SUMMARY OF SAFETY AND EFFECTIVENESS DATA (SSED)

I. GENERAL INFORMATION

Device Generic Name:	Ophthalmic Excimer Laser System
Device Trade Name(s):	iDesign Advanced WaveScan Studio System STAR S4 IR Excimer Laser System
Device Procode:	LZS
Applicant's Name and Address:	AMO Manufacturing USA, LLC. 510 Cottonwood Drive Milpitas, CA 95035
Date of Panel Recommendation:	None

Premarket Approval (PMA) Application Number: P930016/S045

Date of FDA Notice of Approval: November 14, 2016

The ***STAR Excimer Laser System™*** was originally approved on March 27, 1996, under PMA P930016 (http://www.accessdata.fda.gov/cdrh_docs/pdf/p930016.pdf), for the limited indication for myopic photorefractive keratectomy (PRK) using a 6.0 mm ablation zone in patients 18 years of age or older with 1.0 to 6.0 diopters (D) of myopia with astigmatism of < 1.0 D whose refractive change for one year prior to treatment is within < 0.5 D. The original PRK indication was expanded in Supplement 3 (approved April 24, 1997), Supplement 5 (approved January 29, 1998), Supplement 7 (approved November 2, 1998), and Supplement 10 (approved October 18, 2000). The SSED to support each approval for PRK is available on the CDRH website.

On November 19, 1999 (P990010), laser in-situ keratomileusis (LASIK) treatments was added to the approved indications, originally approved for use in patients 18 years of age or older for the reduction or elimination of myopia (nearsightedness) from 0 to -14.0 D with or without -0.50 to -5.0 D of astigmatism. The indication has been further expanded in Supplement 12 (approved April 27, 2001), Supplement 14 (approved November 16, 2001), Supplement 16 (approved May 23, 2003), Supplement 17 (approved December 14, 2004), Supplement 20 (approved March 17, 2005), Supplement 21 (approved August 3, 2005), and Supplement 44 (approved May 6, 2015). The SSED to support each approval for LASIK is available on the CDRH website.

The applicant submitted Supplement 45 to further expand the wavefront-guided LASIK indications to include treatment of patients with mixed astigmatism. The updated clinical data to support the expanded indication is provided in this summary.

II. INDICATIONS FOR USE

The ***STAR S4 IR*** Excimer Laser System and ***iDesign Advanced WaveScan Studio*** System is indicated for wavefront-guided laser assisted in situ keratomileusis (LASIK) in patients:

- with mixed astigmatism as measured by iDesign Advanced WaveScan Studio™ System where the magnitude of cylinder (1.0 to 5.0 D) is greater than the magnitude of sphere, and the cylinder and sphere have opposite signs

- with agreement between manifest refraction (adjusted for optical infinity) and

iDesign Advanced WaveScan Studio System refraction as follows:

- Spherical Equivalent: Magnitude of the difference is less than 0.625 D.

- Cylinder: Magnitude of the difference is less than or equal to 0.5 D.

- 18 years of age or older, and

- with refractive stability (a change of ≤1.0 D in sphere or cylinder for a minimum of 12 months prior to surgery).

III. CONTRAINDICATIONS

The device is contraindicated:

- in patients with collagen vascular, autoimmune or immunodeficiency diseases.

- in pregnant or nursing women

- in patients with signs corneal abnormalities including signs of keratoconus, abnormal corneal topography, epithelial basement membrane disease (EBMD) or degenerations of the structure of the cornea.

- in patients with symptoms of significant dry eye. If the patients have severely dry eyes, LASIK may increase the dryness. This may or may not go away. Severe eye dryness may delay healing of the flap or interfere with the surface of the eye after surgery. It may result in poor vision after LASIK.

- in patients whose corneal thickness would cause the anticipated treatment would violate the posterior 250 microns (μm) of corneal stroma.

- in patients with advanced glaucoma.

- in patients with uncontrolled diabetes.

IV. WARNINGS AND PRECAUTIONS

The warnings and precautions can be found in the ***STAR S4 IR*** Excimer Laser System and ***iDesign Advanced WaveScan Studio*** System labeling.

V. DEVICE DESCRIPTION

A. ***iDesign Advanced WaveScan Studio*** System

The ***iDesign Advanced WaveScan Studio*** System incorporates wavefront aberrometry, auto-refractometry, corneal topography, keratometry, and pupillometry. The System measures the refractive error and wavefront aberrations of the human eye using a high-definition Hartmann-Shack wavefront sensor. The measurements can be used to determine regular (sphero-cylindrical) refractive errors and irregularities (aberrations) that may cause decreased or blurry vision in the human eye.

