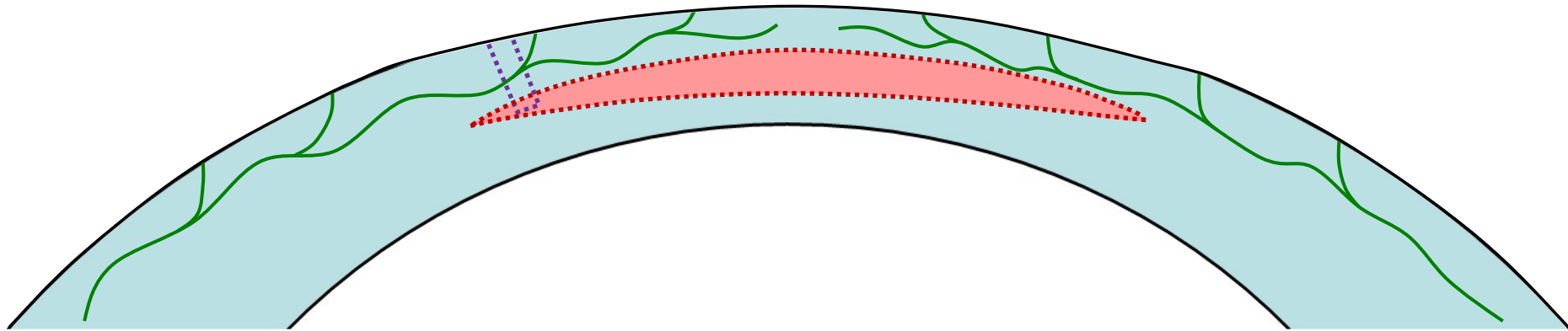
SMILE



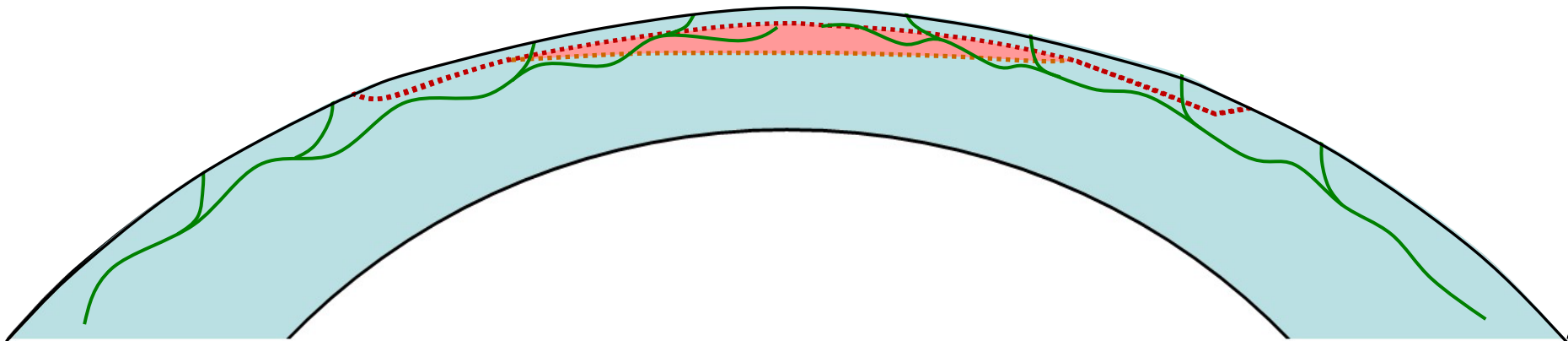
Comparison of LASIK and SMILE

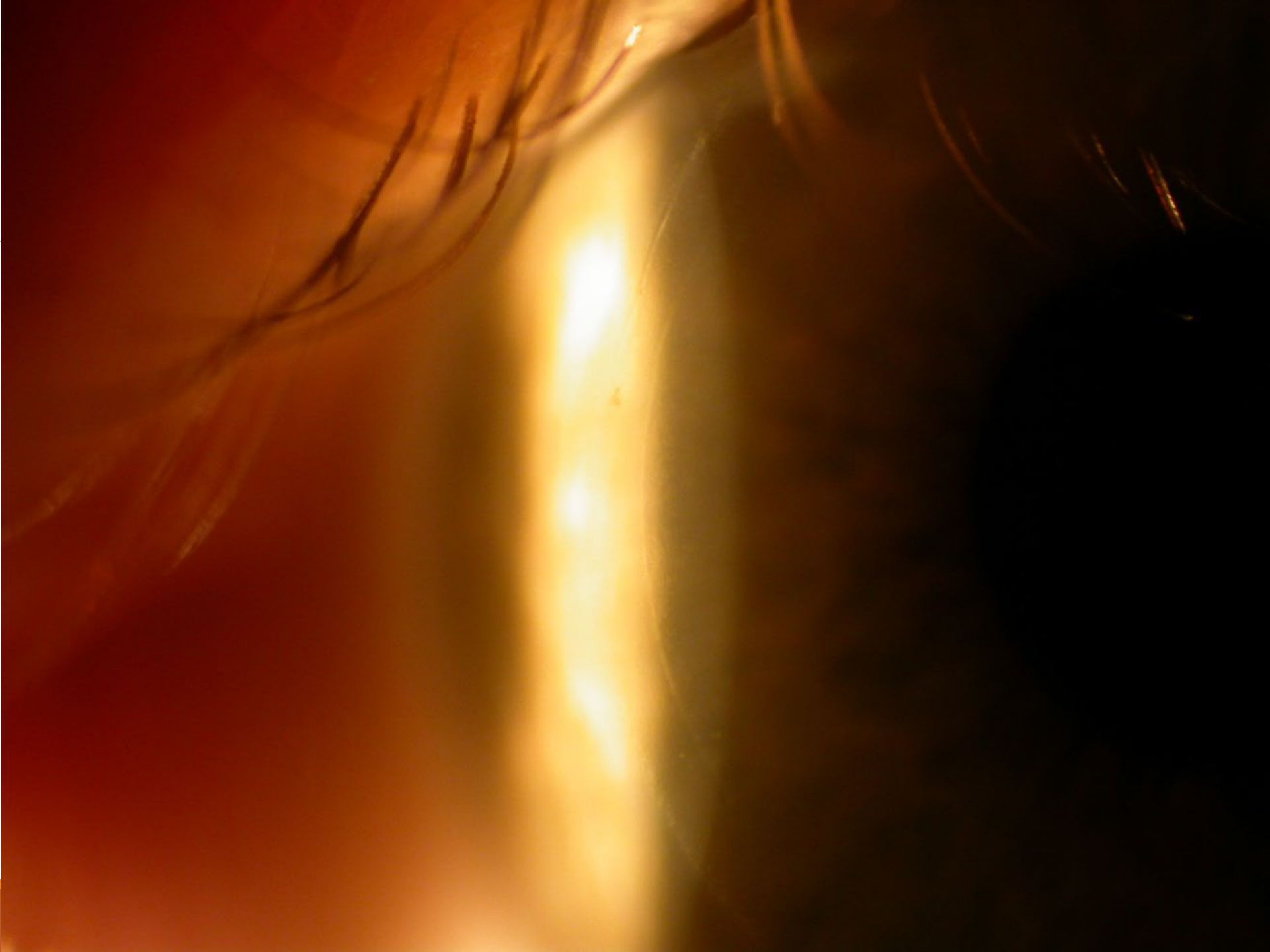
More Corneal Sensation & Less Dry Eyes

SMILE

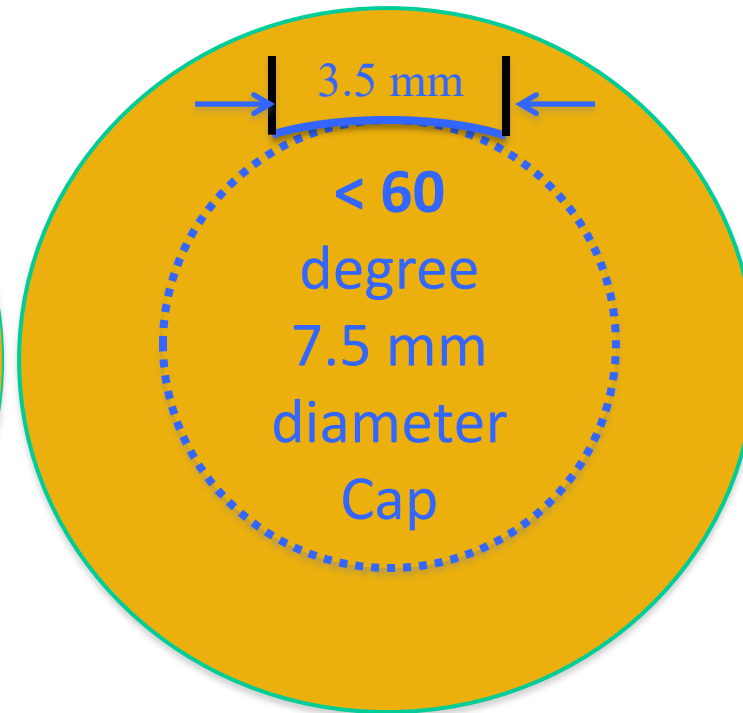
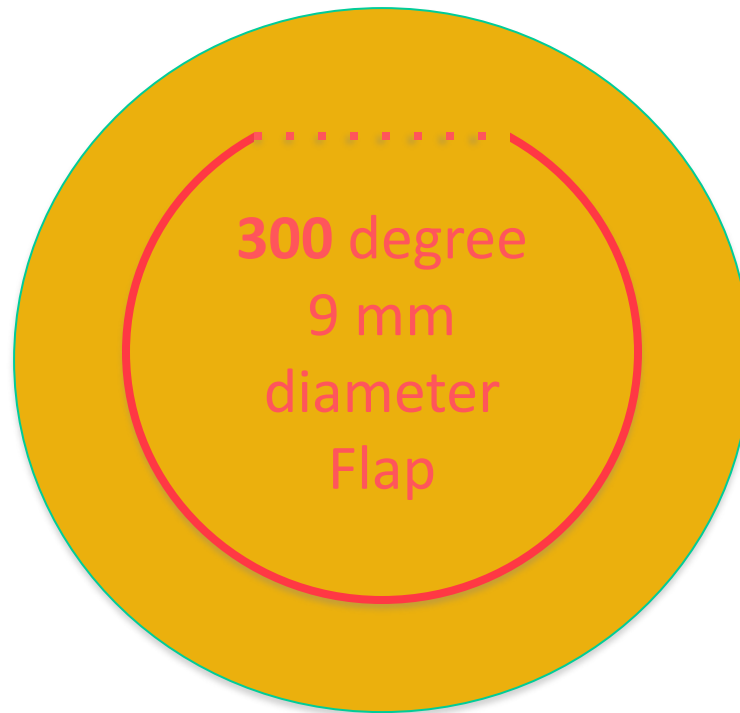
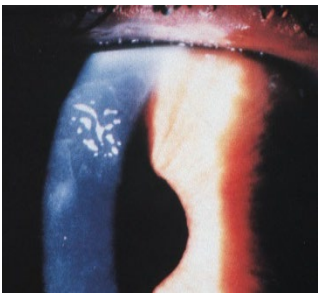
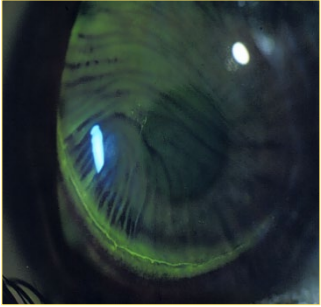


LASIK





Flap Risks/ Complications



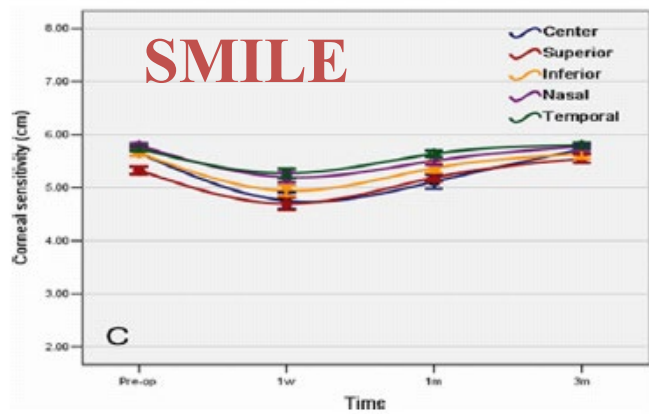
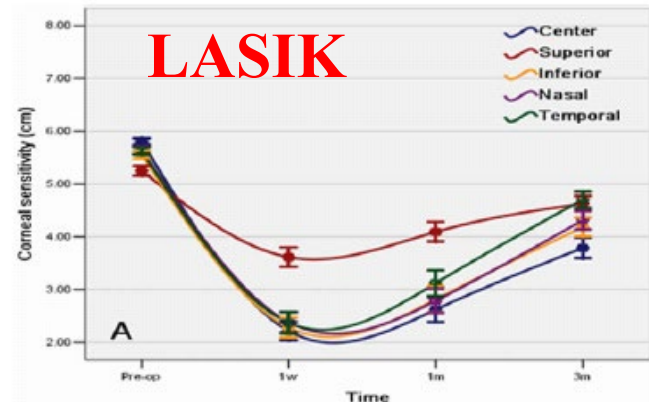
Greater risk of Striae, Ingrowth or Trauma?

Dry Eyes/Neurotrophic Surface

Comparison of corneal sensitivity between FS-LASIK and femtosecond lenticule extraction (ReLEx flex) or small-incision lenticule extraction (ReLEx smile) for myopic eyes

Shengsheng Wei · Yan Wang

Graefes Arch Clin Exp Ophthalmol (2013) 251:1645–1654



Subbasal nerve morphology, corneal sensation, and tear film evaluation after refractive femtosecond laser lenticule extraction

Anders H. Vestergaard · Keca T. Grønbech ·
Jakob Grauslund · Anders R. Ivarsen ·
Jesper Ø. Hjortdal

Graefes Arch Clin Exp Ophthalmol DOI 10.1007/s00417-013-2400-x

6 months post-op after FLEX and SMILE

Corneal sensation change using the Cochet-Bonnet esthesiometer


- 0.38 cm
- SMILE: 0.10 cm
- $p < 0.01$

Greater reduction in corneal sensation with a flap

Retrospective diagnosis of naked eye visual acuity (UCVA) variations in patients with refractive errors treated with SMILE, LASIK, and WF-LASIK refractive surgery

Juan Wu 

Received 07 Mar 2023, Accepted 29 Mar 2023, Published online: 11 Apr 2023

 Download citation <https://doi.org/10.1080/02648725.2023.2199230> Full Article Figures & data References Citations Metrics Reprints & Permissions[Get access](#)

ABSTRACT

A retrospective assessment of the visual acuity (UCVA) variations in bare eyes of the refractive error cases treated with SMILE, LASIK and WF-LASIK. A retrospective selection of 126 patients with refractive error treated by refractive surgery admitted to our hospital between January 2019 and December 2021 were divided into three separate sets of patients according to their surgical methods: the SMILE cohort, the LASIK cohort, and the WF-LASIK cohort, and the three sets of patients were analyzed for bare eye visual acuity, refraction, higher-order aberration, BUT, Sit index, and complications, and the recovery effects of patients with the three surgical procedures. All three types of refractive surgery, SMILE, LASIK and WF-LASIK, can yield good surgical results in the reduction of refractive error, and patients with SMILE have better postoperative tear film stability, while patients with WF-LASIK have the best postoperative visual quality.