The function of the Hartmann-Shack sensor is to measure the refractive error of the eye by evaluating the deflection of rays emanating from a small beam of light projected onto the retina and reflected back to the sensor off of the retina. To control the natural accommodation of the eye during ***iDesign Advanced WaveScan Studio*** system imaging, the system incorporates a fogged fixation target.

The ***iDesign Advanced WaveScan Studio*** System optical head projects a beam of light onto the retina. The light reflects back through the optical path of the eye and into the wavefront device. The reflected beam is imaged by a lenslet array onto the charge-coupled device (CCD). Each lens of the array gathers light information (deflection information) from a different region of the pupil to form an image of the light that passes through that region of the pupil. An array of spots is imaged on the CCD sensor. The system compares the locations of the array of spots gathered from the CCD to the theoretical ideal (the ideal plane wave).

The ***iDesign Advanced WaveScan Studio*** System software uses these data to compute the eye's refractive errors and wavefront aberrations using Fourier Transform analysis. The system displays the refractive errors and wavefront aberrations as the optical path difference (OPD) between the measured outgoing wavefront and the ideal plane wave. The ***iDesign Advanced WaveScan Studio*** system software subtracts the refractive errors from the wavefront errors map and displays the higher order aberrations as OPD errors. Regions of the pupil with positive OPD are in front of the ideal plane wave and areas with negative OPD are behind the ideal plane wave.

The target treatment shape is automatically calculated by the ***iDesign Advanced WaveScan Studio*** system from the wavefront data. Once the target shape is established, the software generates the commands for the laser to create the target shape on the cornea. Corneal geometry, represented by the keratometry values, is

taken into account in computing the laser instructions.

Advanced CustomVue ablations for mixed astigmatism are approved for an optical zone of 6.0 mm, and an ablation zone of 9.0 mm. No treatments with a minimum optical zone greater than 6.0 mm were attempted in the U.S. Clinical Trial. The maximum **iDesign Advanced WaveScan Studio** system pupil size for treatment is 9.5 mm. All treatments utilized a variable repetition rate to a maximum of 20 Hz. **Advanced CustomVue** ablations for this PMA are locked out by the **AMO** Treatment Card below 1.0 D cylinder and above 6.0 D cylinder as measured by **iDesign Advanced WaveScan Studio** system.

The final commercial release versions for ***Advanced CustomVue*** are ***iDesign Advanced WaveScan Studio*** system software version 1.3 and **STAR S4 IR** software version 5.32. The ***iDesign Advanced WaveScan Studio*** System software is capable of calculating mixed astigmatism treatments with an optical zone up to 6.5 mm with total ablation zone up to 9.5 mm.

B. ***STAR S4 IR*** Excimer Laser System

The ***STAR S4 IR*** laser system is a 193 nm excimer laser system that delivers spatially scanning ultraviolet pulses of variable shape and size on to the cornea. Pulse shapes may be circles of variable diameter or slits of variable width and orientation. The range of diameters and slit widths available during treatments is 0.65 mm to 6.5 mm. An auto-centering dual camera infrared eye tracking system (***ActiveTrak***), together with the delivery system, aligns the treatment to the eye, and compensates for eye movements during laser correction to maximize the corneal reshaping accuracy. An operating microscope is used to observe the patient procedures and to facilitate accurate focus and laser beam alignment. A debris-removal system is designed to evacuate the debris plume that occurs during ablation. The operating chair and fixation LED align the patient, while a video camera and monitor records the patient treatment.

The variable spot scanning (***VSS***) feature of the laser, used for ***Advanced CustomVue*** treatments delivers variable diameter ultraviolet pulses to precise locations by the scanning delivery system. The ***VSS*** algorithm optimizes the ablation pattern by choosing the best combination of beam diameters and locations to achieve a target shape.

Wavefront-guided treatments using the ***STAR S4 IR*** and ***iDesign Advanced WaveScan Studio*** and ***WaveScan WaveFront*** Systems utilize an automated iris registration system. The angle of rotation of the patient's eye under the laser is determined by comparing features of the iris on the aberrometer image to the same features located in the image of the iris taken using the ***STAR S4 IR*** camera.

Features and components of the ***STAR S4 IR*** System include:

- Excimer Laser
- Gas Management System
- Laser Beam Delivery System
- Patient Management System
- Computer Control
- ***AMO*** Treatment Card

C. Microkeratome

The ***Advanced CustomVue*** procedure required the use of a commercially available keratome that has been cleared for marketing via premarket notification. The keratomes used in this study consisted of femtosecond ophthalmic surgical lasers that create a LASIK flap through precise individual microphotodisruptions of tissue, created by tightly focused ultrashort pulses which are delivered through a disposable applanation lens while fixating the eye under very low vacuum.

VI. ALTERNATIVE PRACTICES AND PROCEDURES

Alternative methods of correcting of visual correction include: glasses, contact lenses, conventional LASIK, photorefractive keratectomy and incisional cornea surgeries. Each alternative has its own advantages and disadvantages. A prospective patient should fully discuss with his/her care provider these alternatives in order to select the correction method that best meets his/her expectation and lifestyle.

VII. MARKETING HISTORY

The ***iDesign Advanced WaveScan Studio*** system is currently approved in the United States for wavefront-guided laser assisted in situ keratomileusis (LASIK) in patients with myopia. The ***iDesign Advanced WaveScan Studio*** system is marketed in approximately 40 countries including; Algeria, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Czech Republic, Denmark, Egypt, Finland, France, Germany, Great Britain, India, Indonesia, Iraq, Ireland, Italy, Japan, Jordan, Malaysia, Mexico, the Netherlands, New Zealand, Poland, Qatar, Singapore, Saudi Arabia, South Africa, South Korea, Spain, Taiwan, Tunisia, Turkey, United Arab Emirates and Yemen. The ***STAR S4 IR*** Excimer Laser system is on market in 70 countries. Neither device has been withdrawn from any country or market for reasons of safety or effectiveness.

VIII. POTENTIAL ADVERSE EFFECTS OF THE DEVICE ON HEALTH

Potential adverse reactions associated with LASIK include: loss of best spectacle corrected visual acuity (BSCVA), worsening of patient complaints such as double vision, sensitivity to bright lights, increased difficulty with night vision, fluctuations in vision, increase in intraocular pressure, corneal haze, secondary surgical intervention, corneal infiltrate or ulcer, corneal epithelial defect, corneal edema, problems associated with the flap including a lost, misplaced or misaligned flap, retinal detachment, and retinal vascular accidents.

Please refer to the complete listing of adverse events and complications observed during the clinical study which are presented in Tables 8 and 9 of the Summary of Clinical Studies section.

IX. SUMMARY OF NONCLINICAL STUDIES

For a summary of nonclinical studies (excluding hazard analysis and software testing) for the STAR S4 IR Excimer Laser System, please refer to the SSED of the original PMA P930016/S44 (http://www.accessdata.fda.gov/cdrh_docs/pdf/P930016S044b.pdf).

X. SUMMARY OF PRIMARY CLINICAL STUDY

A. Study Design

A Prospective Study to Evaluate the Safety and Effectiveness of Wavefront- Guided Lasik Correction of Mixed Astigmatic Refractive Errors with the iDesign Advanced Wavescan Studio™ System and STAR S4 IR™ Excimer Laser System, Protocol STAR-112-IDMA.

The safety and effectiveness of wavefront-guided LASIK correction of mixed astigmatic refractive errors with the iDesign Advanced WaveScan Studio System and STAR S4 IR Excimer Laser System has been evaluated in a clinical investigation. The study is a 2 year, prospective, multicenter, open-label, non- randomized clinical investigation of up to 150 treated eyes (of up to 200 subjects). The study is currently ongoing at seven (7) active sites in the U.S. Enrollment was closed with a total of 149 eyes of 84 subjects enrolled and treated. All subjects have completed the 3 month study visit which has been determined to be the time point of refractive stability and thus the critical time point for analysis for the PMA supplement submission.