Q KEYWORDS: [Excimer laser in situ keratomileusis](#) [wavefront aberration guidance](#)
[femtosecond laser small incision corneal stromal lens removal](#) [refractive error](#)

Results



Cumulative Post-Operative Day 1 Uncorrected Visual Acuity



Low
Energy
SMILE

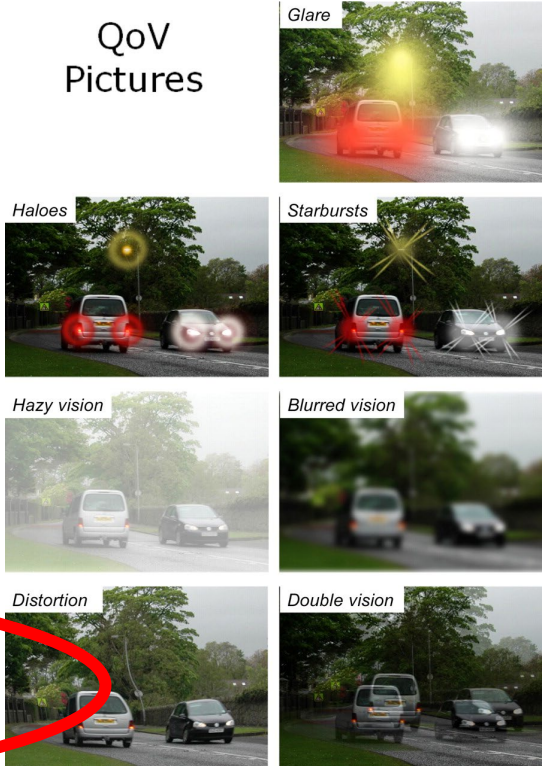
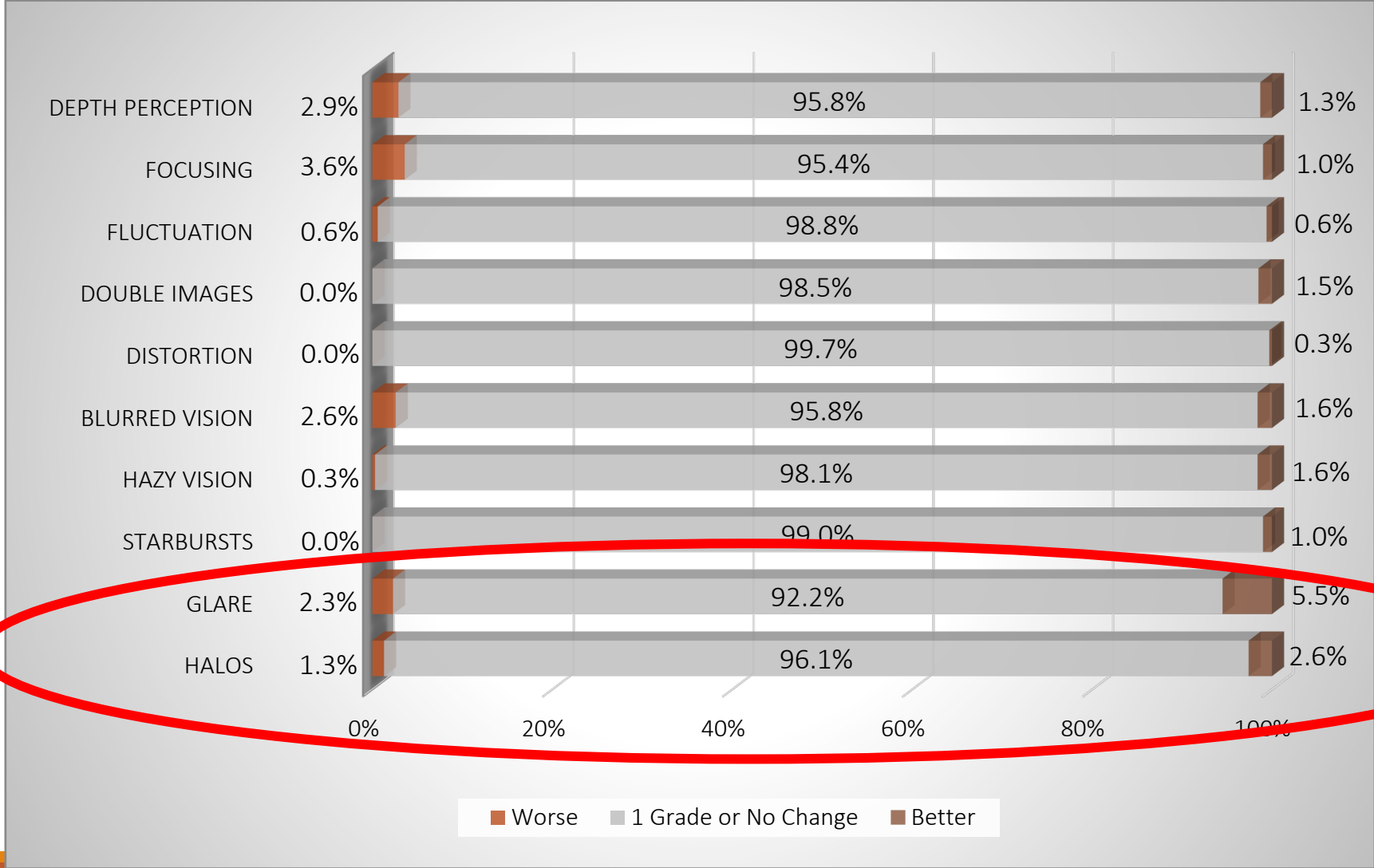
ZEISS ReLEx[®] SMILE Procedure for the Correction of Myopia PMA Study

Study design: Prospective, multi-center, open-label, single-arm study

- 5 U.S. centers
- 357 subjects treated
- Unilateral treatment with 12-month follow-up
- No enhancements
- Self-administrated patient symptom questionnaire

Data source: FDA Website

Changes of 2 or More Grades in QoV Symptoms at 12 Months



Satisfied with SMILE?

Response	Month 6 n=329		Month 12* n=309	
	n	%	n	%
Very Satisfied	292	89%	286	93%
Moderately Satisfied	30	9%	18	6%
Neutral	4	1%	2	<1%
Dissatisfied	2	<1%	3	1%
Very Dissatisfied	1	<1%	0	0%

* n=2 at Month 12 not reported

PROWL Studies

Symptoms and Satisfaction in the LASIK Quality of Life Collaboration Project

Objective: To evaluate patient-reported outcomes of visual symptoms, dry eye symptoms, satisfaction with vision and satisfaction with LASIK surgery

Design: The PROWL studies were prospective, post-market, observational studies designed to develop and evaluate a PRO questionnaire for use post-LASIK

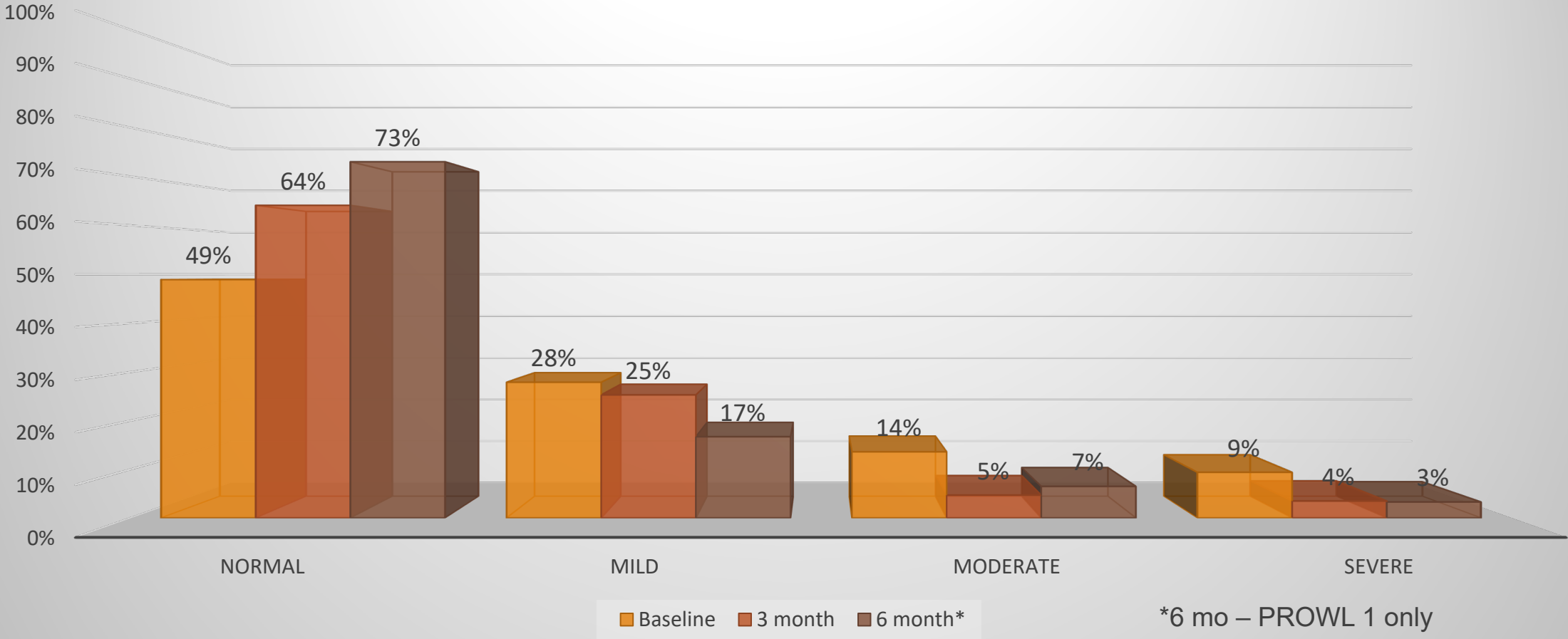
Participants:

- PROWL 1: 262 active duty service personnel
- PROWL 2: 312 civilians in 5 centers