1. Clinical Inclusion and Exclusion Criteria

Subjects who agreed to participate provided informed consent and underwent the required screening procedures to determine eligibility. To qualify for enrollment, subjects were to meet all eligibility criteria for each eye. In general, eyes were to be healthy with ***iDesign Advanced WaveScan Studio*** system measured mixed astigmatic refractive error where the magnitude of the cylinder (up to 6.0 D) is

greater than the magnitude of sphere, and the cylinder and sphere have opposite signs.

i. Subject Inclusion Criteria

- At least 18 years of age and give written informed consent. The refractive error, based on the iDesign-displayed refraction selected for treatment ("4.0 Rx calc" at 12.5 mm), must be mixed astigmatism where the magnitude of cylinder (up to 6.0 D) is greater than the magnitude of sphere, and the cylinder and sphere have opposite signs.
- Anticipated postoperative stromal bed thickness of at least 250 microns.
- BSCVA of 20/20 or better.
- Difficulty maintaining UCVA of 20/40 or better (original) or UCVA of 20/32 or worse (modified during the study), with the need for contact lens or glasses.
- Less than or equal to 0.75 D difference between cycloplegic and manifest refraction sphere.
- A stable refractive error over the last 12 months as defined by a change of ≤1.00 D in sphere or cylinder.
- Demonstration of refractive stability for subjects who wear contact lenses: rigid or toric lenses must be removed for at least 3 weeks and soft contact lenses for a least 1 week prior to the first refraction to establish stability.
- Agreement between manifest refraction (adjusted for optical infinity) and ***iDesign*** Advanced WaveScan Studio System refraction chosen for treatment.

ii. Subject Exclusion Criteria

- Women who are pregnant, breast-feeding, or intend to become pregnant over the course of the study, as determined by verbal inquiry.
- Concurrent use of systemic (including inhaled) medications that may impair healing (e.g., corticosteroids).
- History of any of the following medical conditions, or any other condition that could affect wound healing: collagen vascular disease, autoimmune disease, immunodeficiency diseases, ocular herpes zoster or herpes simplex, endocrine disorders (including, but not limited to, unstable thyroid disorders and diabetes), lupus, rheumatoid arthritis, and diabetes (regardless of type, duration, severity or control).
- Subjects with a cardiac pacemaker, implanted defibrillator or other implanted electronic device.
- History of prior intraocular or corneal surgery (including cataract extraction), active ophthalmic disease or abnormality (including, but not limited to, symptomatic blepharitis, recurrent corneal erosion, dry eye syndrome, neovascularization > 1 mm from limbus), retinal detachment/repair, clinically significant lens opacity, clinical evidence of

trauma, corneal opacity within the central 9 mm and visible on topography, at risk for developing strabismus, or with evidence of glaucoma or propensity for narrow angle glaucoma.
- Evidence of keratoconus, corneal dystrophy or irregularity, or abnormal topography.

2. **Follow-up Schedule and Study Procedures**

All eyes were evaluated according to the schedule below.

Clinical Study Visit Schedule

EXAM		VISIT WINDOW
Preoperative Evaluation		
Operative		1-120 days following preoperative exam
1 Day	Postoperative Exam	12-26 hours postoperative
1 Week	Postoperative Exam	5-9 days postoperative
1 Month	Periodic Exam	3-5 weeks postoperative
3 Months	Periodic Exam	10-14 weeks postoperative
6 Months	Periodic Exam	21-26 weeks postoperative
9 Months	Periodic Exam	35-43 weeks postoperative
12 Months	Periodic Exam	11-14 months postoperative
24 Months	Periodic Exam	23-27 months postoperative

Study procedures included uncorrected distance visual acuity, best spectacle corrected distance visual acuity, contrast sensitivity, manifest refraction, cycloplegic refraction, keratometry, intraocular pressure, corneal pachymetry, corneal topography, ***iDesign Advanced WaveScan Studio*** System measurements, slit-lamp evaluation of the anterior segment, subjective questionnaires, and determination of adverse events and complications. Treatment plans were based on preoperative ***iDesign Advanced WaveScan Studio*** system measurements and all eyes were targeted for emmetropia.

3. Clinical Study Endpoints

The key safety and effectiveness endpoint targets, evaluated at the time of refractive stability, are:

i. Safety Endpoint Targets

a) PRIMARY: <5% of eyes with a loss of >2 lines of best spectacle corrected visual Acuity (BSCVA)

b) <1% of eyes with a BSCVA of 20/20 or better preoperatively that have a BSCVA of worse than 20/40 (Note: All eyes had to have BSCVA of 20/20 or better for study inclusion.)

c) <5% of eyes with induced manifest refractive astigmatism >2.00 D (diopters)

d) <1% of eyes with an adverse event (serious, non-flap related)

ii. Effectiveness Endpoint Targets

a) PRIMARY: 85% of eyes with an uncorrected visual acuity (UCVA) of 20/40 or better

b) 50% of eyes with a manifest refractive spherical equivalent (MRSE) within 0.50 D of intended correction.

c) 75% of eyes with an MRSE within 1.00 D of intended correction

d) 95% of eyes achieve refractive stability

Other endpoints included contrast sensitivity, higher order aberrations, complications, visual symptoms, visual functioning and well-being, keratometric analyses, and vector and non-vector analyses of manifest refractive cylinder.