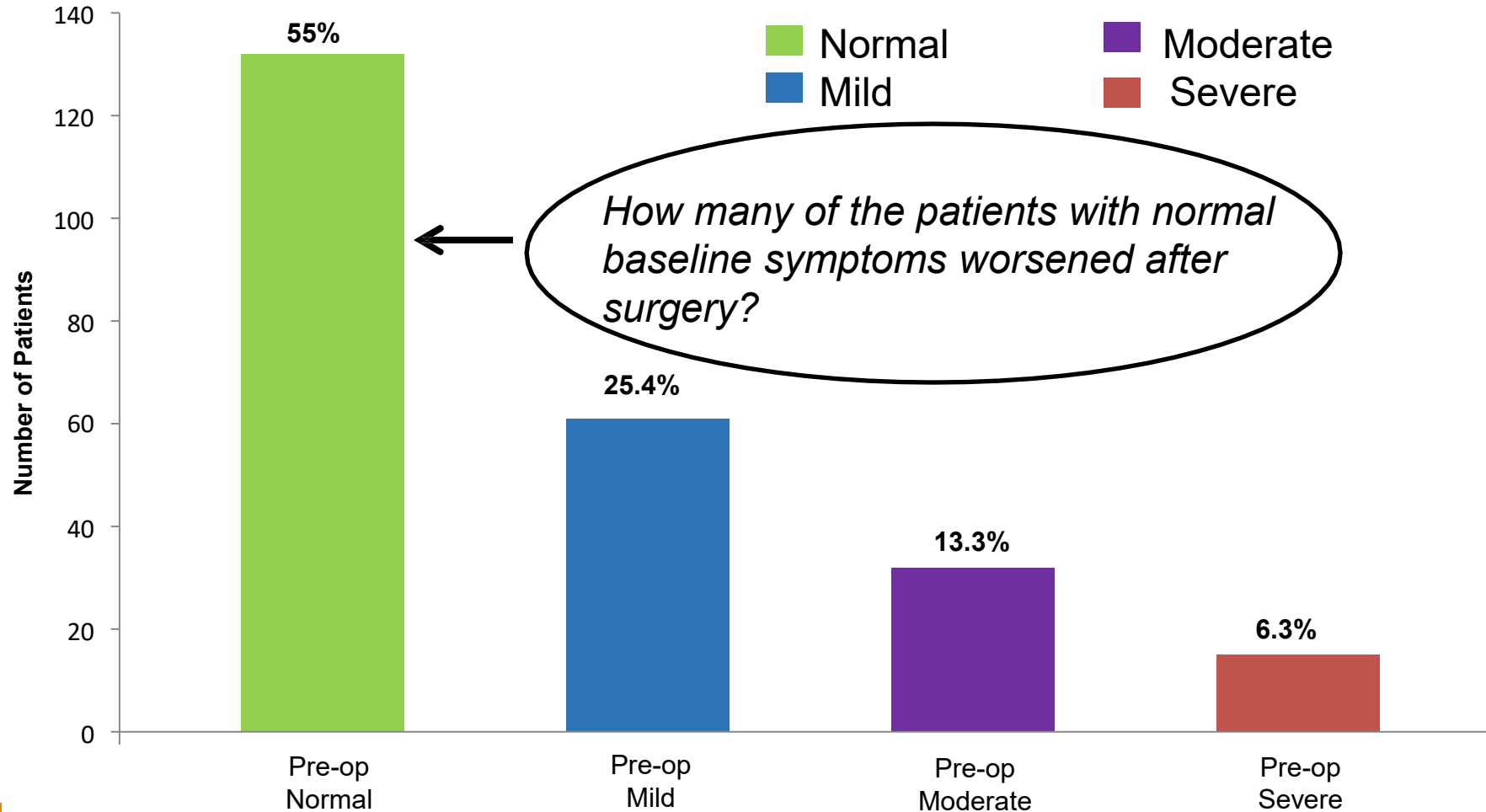
On line questionnaire

PROWL Dry Eye Symptoms - OSDI

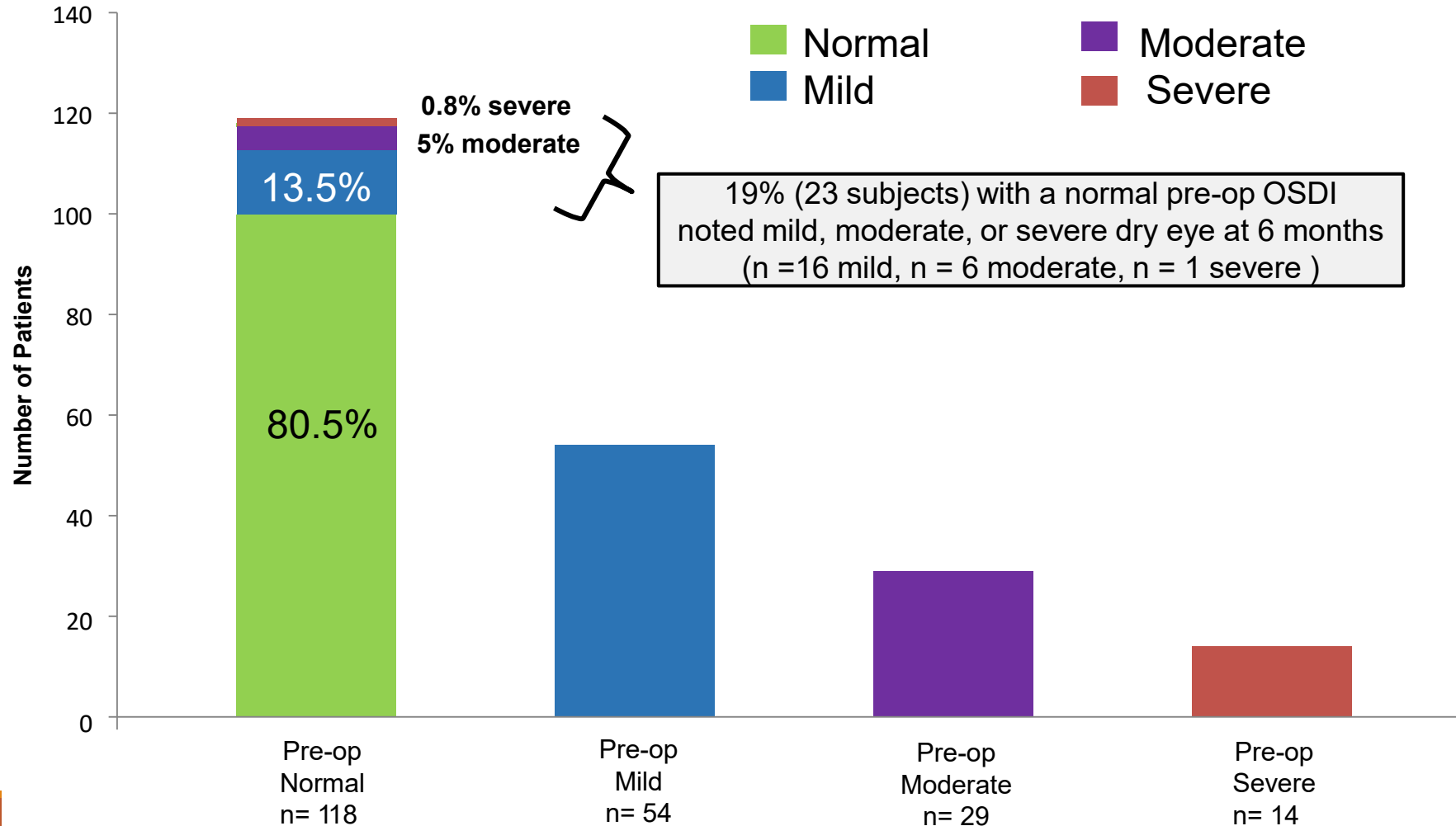
PROWL 1 & 2 Combined



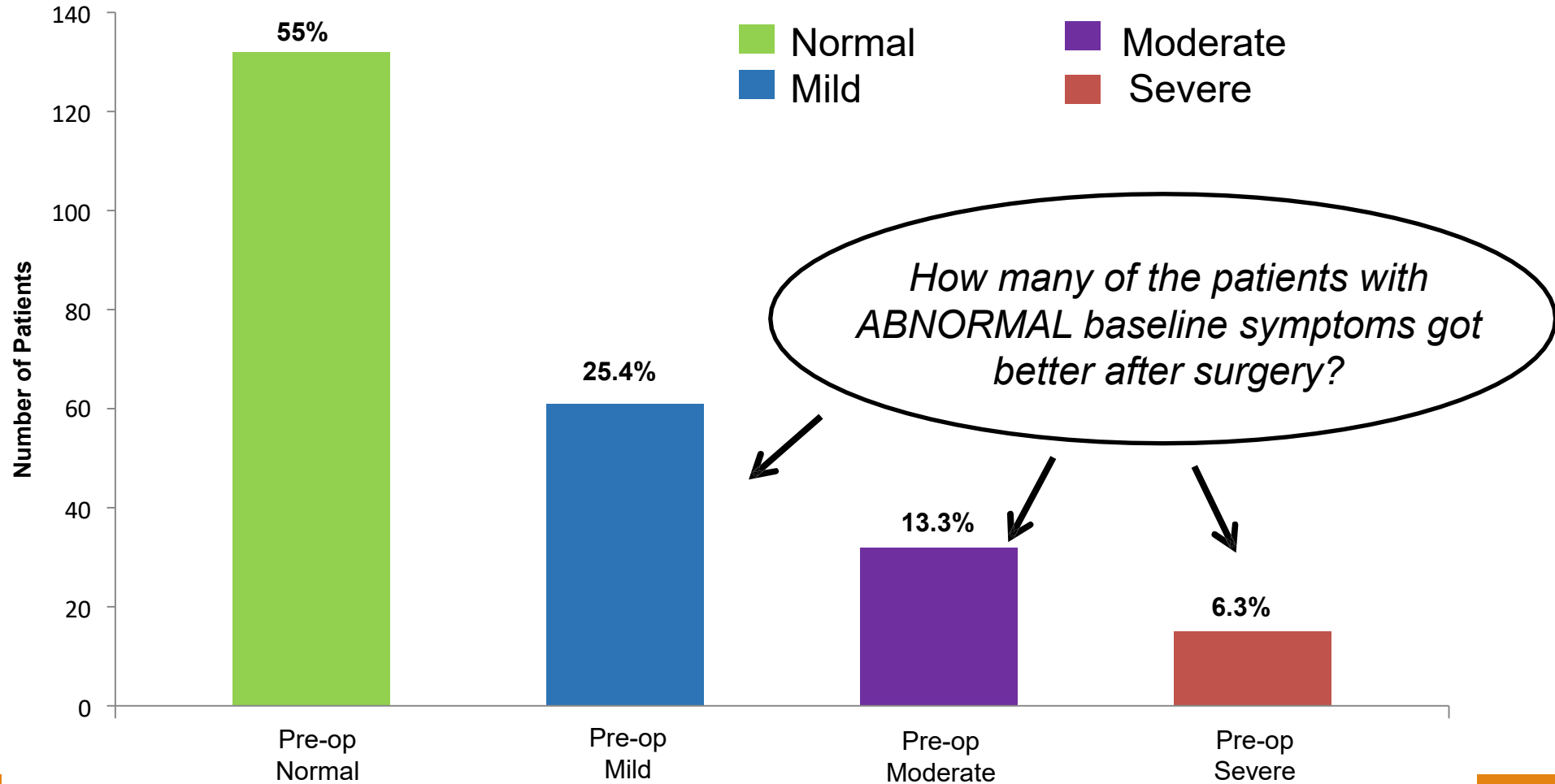
PREOPERATIVE Ocular Surface Disease Index (OSDI) Scores



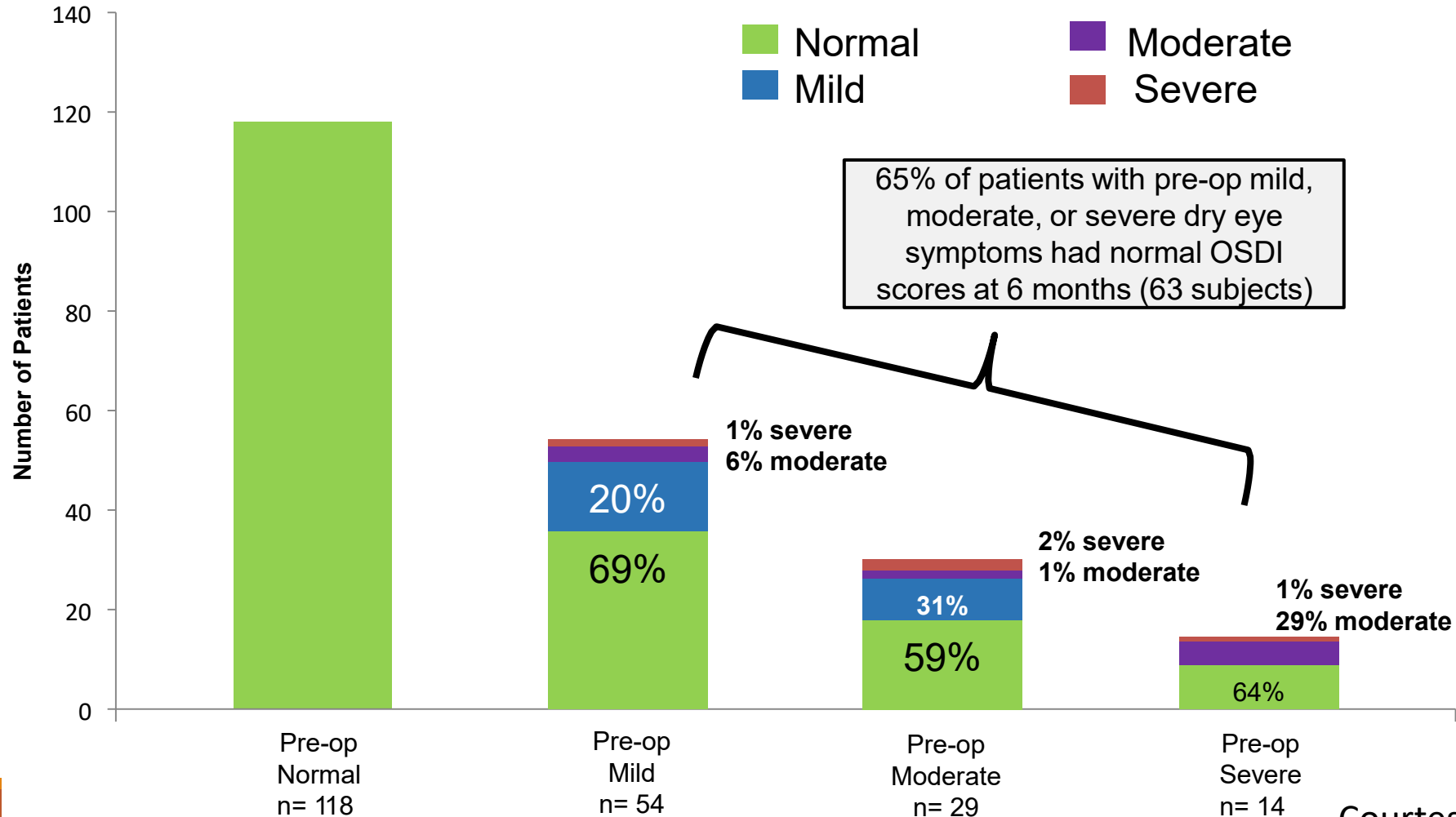
Prevalence of Subjects with Normal Pre-op OSDI Scores Who Had Worsening OSDI Scores at 6 Months



Preoperative Ocular Surface Disease Index (OSDI) Scores



Prevalence of Subjects with Mild/Moderate/Severe OSDI Scores Who Had Normal OSDI Scores at 6 Months



PROWL 6 Month Dry Eye Data

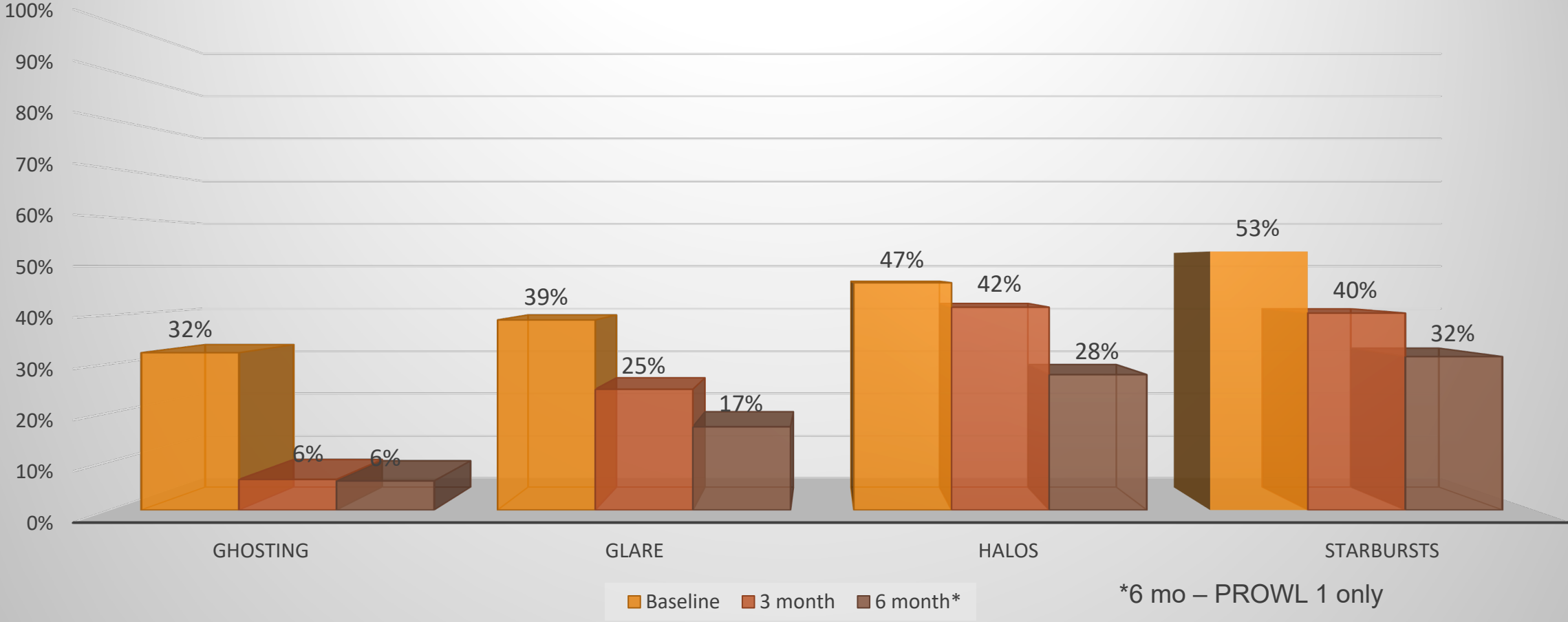
65% with baseline
ABNORMAL OSDI
got BETTER & had a
NORMAL OSDI

21% with baseline
NORMAL OSDI got
WORSE (most were mild,
only 1 severe)

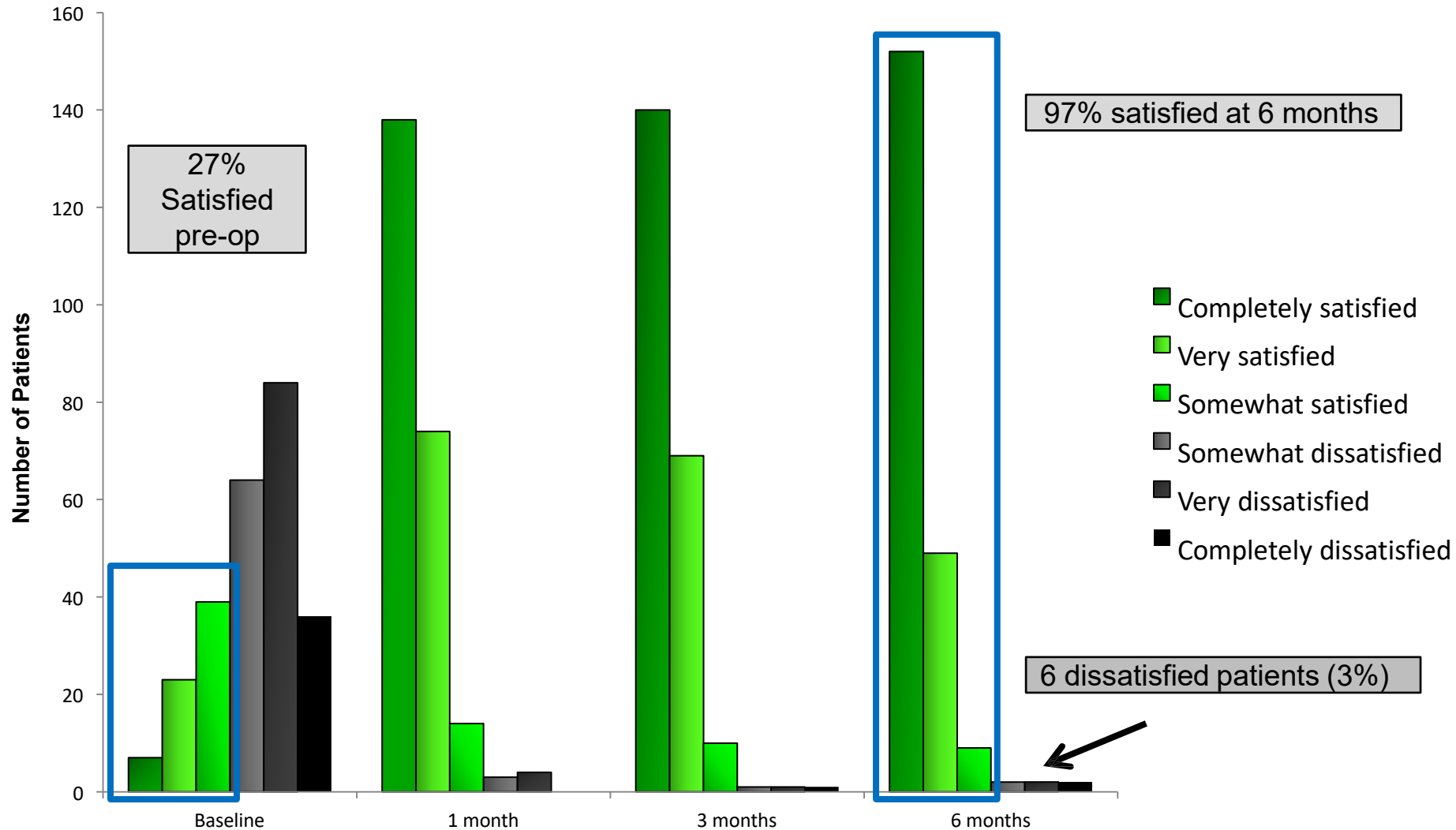
3X more people had BETTER dry eye after LASIK
Than those who Got Worse

PROWL Visual Symptoms out to 6 Months

PROWL 1 & 2 Combined



How satisfied are you with your present vision?



Three-year longitudinal survey comparing visual satisfaction with LASIK and contact lenses

Study sponsor: The Cornea Research Foundation of America

Purpose: To assess patient satisfaction and perceived outcomes with different methods of refractive correction through annual surveys administered over a 3-year period

Design: Prospective, longitudinal, parallel group, multi-center survey

20 U.S. centers

1800 subjects

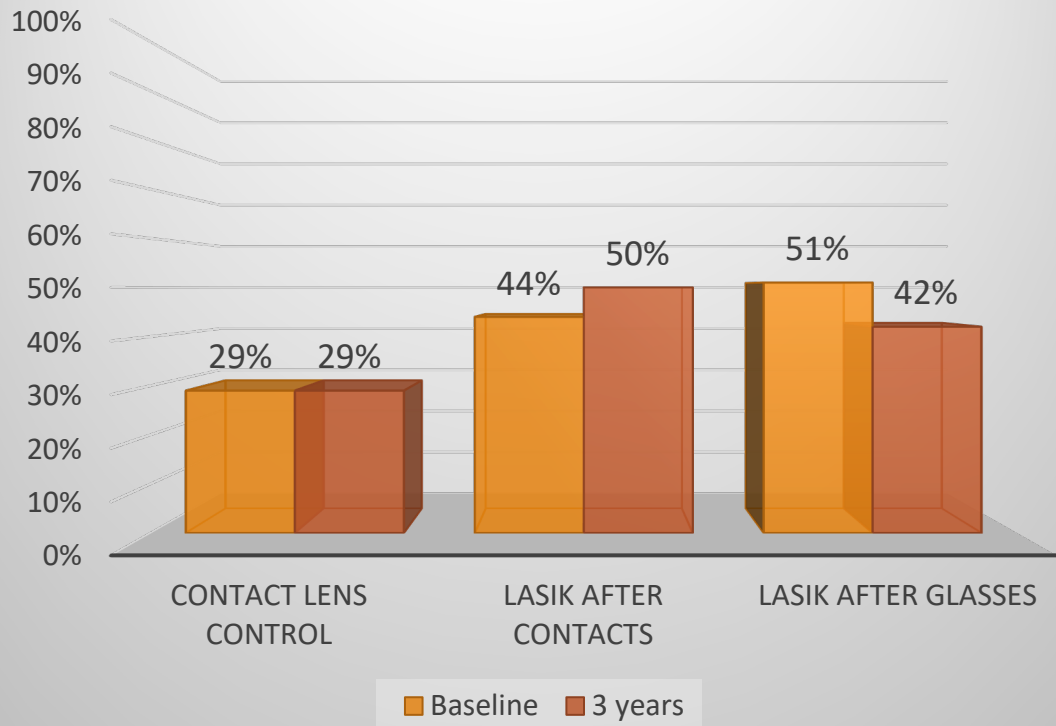
- 694 continued contact lens wear
- 819 wore contact lenses at baseline and had LASIK
- 287 wore glasses at baseline and had LASIK



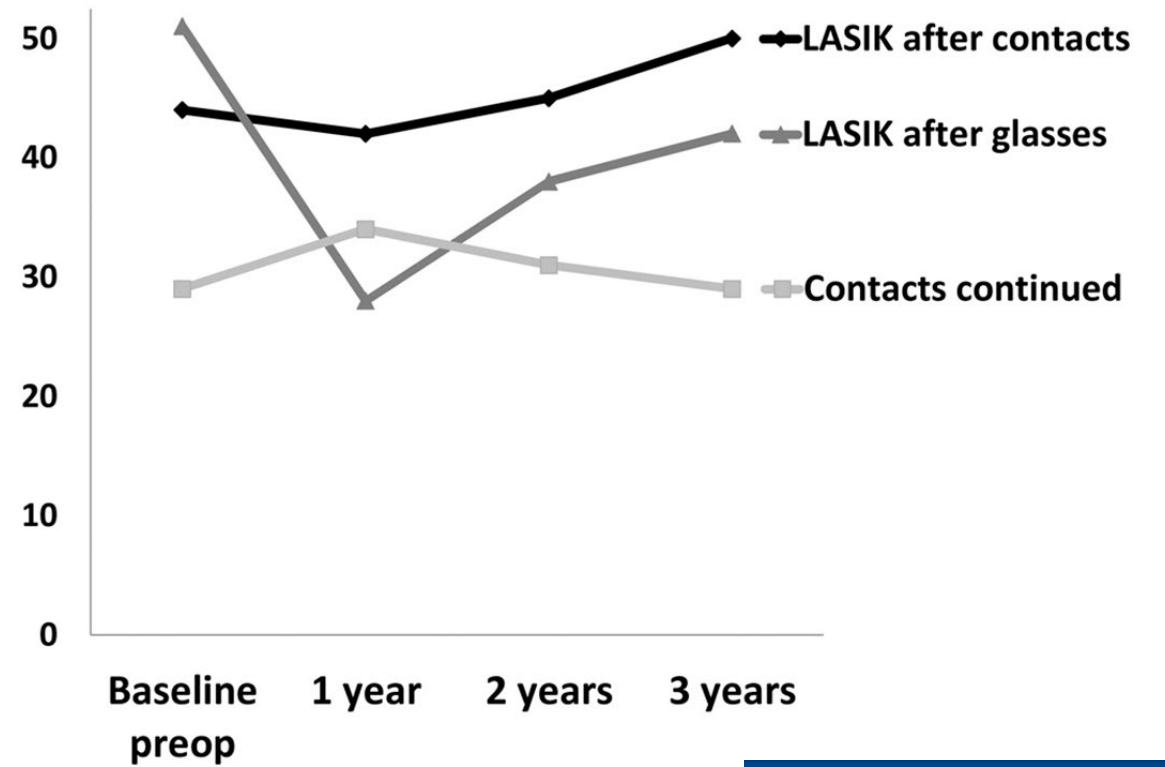
The screenshot shows the top portion of a journal article page from Ophthalmology. The header includes the journal title "Ophthalmology" and the logo of the American Academy of Ophthalmology. Below the header is a search bar with "All Content" selected. The page is dated "August 2016" and is Volume 123, Issue 8, Pages 1659-1666. A red message box states: "To read this article in full, please review your options for gaining access at the bottom of the page." The article title is "Three-Year Longitudinal Survey Comparing Visual Satisfaction with LASIK and Contact Lenses". Below the title, it says "Presented at: American Academy of Ophthalmology Meeting Paper, October 2014, Chicago, Illinois (interim results)." The authors listed are Marianne O. Price, PhD, David A. Price, BS, Frank A. Bucci Jr., MD, Daniel S. Durrie, MD, William L. Bond, MD, and Francis W. Price Jr., MD. The manuscript number is 2016-436. There are links for PlumX Metrics, DOI (http://dx.doi.org/10.1016/j.ophtha.2016.04.003), and CrossMark. At the bottom, there is a link for "Article Info".

During the past week have you experienced a feeling of dry eyes?

No Dry Eye Symptoms

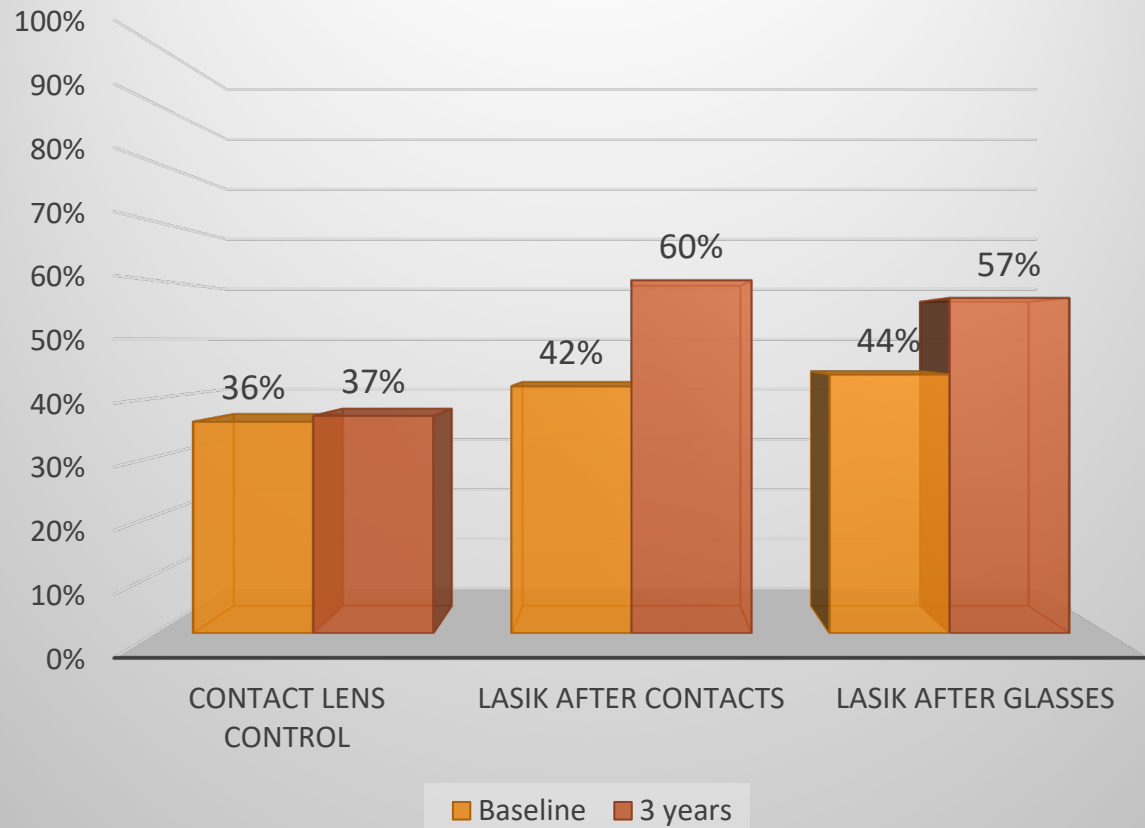


No dry eyes (%)

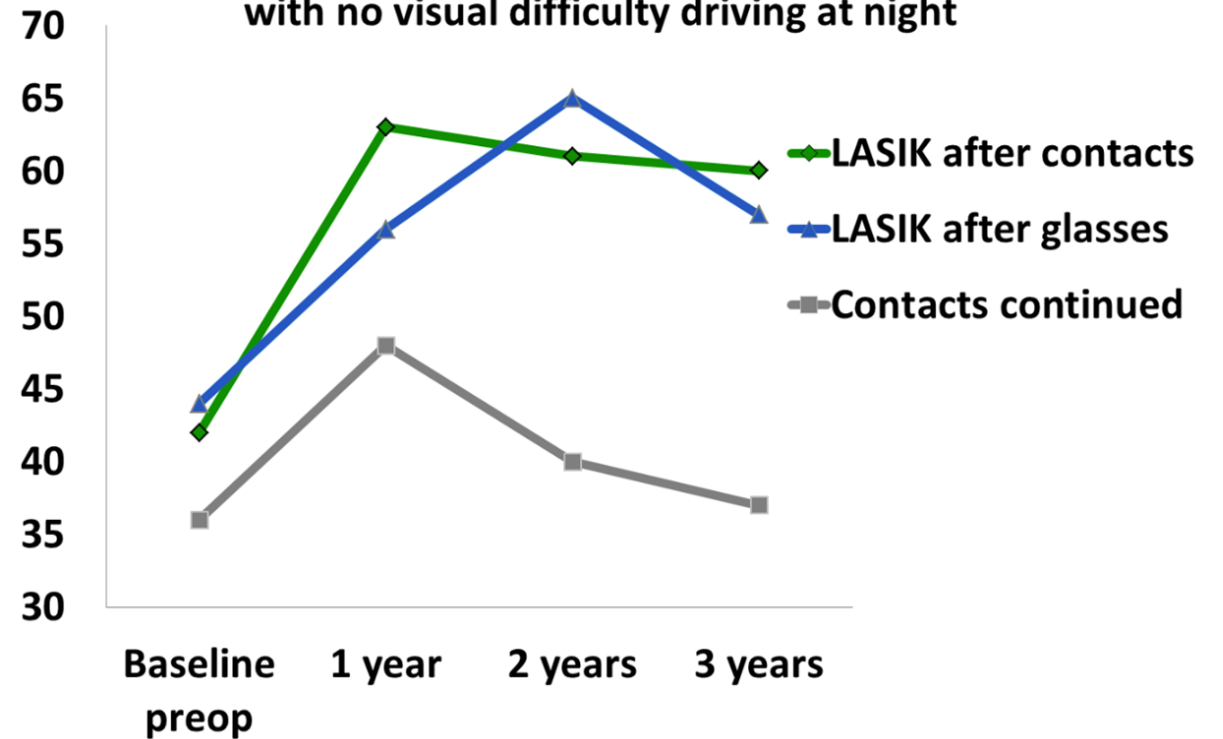


Do you have any difficulty driving at night?

No Difficulty



Percentage of respondents in the three study groups with no visual difficulty driving at night



To read this article in full, please review your options for gaining access at the bottom of the page.

Three-Year Longitudinal Survey Comparing Visual Satisfaction with LASIK and Contact Lenses

Presented at: American Academy of Ophthalmology Meeting Paper, October 2014, Chicago, Illinois (interim results).

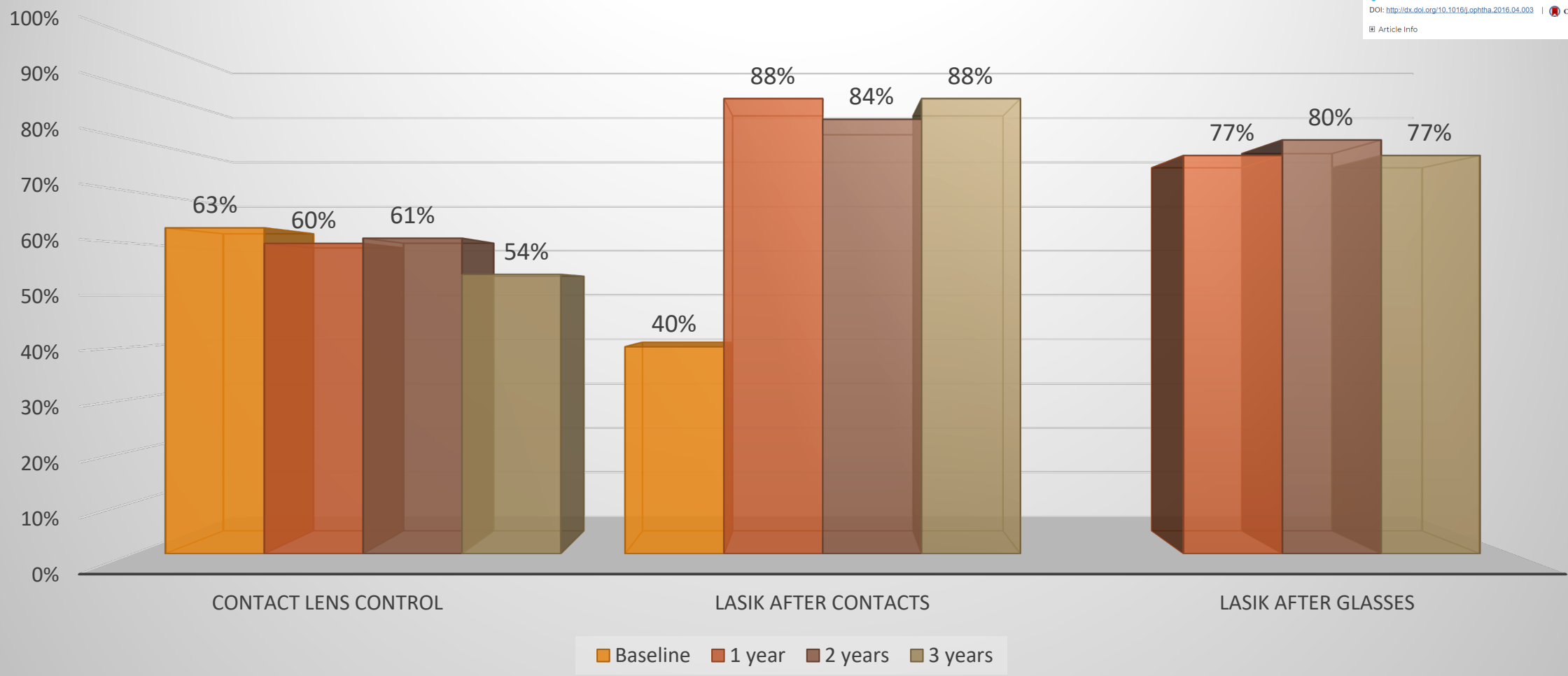
Marianne O. Price, PhD, David A. Price, BS, Frank A. Bucchi Jr., MD, Daniel S. Durrie, MD, William I. Bond, MD, Francis W. Price Jr., MD
Manuscript no. 2016-436.