The key outcome variables were assessed postoperatively at the periodic exams. Refractive stability was achieved at 3 months and confirmed at the 6 month visit; therefore, the key safety and effectiveness study endpoints were evaluated at 3 months as the primary study analysis.

No retreatments were performed in the study. Therefore, no safety or effectiveness data are available for the use of the ***iDesign Advanced WaveScan*** *Studio* System and ***STAR S4 IR*** Excimer Laser System in performing a retreatment procedure.

iii. Statistical Methods

Descriptive statistics (including sample size (n), mean, standard deviation (SD), minimum, maximum, as appropriate) and frequency distributions were used to summarize clinical outcomes. Statistical tests and resulting p-values were reported as two-sided and assessed at a 0.05 significance level.

For analysis of refractive outcomes, the sphere component of the manifest refraction (as tested at 4.0 m) was adjusted for optical infinity by adding -0.25 D to the sphere magnitude. Similarly, manifest refraction spherical

equivalent (MRSE) was calculated using the adjusted manifest sphere value. Additionally, all refractions were converted to plus cylinder format and adjusted for vertex distance (12.5 mm).

B. Accountability of PMA Cohort

Eighty four (84) subjects had one or both eyes treated for a total of 149 treated eyes across 7 active clinical sites in the U.S. The majority of subjects were bilaterally treated; 65 subjects (77.4%; 65/84) had both eyes treated, and nineteen subjects (22.6%; 19/84) had a single eye treated.

Table 1 presents the accountability to date for the 149 eyes treated in this study. Subject compliance was excellent; as of database closure on June 6, 2016, all 1 and 3 month visits have been completed with percent accountability rates of 98.0% (146/149) at 1 month, and 100% (149/149) at 3 months. The study is ongoing; 64.4% (96/149) of eyes have completed the 6-month study visit, 59.7% (89/149) of eyes have completed the 9 month visit, 59.1% (88/149) of eyes have completed the 12 month visit, and 46.3% (69/149) of eyes have completed the 24 month visit.

TABLE 1
Accountability of All Treated Eyes (N=149)

Subject Status	1 Day		1 Week		1 Month		3 Months		6 Months		9 Months		12 Months		24 Months	
Available for Analysis	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
- In Interval (included in analysis)	149	100	149	100	146	98.0	149	100	96	64.4	89	59.7	88	59.1	69	46.3
- Out of Interval (included in analysis)	149	100	147	98.7	146	98.0	149	100	94	63.1	89	59.7	85	57.0	68	45.6
Missing Eyes	0	0.0	2	1.3	0	0.0	0	0.0	2	1.3	0	0.0	2	1.3	1	0.7
- Discontinued	0	0.0	0	0.0	3	2.0	0	0.0	3	2.0	4	2.7	6	4.0	17	11.4
- Missed visit	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
- Not seen but accounted for	0	0.0	0	0.0	3	2.0	0	0.0	1	0.7	2	1.3	1	0.7	0	0.0
- Lost-to-follow-up	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Active	0	0.0	0	0.0	0	0.0	0	0.0	2	1.3	2	1.3	5	3.4	17	11.4
- Active (not yet in visit interval)	0	0.0	0	0.0	0	0.0	0	0.0	50	33.6	56	37.6	56	37.6	63	42.3
- In interval or past interval (form not yet	0	0.0	0	0.0	0	0.0	0	0.0	32	21.5	56	37.6	56	37.6	60	40.3
	0	0.0	0	0.0	0	0.0	0	0.0	18	12.1	0	0.0	0	0.0	3	2.0

Percent Accountability[a] (ANSI Z80.11-2012)	100%	100%	98%	100%	97.0%	95.7%	94.6%	80.2%

[a] Percent Accountability = (Available for Analyses x 100) / (Enrolled [treated] – Discontinued – Active)

C. Study Population Demographics and Baseline Parameters

Subject demographics are presented in **Table 2**. The mean age was 36.3 years (SD 10.4 years) and the majority of subjects were Caucasian (86.9%; 73/84). There were more males (53.6%; 45/84) than females (46.4%; 39/84). Most subjects (79.8%; 67/84) did not wear contact lenses preoperatively; the remaining subjects (20.2%; 17/84) wore rigid or toric contact lenses preoperatively.