PlumX Metrics
DOI: <http://dx.doi.org/10.1016/j.ophtha.2016.04.003> | CrossMark

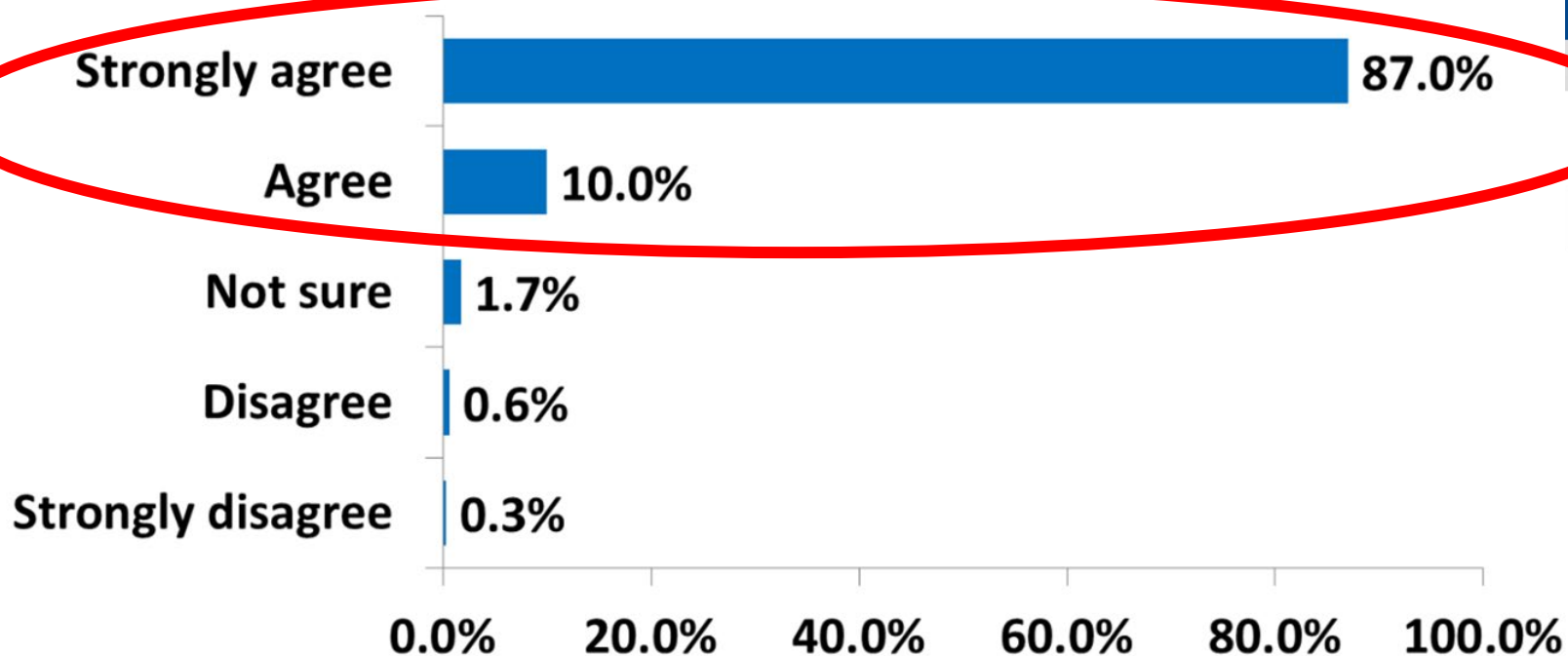
Article Info

“I would recommend my current method of vision correction to a close friend or relative”

Strongly Agree



Responses at year 3 to the following question:
“At this time, do you believe that LASIK works better for you than contact lenses?”



To read this article in full, please review your options for gaining access at the bottom of the page.

Three-Year Longitudinal Survey Comparing Visual Satisfaction with LASIK and Contact Lenses

Presented at: American Academy of Ophthalmology Meeting Paper, October 2014, Chicago, Illinois (interim results).

Marianne O. Price, PhD, David A. Price, BS, Frank A. Bucci Jr., MD, Daniel S. Durrie, MD, William I. Bond, MD, Francis W. Price Jr., MD
Manuscript no. 2016-436.

These Reports of PRO's Support What We Already Knew

Modern Refractive Surgery is **Safe and Effective**

Quality of life is improved

Dry eye is **NOT** a typical side effect of Modern LASIK & OSDI responses on average IMPROVE

Glare and halos are **NOT** typical side effects of Modern Refractive Surgery

Night Vision Symptoms are **LESS** after Modern Refractive Surgery

On Average, Refractive Surgery is **THERAPEUTIC** for dry eyes and night vision glare and halo's

With Results Like These, Why Aren't More People Adopting Refractive Surgery Today?

- Myths Persist
 - Will Patients be Dependent on Glasses Even After Refractive Surgery?
 - Do Refractive Surgeons Have Refractive Surgery Themselves?

Prevalence of laser vision correction in ophthalmologists who perform refractive surgery



Guy M. Kezirian, MD, MBA, Gregory D. Parkhurst, MD,
Jason P. Brinton, MD, Richard A. Norden, MD

PURPOSE: To determine the prevalence of laser corneal refractive surgery (laser vision correction [LVC]) among ophthalmologists who perform these procedures and to assess the willingness of these ophthalmologists to recommend LVC to immediate family members.

SETTING: Online survey with results analyzed at Surgivision Consultants, Inc., Scottsdale, Arizona, USA.

DESIGN: Prospective randomized questionnaire study.

METHODS: The 22-question Global Survey on Refractive Surgery in Refractive Surgeons was sent by e-mail to 250 ophthalmologists randomly selected from a database of 2441 ophthalmologists known to have performed LVC at some point in the past decade. Responses were solicited by e-mail, with subsequent telephone reminders to nonresponders.

RESULTS: Responses were received from 248 (99.2%) of 250 queried individuals, of which 232 (92.8%) met the protocol criteria of currently working as refractive surgeons. Of the 232 subjects, 161 (69.4%) reported that they had refractive errors potentially amenable to treatment with LVC, not including presbyopia. Of the 161 ophthalmologists with treatable refractive errors, 54 (33.5%) reported they were not candidates for LVC for a variety of reasons and 107 (66.5%) reported they were candidates for LVC. Of the LVC candidates, 62.6% reported that they had an LVC procedure in their own eyes. Of the overall 232 subjects, more than 90% recommend LVC for adult members of their immediate family.

CONCLUSIONS: Ophthalmologists who perform LVC were significantly more likely than the general population to have LVC in their own eyes. The prevalence of refractive errors was significantly higher among ophthalmologists performing refractive surgery than in the general population.

Financial Disclosure: No author has a financial or proprietary interest in any material or method mentioned.

J Cataract Refract Surg 2015; 41:1826–1832 © 2015 ASCRS and ESCRS

Laser vision correction (LVC) has been available in the United States since the first excimer laser received U.S. Food and Drug Administration approval for photorefractive keratotomy (PRK) in 1995.¹ Reports of satisfaction with the procedure are high. Metaanalysis of the world's literature on laser in situ keratomileusis (LASIK)² suggests that satisfaction rates average 95.4% worldwide, ranging from 87.2% to 100%. Studies report similar rates of LVC acceptance rates among active-duty U.S. Navy aviators,³ physicians,⁴ astronauts,⁵ and individuals likely to be driving in mesopic and high-glare conditions.⁶

As of 2014, estimates put the number of patients who had LVC procedures at only 16.2 million in the United States, for an overall penetration rate of 13.1% of appropriate candidates.⁷ Reasons cited for low penetration range from general economic conditions to concerns about safety and the availability of alternate treatments for refractive errors. All these and other reasons may play a role.

Prior surveys have attempted to quantify the prevalence of LVC among members of the International Society of Refractive Surgery (ISRS)⁸ and suggest that approximately 40% of all refractive surgeons

Refractive Surgeons who were candidates for LVC are 4x more likely to have already undergone LVC

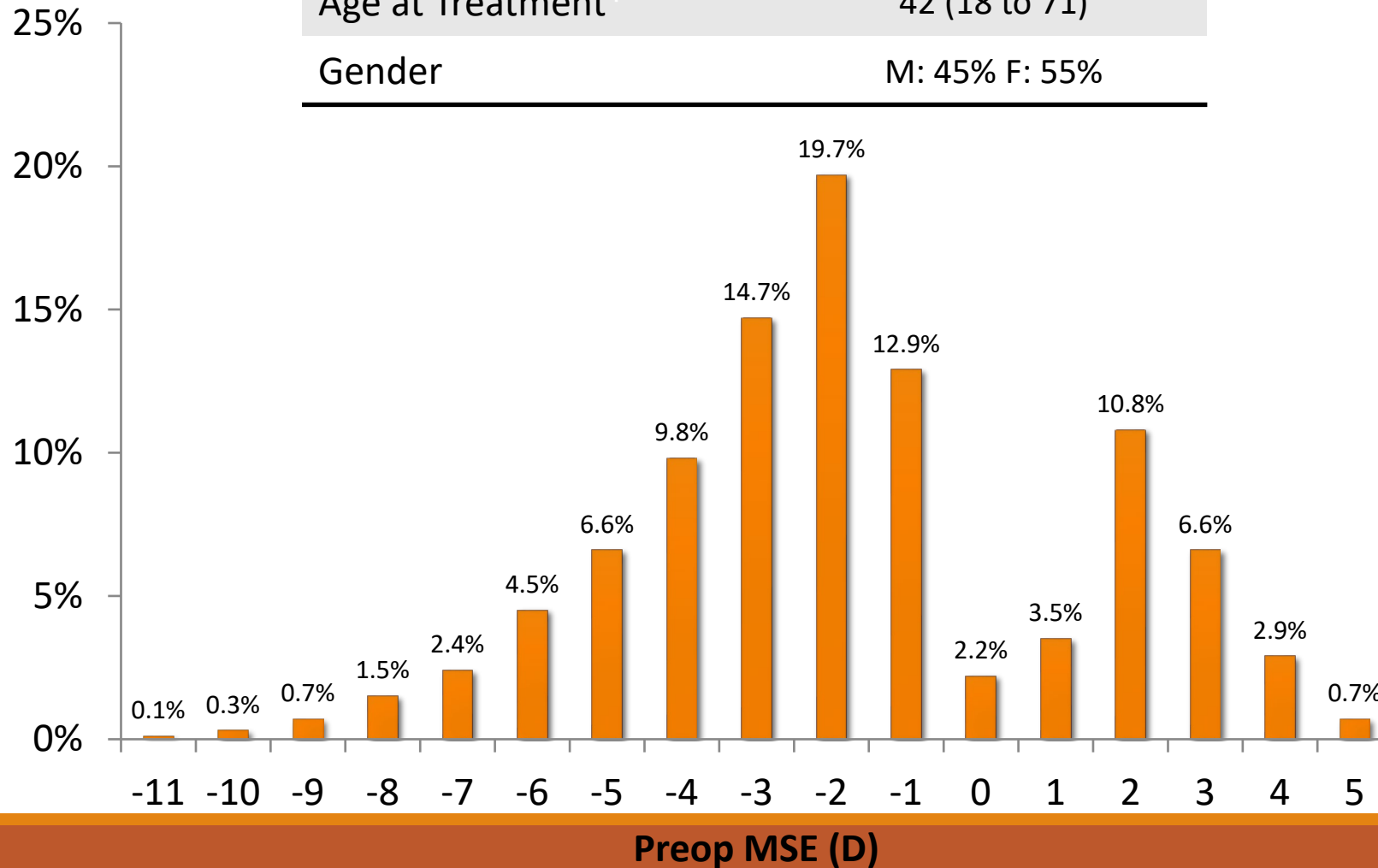
Does Lasik Wear Off?

Optical Express 10 Year Post-LASIK Evaluation

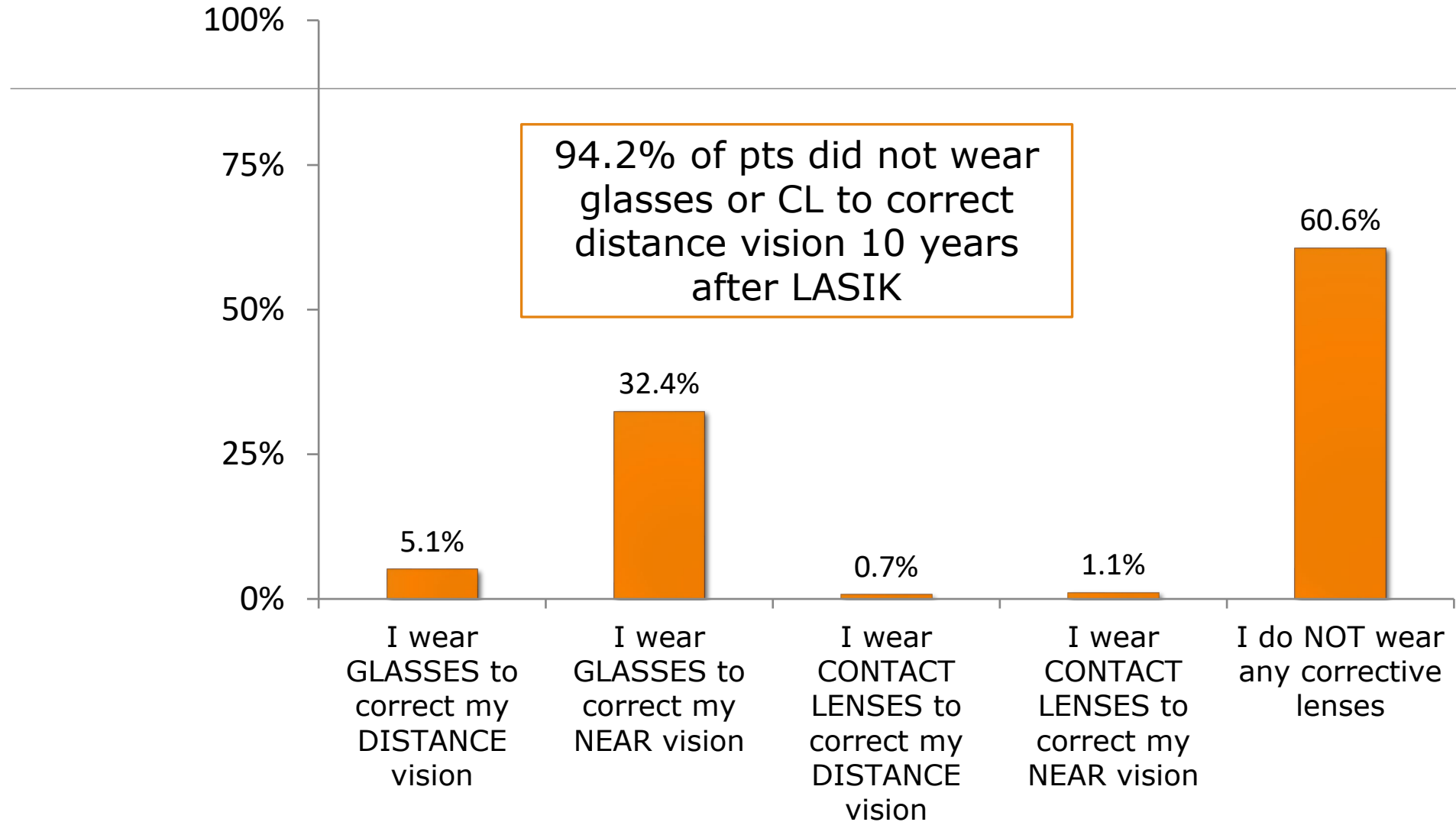
Patients (Eyes) 3,317 (6,465)

Age at Treatment* 42 (18 to 71)

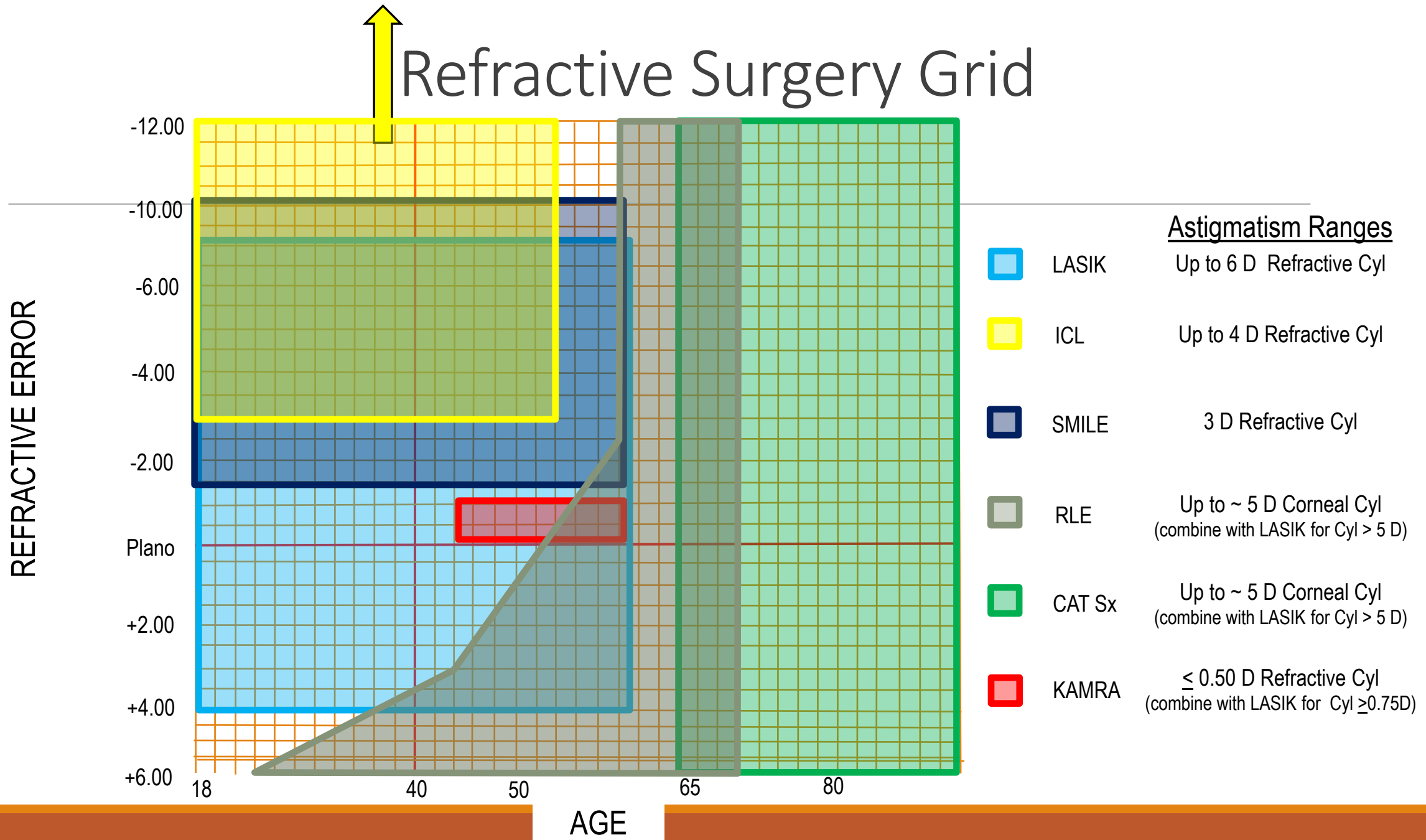
Gender M: 45% F: 55%



“Please check ALL that apply. During a typical day...”

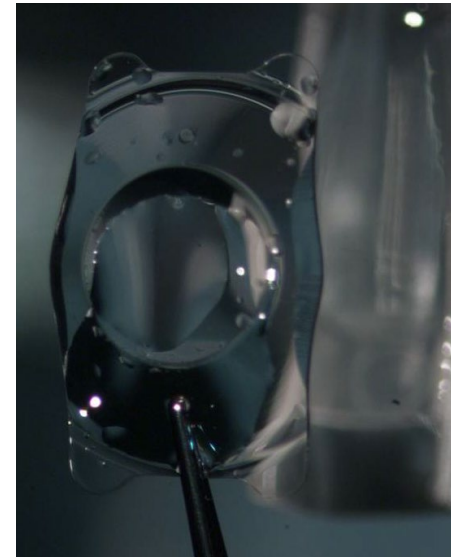
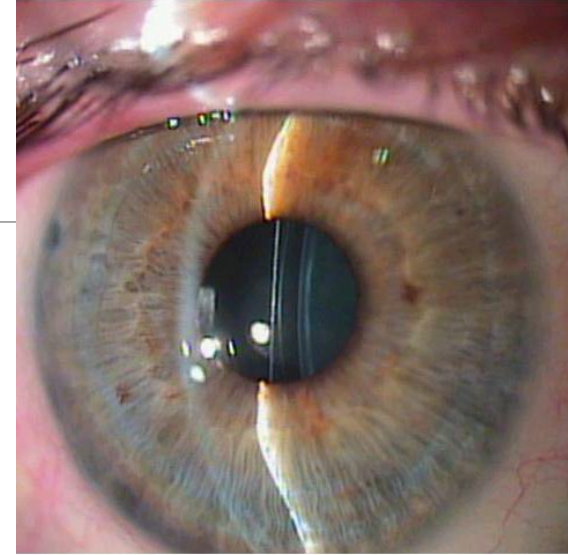


Refractive Surgery Grid



What About High Myopia: Phakic IOLs

- Visian ICL has been available for over 10 years in the U.S.
- Indicated for use in adults 21-45 years of age.
- 20+ years experience in eyes outside the USA.
- Over 900,000 ICL's implanted worldwide.



What can we correct with ICLs/toric ICLs?

Up to 16D of myopia

4D astigmatism

Approved for myopic reduction up to 20D (-16.25D to -20.0D)

MUST HAVE ADEQUATE ANTERIOR CHAMBER DEPTH (>3.0mm?)

Visian Toric ICL – FDA Study: Change in BSCVA³



~75% of patients had improved BSCVA after toric ICL

Patient A.M.

35 yo WM

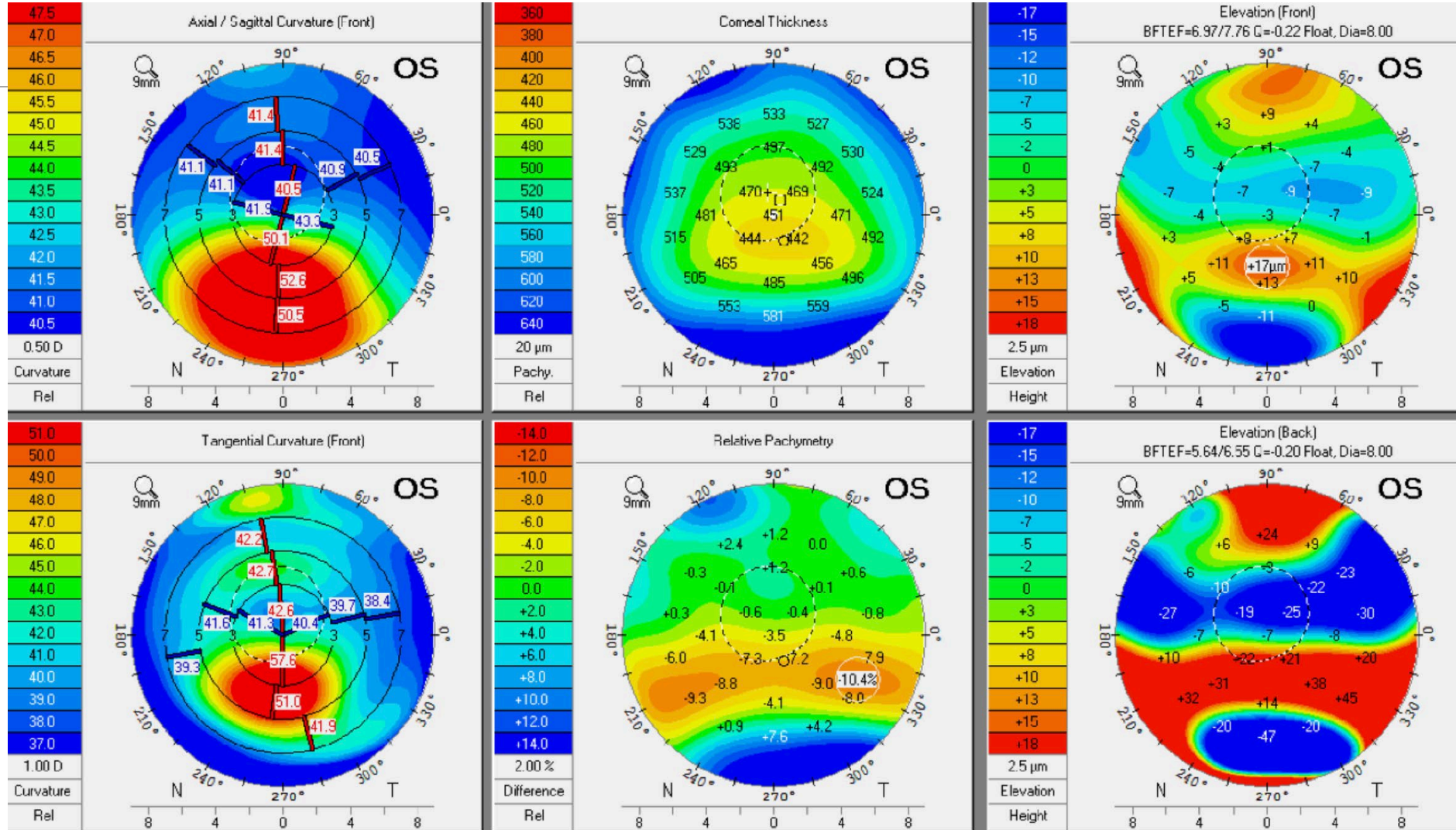
OD: -5.50 -2.00 x 180

OS: -5.00 -1.25 x 180

VA with glasses 20/25 OU

Stable past 6 yrs

Patient A.M.



Poll 2

What would you do?

Options

LASIK

PRK

SMILE

ICL

RLE

K inlay

CXL

Cataract Surgery

Combination of the above

Sorry, we can't help

Evaluation of a Toric Implantable Collamer Lens After Corneal Collagen Crosslinking in Treatment of Early-Stage Keratoconus: 3-Year Follow-up

Shafik Shaheen, Mohamed MD, PhD; El-Kateb, Mohamed MD, PhD; El-Samadouny, Mohamed A. MD, PhD; Zaghloul, Hussam MD

Cornea: May 2014 - Volume 33 - Issue 5 - p 475–480
doi: 10.1097/ICO.0000000000000094
Clinical Science

BUY

Abstract

Author Information

Article Metrics

Correction of spherical and cylindrical refractive errors in keratoconic eyes by TICL....Promising outcomes, particularly in the **astigmatic** component of refraction

endothelial cell count (using specular microscopy) were evaluated during a 3-year follow-up.

Results: The mean Snellen decimal CDVA improved from 0.56 ± 0.13 (range, 0.40–0.80) preoperatively to 0.89 ± 0.17 (range, 0.60–1.20) at 3 years of the follow-up ($P < 0.0001$). The mean UDVA also improved significantly from 0.63 ± 0.14 before ICL implantation to 0.88 ± 0.18 after 3 years of the follow-up ($P < 0.001$). At 3 years, the mean spherical and cylindrical manifest refractions were 0.00 ± 0.18 D and -0.05 ± 0.14 D, respectively. At the end of the follow-up, the vault was 509.75 ± 141.47 μ m (range, 320–900) and the intraocular pressure was 11.94 ± 1.12 mm Hg. No complications occurred during the surgical procedures. No eye needed explantation or repositioning of the TICL. The endothelial cell count loss after 3 years was -8.98% .

Conclusions: Correction of spherical and cylindrical refractive errors in keratoconic eyes by TICL implantation 12 months after crosslinking gave significantly promising outcomes, particularly in the astigmatic component of refraction.

i2013!

Journal of Refractive Surgery

ORIGINAL ARTICLE

Safety and Visual Outcome of Visian Toric ICL Implantation After Corneal Collagen Cross-linking in Keratoconus

Ali Fadlallah, MD; Ali Dirani, MD; Hala El Rami, MD; Georges Cherfane, MD; Elias Jarade, MD

Journal of Refractive Surgery. 2013;29(2):84-89 <https://doi.org/10.3928/1081597X-20130117-01>

Posted February 1, 2013

ABSTRACT

FULL TEXT

FIGURES/TABLES

REFERENCES

 VIEW PDF

Abstract

PURPOSE:

To evaluate the safety and clinical outcome of phakic Visian toric implantable collamer lens (ICL) (STAAR Surgical, Monrovia, CA) insertion after corneal collagen cross-linking (CXL) in progressive keratoconus.

Three-year follow-up of posterior chamber toric phakic intraocular lens implantation for the correction of high myopic astigmatism in eyes with keratoconus

Kazutaka Kamiya¹, Kimiya Shimizu¹, Hidenaga Kobashi¹, Akihito Igarashi¹, Mari Komatsu², Akio Nakamura³, Takashi Kojima⁴, Tomoaki Nakamura⁴

[Author affiliations](#) +

Abstract

Aim To assess the clinical outcomes following the use of toric implantable collamer lenses (toric ICL, STAAR Surgical) for the correction of high myopic astigmatism with keratoconus.

Methods This retrospective study evaluated 21 eyes of 11 patients with spherical equivalents of -9.70 ± 2.33 D (mean \pm SD) and astigmatism of -3.21 ± 1.56 D who underwent toric ICL implantation for keratoconus. Preoperatively, and at 1, 3 and 6 months and 1, 2 and 3 years postoperatively, we assessed the safety, efficacy, predictability, stability and adverse events of the surgery.

Results The logarithm of the minimum angle of resolution (logMAR) uncorrected distance visual acuity (UDVA) and the logMAR corrected distance visual acuity (CDVA) were -0.06 ± 0.11 and -0.12 ± 0.09 , respectively, at 3 years postoperatively. At 3 years, 67% and 86% of the eyes were within ± 0.5 and ± 1.0 D, respectively, of the targeted correction. Manifest refraction changes of 0.04 ± 0.33 D occurred from 1 month to 3 years postoperatively. No significant change in manifest refraction (analysis of variance, $p=0.989$) or keratometry ($p=0.951$), or vision-threatening complications occurred during the observation period.

Conclusions Toric ICL implantation is beneficial according to measures of safety, efficacy, predictability and stability for the correction of refractive errors for keratoconus during a 3-year observation period. The disease did not progress even in the late-postoperative period, suggesting the viability of this procedure as a surgical option for the treatment of such eyes.

Patient A.M. – s/p 1 day toric ICL

VA OD 20/25

VA OS 20/20-2

Ethical

Optometric Oath

- I **WILL** place the treatment of those who seek my care above personal gain and strive to see that none shall lack for proper care.
- I **WILL** advise my patients fully and honestly of **ALL** which **may serve** to restore, maintain or enhance their vision and general health.



Hi all, looking for some guidance on what/if any soft contact lens might work for this patient. Thanks in advance!

How do ICLs fit into Optometric Practice?

single vision
 bifocal
 lenticular aspheric
 rd seg
 sv
 flat top 28 ()
 rd seg

COMPLETE IN MINUS CYLINDER

		SPH	CYL	AXIS	PRISMS	BASE	DECENTRE	
							IN	OUT
	R	-17.25	-1.25	025				
	L	-15.00	+1.25	140				
			Segment Height		Inset		Total Inset	
for near	R			R		R	X	Far 34
	L			L		L	X	Near 5

Shipped: _____ Date Received: _____

al Instructions: _____

that the information on this form, and any attached statement that I have pro



Just saw a -26.00 myope 🤔
Had to put -12.00 contacts on him just to get a refraction! BCVA 20/40 OD and OS with posterior staphyloma.
He has never worn RGP before, only soft CL.
What contacts have you used for crazy high myopes?
Most only go up to -20 and he needs -22!

  13

18 comments

 Like

 Comment

 Send

More from the web...

ODs on Facebook 🧐

Any planned replacement contacts with Rx of -12.00-4.25 (or close) x180?

22 Comments

Like

Comment

What contacts lens company can make -10.00 -2.25 x 180 and -11.00 -1.75 x 180 soft Toric lens? Proclear only goes up to -10.00.

16 Comments

Like

Comment

Hey Guys, I have a patient who is a high myope -16 OU and looking to try a different lens. She has complaint of dryness with her current CV 55 soft lens that shes been wearing for the last 10 years. She does not want to try hybrid or RGPs. Any suggestions?
TIA

16 Comments

Like

Comment

CL question for you guys. Pt with manifest OD: -13.25DS OS: -17.50-1.00 wants dailies...wait for it....colors. Any idea if this exists? I am asking because she is demanding and "will pay for it". Not what I'm use to hearing these days LOL. Any Ideas I would love to hear about. thanks in advance.