TABLE 2
Demographic Characteristics

Category	Classification	All Subjects (N=84)	
		n	(%)
Gender	Male	45	(53.6%)
	Female	39	(46.4%)
Race	Caucasian	73	(86.9%)
	Black/African Descent	5	(6.0%)
	Native American/Inuit	1	(1.2%)
	Asian	2	(2.4%)
	Pacific Islander	0	(0.0%)
	Other[a]	3	(3.6%)
Age (Years)	Mean	36.3	
	SD	10.36	
	Min	18	
	Max	58	
Contact Lens History	No	67	(79.8%)
	Soft	0	(0.0%)
	Rigid/Toric	17	(20.2%)

[a] Other race includes Part Filipino, Middle Eastern and Hispanic.

Table 3 presents the mean preoperative manifest and ***iDesign Advanced WaveScan Studio*** system measured refractive error for the 149 treated eyes. Mean preoperative refractive measurements were comparable between manifest refraction and ***iDesign Advanced WaveScan Studio*** system refraction.

TABLE 3
Mean Preoperative Manifest and iDesign AWS Refractive Errors in Diopters
All Eyes N=149

Refractive Variable	Mean	Std Dev	Median	Min	Max
Manifest Refraction Spherical Equivalent	-0.58	0.84	-0.75	-2.38	2.00
Manifest Refractive Cylinder (MRC)	2.99	1.16	2.75	0.75	6.00
iDesign Spherical Equivalent (IDSE)	-0.43	0.83	-0.52	-2.28	2.27
iDesign Refractive Cylinder (IDC)	2.99	1.14	2.72	0.87	5.80

Tables 4 and **5** present the preoperative refractive error bin distributions for the study population based on preoperative ***iDesign Advanced WaveScan Studio*** system measurements.
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TABLE 4
Preoperative Refractive Error Stratified by iDesign AWS Sphere and Cylinder
All Eyes (N=149)

iDesign Sphere	>1 to <=2 D[a]	>2 to <=3 D	>3 to <=4 D	>4 to <=5 D	>5 to <=6 D	Total
	N	N	N	N	N	N
<=0 to >=-1 D	10	10	6	4	0	**30**
<-1 to >=-2 D	16	31	6	1	1	**55**
<-2 to >=-3 D	0	22	14	4	1	**41**
<-3 to >=-4 D	0	0	4	8	4	**16**
<-4 to >=-5 D	0	0	0	3	4	**7**
Total	**26**	**63**	**30**	**20**	**10**	**149**

[a] Includes one eye with iDesign Cylinder <1D (0.87 D)

Treatment of diopter ranges indicated by shaded rows and columns is locked out by *AMO* Treatment Card

Note: % Percentage is calculated by dividing the n(bin)/N(149).

TABLE 5
Preoperative Refractive Error Stratified by iDesign AWS Spherical Equivalent (SE) and Cylinder, All Eyes (N=149)

iDesign SE	>1 to <=2 D[a]	>2 to <=3 D	>3 to <=4 D	>4 to <=5 D	>5 to <=6 D	Total
	N	N	N	N	N	N
>1 D	0	0	5	4	1	**10**
>0 to <= 1 D	5	13	6	1	0	**25**
<=0 to >=-1 D	21	39	12	6	4	**82**
<-1 to >=-2 D	0	11	7	7	4	**29**
<-2 to >=-3 D	0	0	0	2	1	**3**
<-3 to >=-4 D	0	0	0	0	0	**0**
<-4 to >=-5 D	0	0	0	0	0	**0**
Total	**26**	**63**	**30**	**20**	**10**	**149**

[a] Includes one eye with iDesign Cylinder <1D (0.87 D)

Treatment of diopter ranges indicated by shaded rows and columns is locked out by *AMO* Treatment Card

Note: % Percentage is calculated by dividing the n(bin)/N(149).

D. Safety and Effectiveness Results

As refractive stability was achieved at 3 months, and confirmed at 6 months, the key safety and effectiveness study endpoints were evaluated at 3 months for all treated eyes (N = 149).

1. Safety Results

A summary of key safety variables over time is presented in **Table 6** for all eyes.

a) *Less than 5% of eyes with a loss of >2 lines BSCVA:* At 3 months, no eyes (0.0%; 0/149) had a decrease in BSCVA of >2 lines meeting the primary study endpoint safety target of <5% of eyes with a loss of >2 lines of BSCVA.

b) *Less than 1% of eyes with a BSCVA of 20/20 or better preoperatively that have a BSCVA of worse than 20/40:* No eyes (0%; 0/149) had preoperative BSCVA of 20/20 or better but worse than 20/40 postoperatively at 3 months or any time during the study, meeting the safety endpoint target of <1% of eyes with preoperative BSCVA of 20/20 or better having BSCVA worse than 20/40 postoperatively.

c) *Less than 5% of eyes with induced manifest* refractive astigmatism >2.00 diopters: At 3 months, no eyes (0%; 0/149) had induced manifest refractive astigmatism >2.00 D, meeting the safety criterion of <5% of eyes with induced manifest refractive astigmatism >2.00 D.

TABLE 6
Key Safety Variables Over Time
All Eyes (N=149)

Safety Variable	1 Week (n=149)	1 Month (n=146)	3 Months (n=149)	6 Months (n=96)	9 Months (n=89)	12 Months (n=88)	24 Months (n=69)
	n %	n %	n %	n %	n %	n %	n %
Loss of > 2 lines BSCVA[a]	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Loss of ≥ 2 lines BSCVA	0 0.0%	1 0.7%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
BSCVA worse than 20/25	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
BSCVA worse than 20/40[b]	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Induced Manifest Cylinder >2.0 D[c]	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%

[a] **Safety endpoint target:** <5% of eyes with loss of >2 lines BSCVA vs. preoperative

[b] **Safety endpoint target:** <1% of eyes with BSCVA of 20/20 or better preoperative have BSCVA of worse than 20/40 postoperative. All eyes had preoperative BSCVA of 20/20 or better.

[c] **Safety endpoint target:** <5% of eyes with induced manifest refractive astigmatism >2.00 D

% = n/N (100)

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per time period.

d) *BSCVA Preservation*

The change in lines of BSCVA postoperatively compared to preoperatively for all eyes is presented in **Table 7**. At 3 months, 42.3% (63/149) of eyes had at least a one (1) line improvement in BSCVA compared to preoperatively. No eyes were reported with a loss of >2 lines of BSCVA at any visit (scheduled or unscheduled).

TABLE 7
Change in BSCVA Over Time vs. Preoperative
All Eyes (N=149)

Acuity Change	1 Week		1 Month		3 Months		6 Months		9 Months		12 Months		24 Months	
	n	%	N	%	n	%	n	%	n	%	n	%	n	%
>2 line increase	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	1.4%
2 line increase	5	3.4%	6	4.1%	13	8.7%	11	11.5%	16	18.0%	8	9.1%	5	7.2%
1 line increase	39	26.2%	54	37.0%	50	33.6%	43	44.8%	39	43.8%	44	50.0%	36	52.2%
No change	90	60.4%	80	54.8%	82	55.0%	38	39.6%	32	36.0%	33	37.5%	24	34.8%
1 line decrease	15	10.1%	5	3.4%	4	2.7%	4	4.2%	2	2.2%	3	3.4%	3	4.3%
2 line decrease	0	0.0%	1	0.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
>2 line decrease	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
All	149		146		149		96		89		88		69	

Percentage calculated based on non-missing values. % = n/N (100)

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per time period.

e) Adverse Events

A summary of adverse events (following the ANSI Guidance Document for Corneal Reshaping, Z80.11-2012) is presented in **Table 8**. There were no occurrences of the ANSI-specific adverse events in this study (0%, 0/149). There was one case of non- serious, device-related TLSS (0.7%; 1/149) which resolved within 1 month. One (1) additional eye (0.7%; 1/149) experienced two (2) complications (trace DLK and epithelial ingrowth) which required treatment during the first month and these events were classified as non-serious, device-related adverse events. Thus, a total of two (2) eyes (1.3%;2/149) experienced non-serious, device-related adverse events in this study.

Less than 1% of eyes with an adverse event (serious, non-flap related): No serious ocular adverse events have been reported in this study (0%; 0/149). As such, the safety criterion for the overall rate of serious, non-flap related, adverse events (< 1%) was achieved.