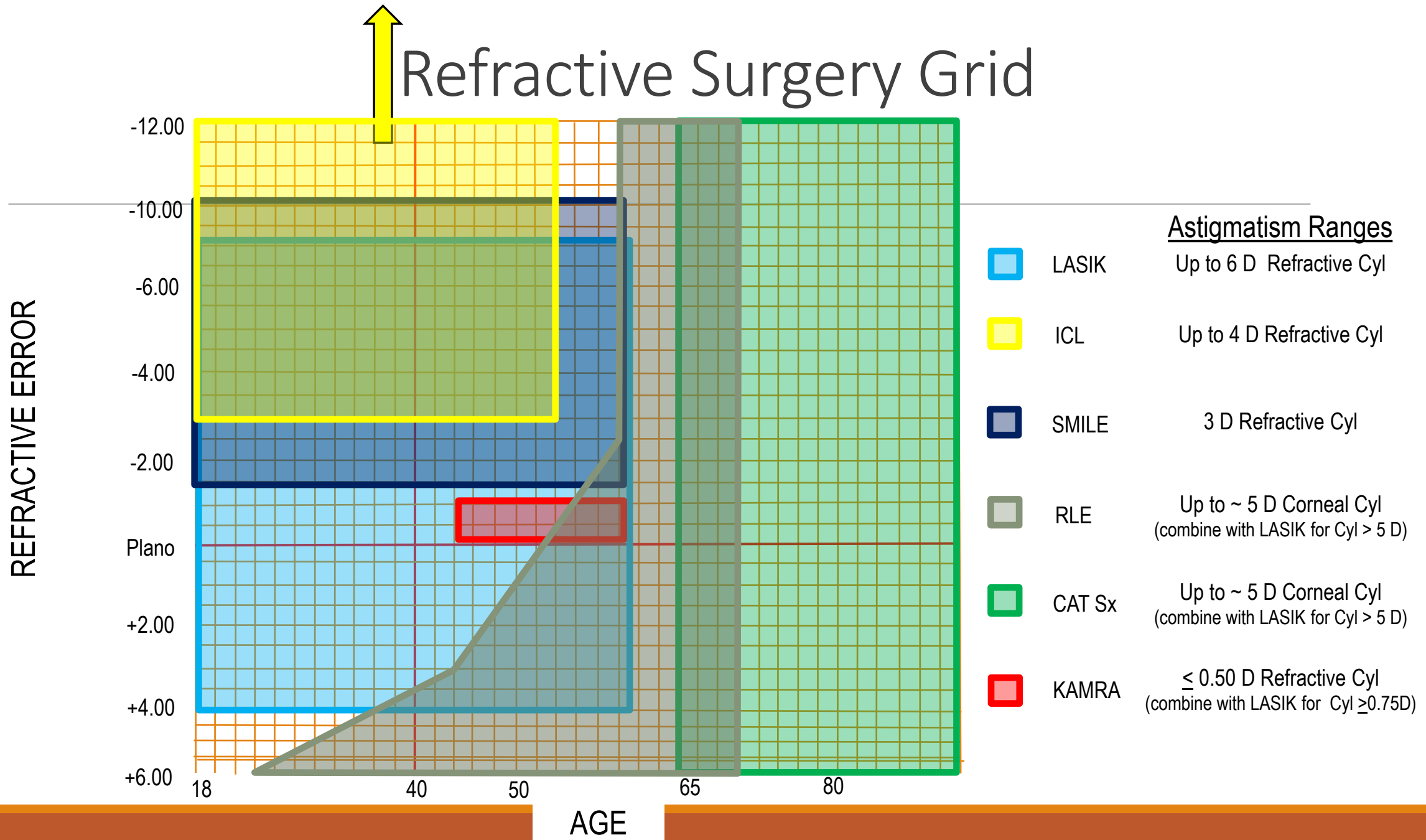
4

26 Comments

Like

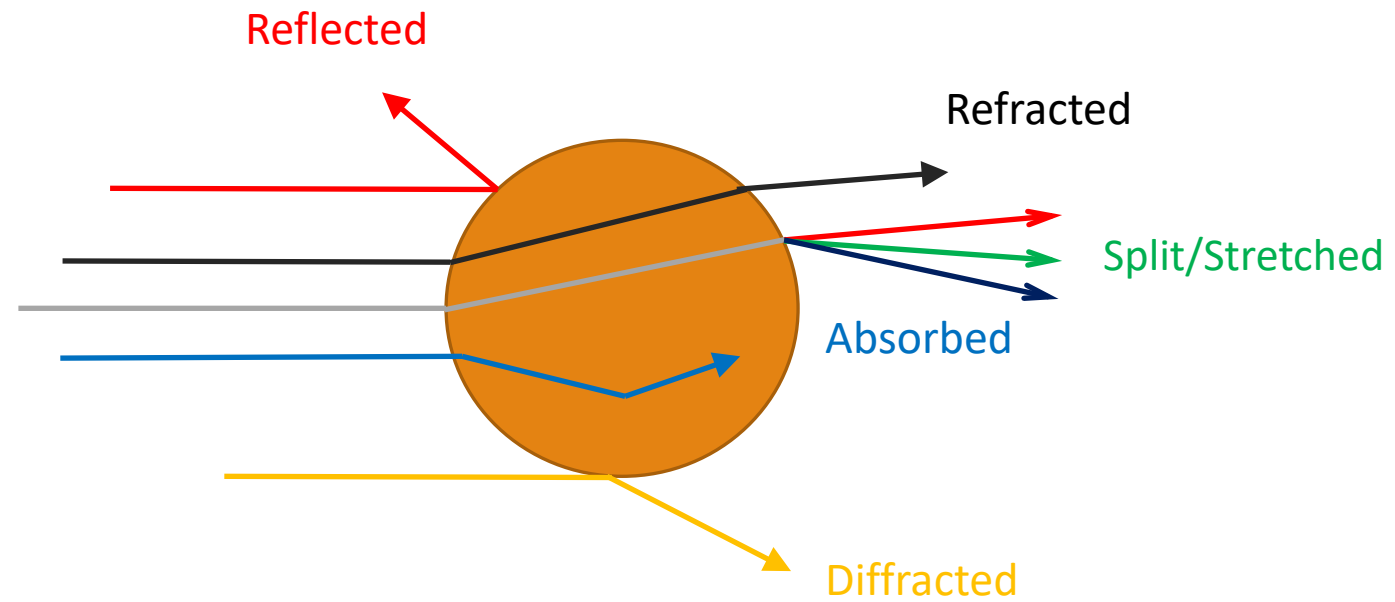
Comment

Refractive Surgery Grid



Modern IOs

IOL Optics



Who is a candidate for diffractive lenses?

Because of the diffractive optics, multifocal patients should be free from ocular pathology

- The eye should be capable of ~20/25 vision or better
- No significant surface disease with normal topography
 - May consider presurgical treatment with Azasite and Restasis

Multifocal candidates are those that have a desire to be less dependent on (not free from) spectacles

They should be willing to accept some initial glare/halos

Ideally are long time presbyopes

Best results are with bilateral lenses

Aggressively treat ocular surface!!

Who is not a candidate for diffractive technology?

ANTERIOR SEGMENT

Dry Eye

Significant corneal disease/irregularities/scarring

Pupil abnormalities

Capsular/zonular problems

History of significant refractive surgery

- >2 D hyperopic treatment
- >4 D of myopic treatment
- RK is generally a contraindication

Prism wearers

Patients who love their glasses

Dry Eye

POSTERIOR SEGMENT

ARMD

- A few drusen are OK

Diabetic Retinopathy

- Any h/o ME is contraindicated

Other macular pathology

- ERM
- Macular hole
- h/o mac off RD
- VMT

h/o vascular occlusion especially with ME

Patients with the above conditions may still benefit from EDOF lenses.

However, reading vision is not likely to be optimal

PanOptix

- Alcon PanOptix is a trifocal IOL approved August 26, 2019
- Contraindications for lens use are the same as other diffractive lenses
- 4 toric powers: 1.50, 2.25, 3.00, 3.75



**Table 22: IOLSAT: Satisfaction with Your Vision
(Collected at 6 Months) (All-Implanted Analysis Set)**

From FDA Clinical Trials

		PanOptix® IOL (N = 129)	Monofocal IOL (N = 114)
Question	Response	n (%)	n (%)
In the past 7 days, how satisfied were you with your vision?	Total	127	110
	Very Dissatisfied	2 (1.6)	0 (0.0)
	Dissatisfied	2 (1.6)	3 (2.7)
	Neither Satisfied nor Dissatisfied	2 (1.6)	7 (6.4)
	Satisfied	27 (21.3)	34 (30.9)
	Very Satisfied	94 (74.0)	66 (60.0)
Given your vision today, if you had to do it all over, would you have the same lenses implanted again?	Total	127	111
	No	1 (0.8)	14 (12.6)
	Yes	126 (99.2)	97 (87.4)
Given your vision today, would you recommend the lenses you had implanted to your family or friends?	Total	127	110
	No	2 (1.6)	5 (4.5)
	Yes	125 (98.4)	105 (95.5)
Percentage calculated as (n / Total) * 100			

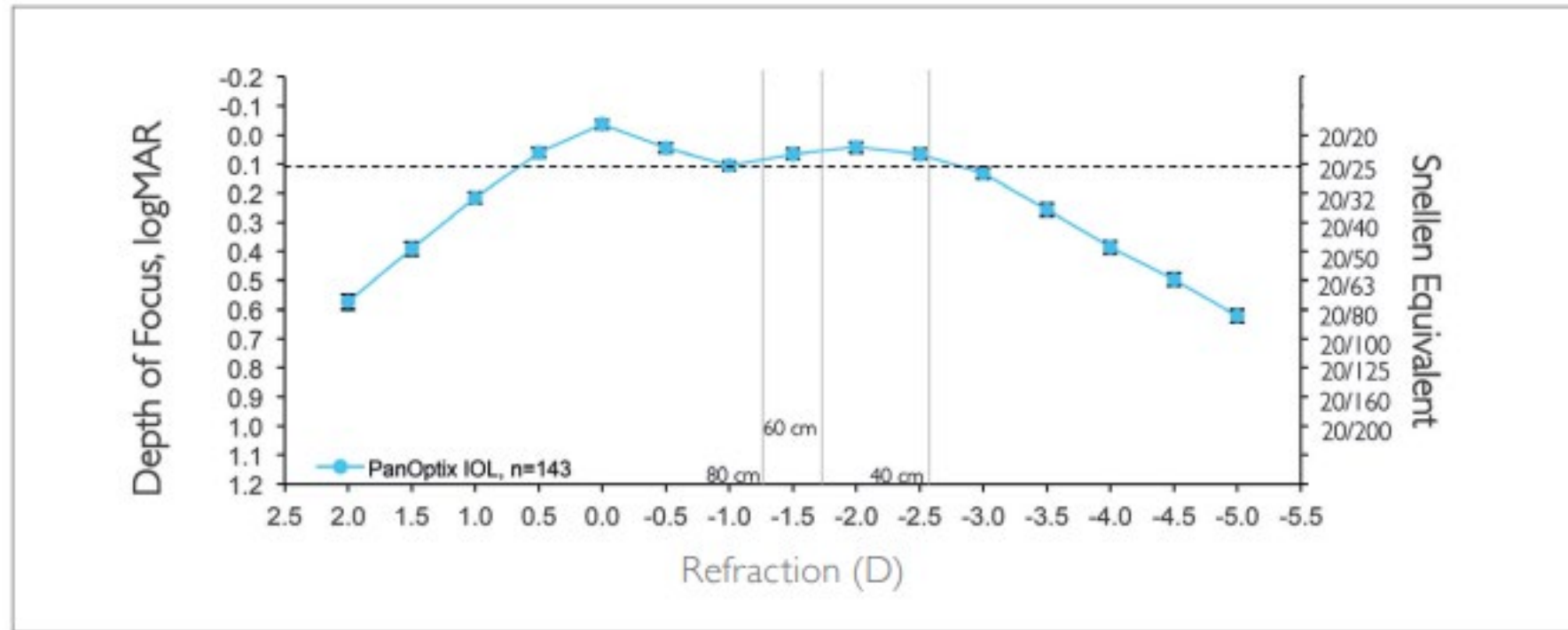


Figure 2. Binocular defocus curve for PanOptix™ at 6 months (4). Binocular defocus testing was performed under photopic conditions ($\sim 85 \text{ cd/m}^2$) using a 100% ETDRS chart at 4 m. Subjects were defocused from manifest refraction using a -5.00 D and $+2.00 \text{ D}$ spherical correction in 0.5 D increments increments. Data reflect mean and 90% confidence intervals.

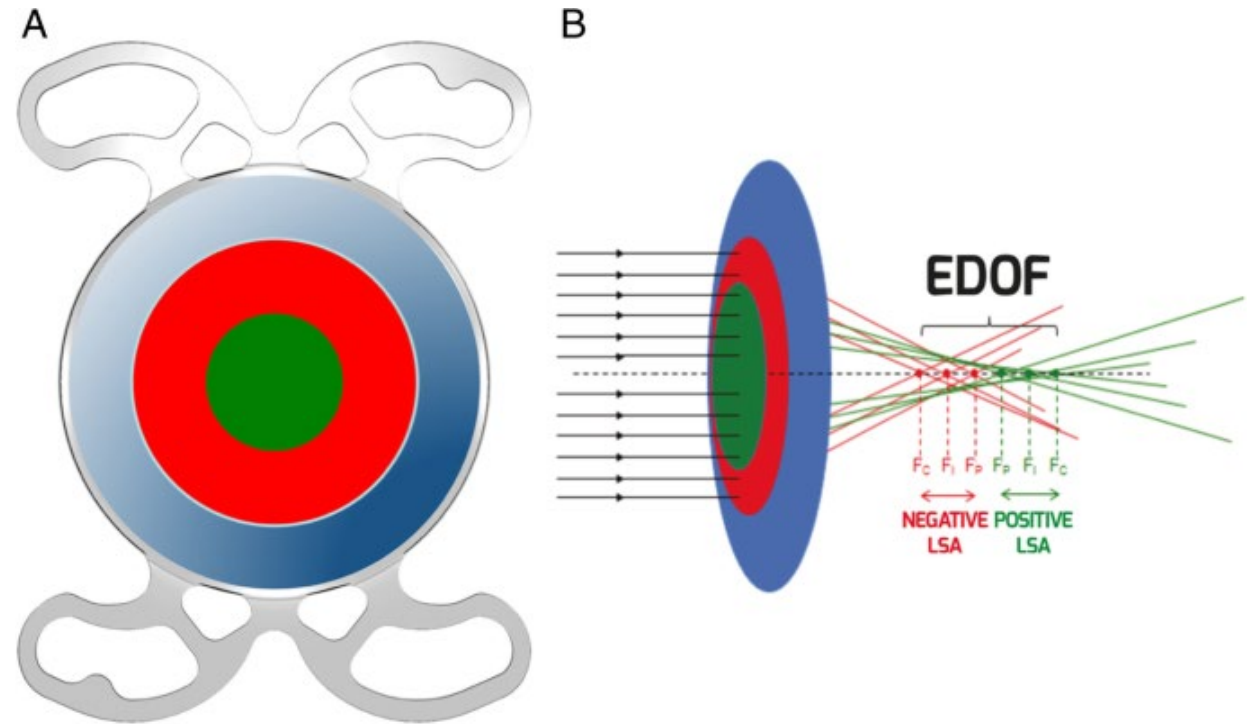
EDOF – Extended Depth of Focus

The FDA recognizes EDOF lenses as a separate category from monofocal lenses and multifocal lenses.

FDA definition of EDOF:

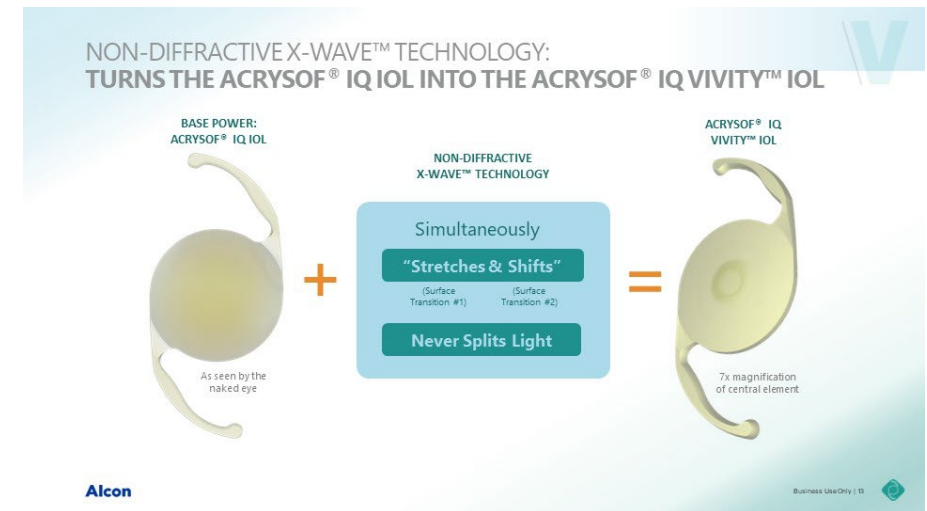
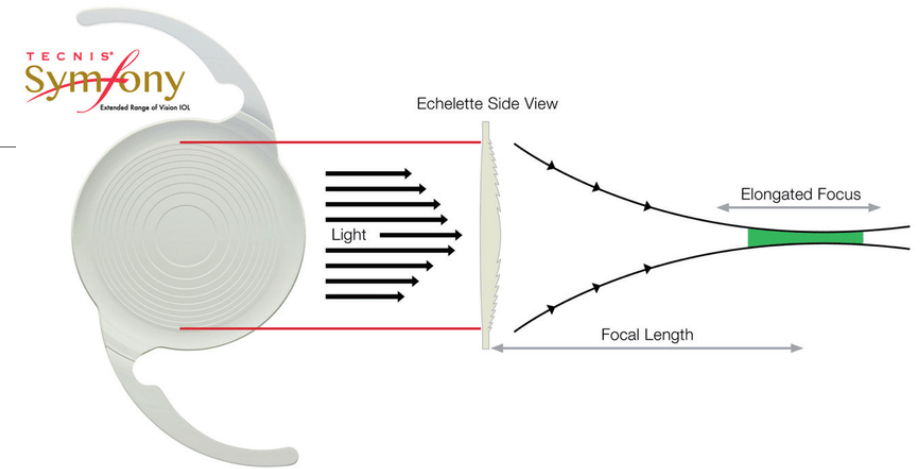
Lenses that provide Snellen visual acuity to within 1 letter of that provided by a monofocal IOL, and a depth of field that is at least 0.50 D greater than a monofocal.

Note that most monofocal lenses also will provide a depth of field of about 0.75D – 1.00D (pupil dependent). This means we can expect an EDOF lens to provide between 1.25D and 1.50D of reading ability. This is enough for intermediate tasks in most cases.



EDOF lenses

- Symphony – First to market in 2016
 - Combined some elements of diffraction and correction of chromatic aberration
 - Technically, it creates an EDOF for the patient because the focal peaks are relatively close (plano and 1.75D) so the patient appreciates a range of clear vision from about 60cm to infinity.
 - More forgiving in terms of ocular pathology
- Vivity – 2020
 - This combines 2 smooth surface transition elements to simultaneously stretch the wavefront, creating an extended visual range without using diffraction
 - A smooth, slightly elevated (approximately 1 μm) plateau surrounds a 2.2-mm small curvature change to delay the wavefront passing through this section of the IOL.



Vivity IOL



- Extends depth of focus
- X wave technology "stretches and shifts"
- May be one of the best options for pts that desire presbyopia correction but do not qualify for diffractive technology

From Alcon regarding the FDA trials

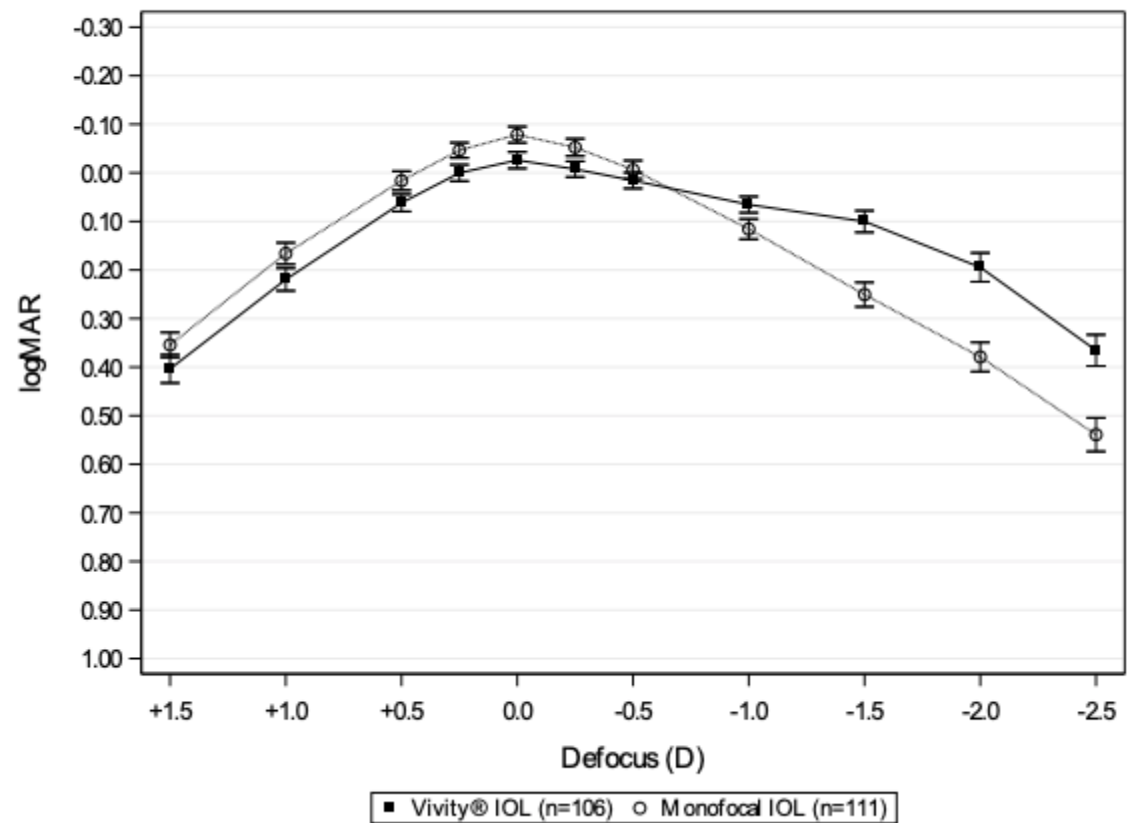
94% and 92% of Vivity patients reported very good or good vision at distance and arm's length, respectively, without glasses in bright light, with vision of 20/20 at distance and greater than 20/25 at intermediate

Comparable visual disturbance profile to a monofocal IOL

Vivity 1.5

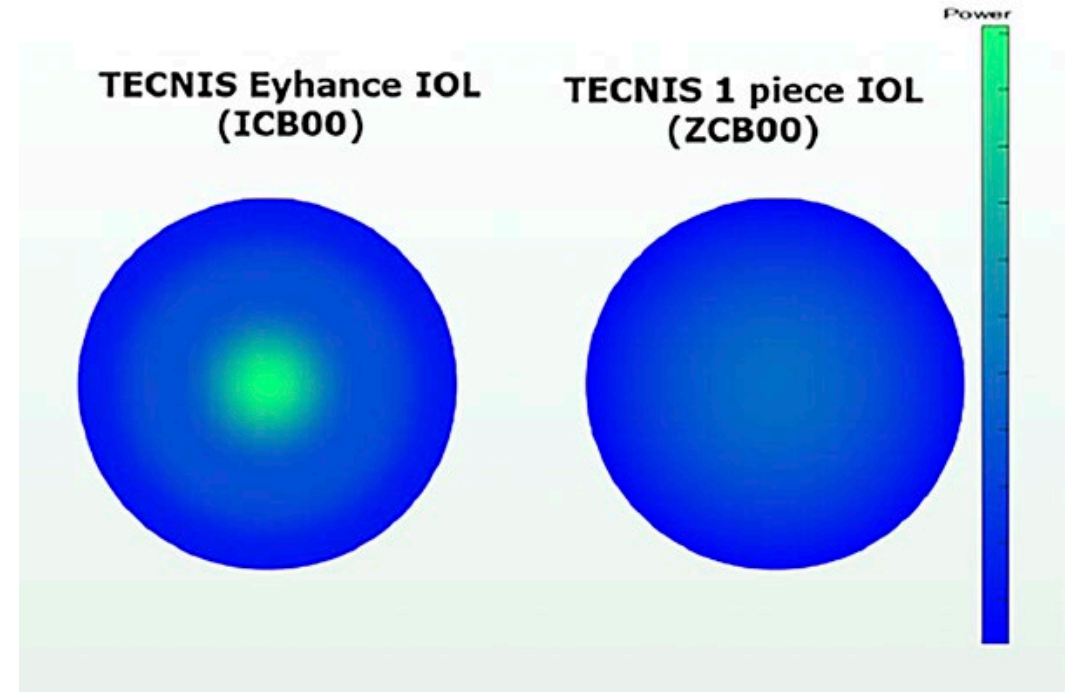


Figure 9: Binocular Mean Defocus Curve with 95% Confidence Limits
by Lens Model at 6 Months Postoperative
All Implanted



EDOF LENSES

- Eyehance – 2021
 - Center of the lens has a slight increase in power which helps to increase the depth of focus
 - This lens is classified as a monofocal lens in the US, but is recognized as an EDOF lens in other countries
 - This lens can be challenging to autorefract post op so the recommendation is to “push plus” to estimate the true refractive error.



IC-8 (AcuFocus)

Small Aperture IOL that utilizes the same pinhole optics that are found in the Kamra corneal inlay

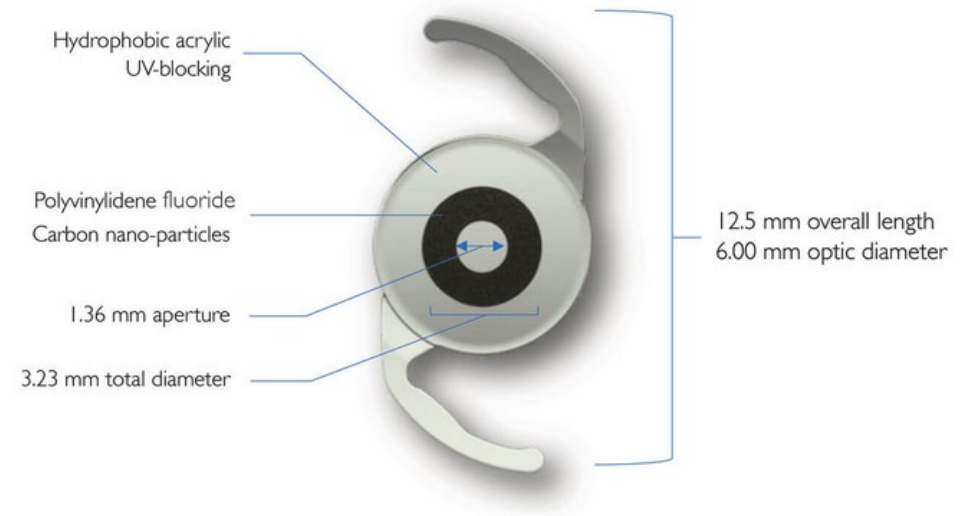
Received FDA approvable letter in December 2021 and will likely receive full approval after inspection of facilities in Q2 of 2022.

Already approved for use in Europe, Argentina, Singapore, Australia and New Zealand

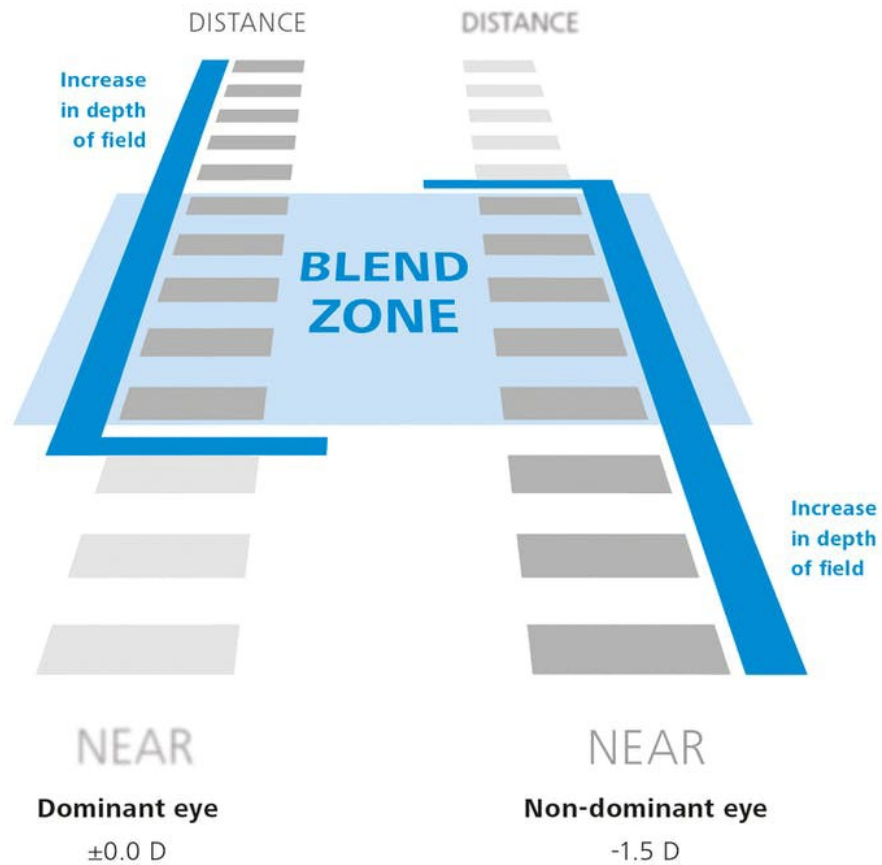
It can provide

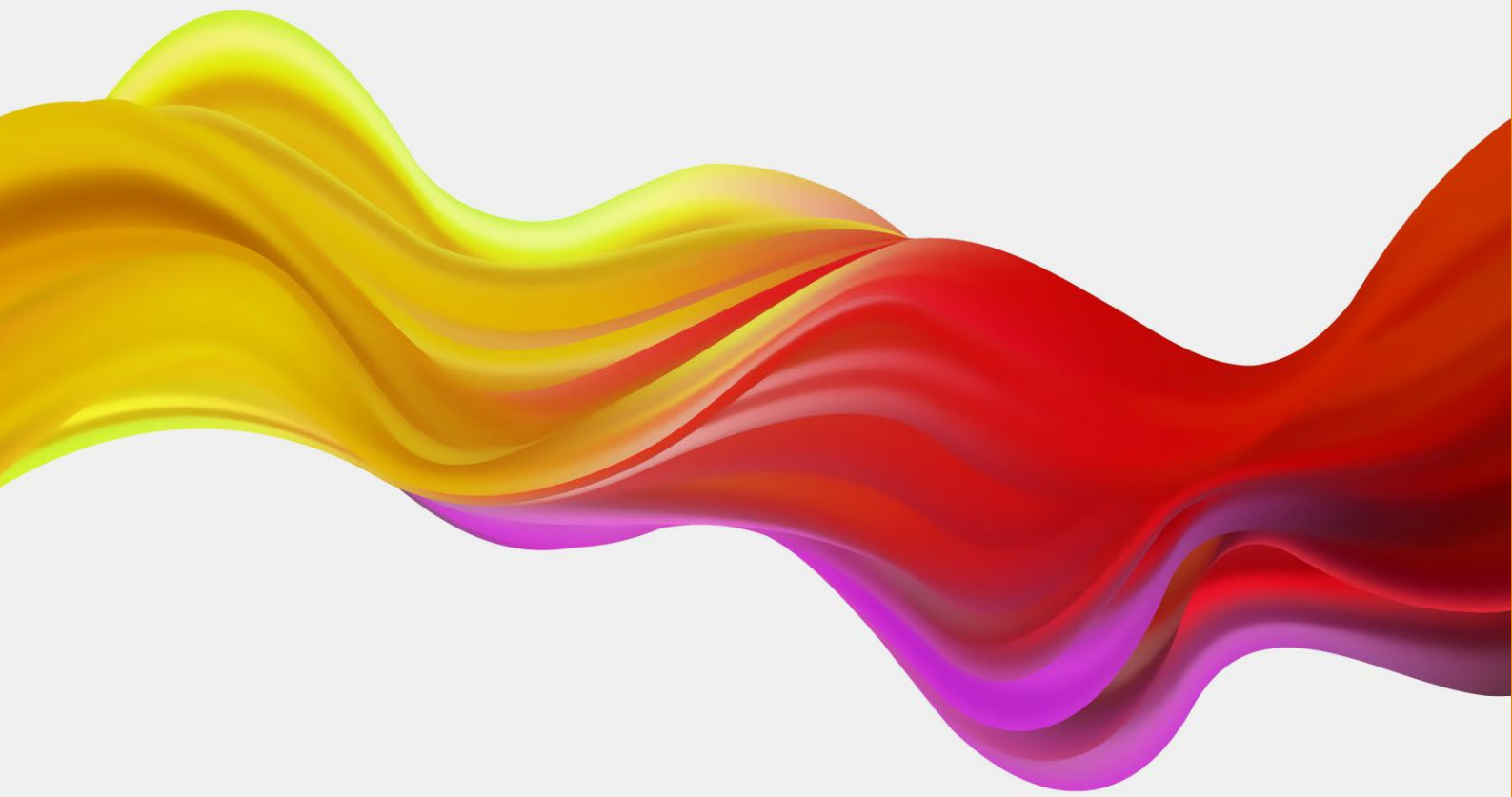
- 3.00D of extended depth of focus (EDOF) range
- 1.00D of deviation from the target manifest (makes it more forgiving)
- 1.50D of astigmatic correction

The IC-8™ Small Aperture IOL



A common strategy





Questions?