TABLE 8
Summary of Adverse Events Over Time; All Eyes (N=149)

Complication	< 1 Month (n=149)		1 Month (n=146)		3 Months (n=149)		6 Months (n=96)		9 Months (n=89)		12 Months (n=88)		24 Months (n=69)		Cumulative (n=149)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Corneal infiltrate or ulcer	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Any persistent corneal epithelial defect at 1 month or later			0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Corneal edema at 1 month or later (specify "flap", "bed", or both)			0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Epithelium in the interface with loss of 2 lines (≥10 letters) or more of BSCVA	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Miscreated flap (decentered, lost, incomplete, too thin, or other)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Melting of the flap	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
IOP with increase >10 mmHg above baseline on two consecutive examinations or an IOP >30 mmHg on two consecutive examinations	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Haze beyond 6 months with loss of 2 lines or greater (≥10 letters)							0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Ocular penetration	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Severe glare, dry eye, or halos at 3 months or later					0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Decrease in BSCVA of greater than or equal to 2 lines (≥10 letters) not due to irregular astigmatism, at 3 months or later					0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Any other vision-threatening event	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Diffuse Lamellar Keratitis (DLK, grade 3 or above)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Retinal detachment	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Retinal vascular accidents	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other adverse events:																
Transient Light Sensitivity Syndrome	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7
Trace diffuse lamellar keratitis (DLK) requiring extended treatment	1[a]	0.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1[a]	0.7
Epithelial ingrowth requiring removal	1[a]	0.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1[a]	0.7

Shaded areas represent time frames outside event definition

[a] Same eye.

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per time period.

f) *Complications*

Complications that occurred during the study are presented in **Table 9**. Complications are defined as anticipated, transient, and non-sight-threatening events. There were no reports of corneal epithelial defects or diffuse lamellar keratitis (DLK; grade 2 or less) at 1 month or later. There were reports of epithelium in the interface (epithelial ingrowth) over time (4.0% at 3 months) but all were either trace or mild in severity (further details in Section 7.4.5, Anterior Segment Evaluation). There were also reports of foreign body sensation and pain at 1 month or later (7.4 % and 2.0% at 3 months, respectively) but most of these were reported as mild.

TABLE 9
Summary of Complications Over Time
All Eyes (N=149)

Complication		<1 Month (n=149)		1 Month (n=146)		3 Months (n=149)		6 Months (n=96)		9 Months (n=89)		12 Months (n=88)		24 Months (n=69)		Cumulative (n=149)	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Corneal edema between 1 week and 1 month after procedure	Total[a]	0	0.0														
	Cornea	*0*	*0.0*														
	Flap	*0*	*0.0*														
Peripheral corneal epithelial defect at 1 month or later (location of defect to be identified as on, off, or across the flap)				0	0.0	0	0.0	0	0.0	0	0.0	0	0.0			0	0.0
Epithelium in the interface	Total[a]	2	1.3	5	3.4	6	4.0	5	5.2	4	4.5	3	3.4	1	1.4	8	5.4
(epithelial ingrowth; trace/mild)	*Cornea*	*2*	*1.3*	*5*	*3.4*	*5*	*3.4*	*4*	*4.2*	*3*	*3.4*	*3*	*3.4*	*1*	*1.4*	*7*	*4.7*
	Flap	*0*	*0.0*	*0*	*0.0*	*1*	*0.7*	*1*	*1.0*	*1*	*1.1*	*0*	*0.0*	*0*	*0.0*	*1*	*0.7*
Diffuse Lamellar Keratitis	Total[a]	3[b]	2.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3[b]	2.0
(DLK, Grade 2 or less)	*Cornea*	*3[b]*	*2.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*3[b]*	*2.0*
	Flap	*0[b]*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*
Foreign body sensation at 1 month or later				17[c]	11.6	11[c]	7.4	2[c]	2.1	5[c]	5.6	3[c]	3.4	1[c]	1.4	22[c]	14.8
Pain at 1 month or later				5[d]	3.4	3[d]	2.0	4[d]	4.2	0	0.0	4[d]	4.5	5[d]	7.2	17[d]	11.4

Shaded areas represent time frames outside complication definition.

[a] Finding noted on cornea and flap; no duplicate reports at the same visit.

[b] All reports of DLK were Grade 2 (mild) or less.

[c] Most reports were mild; 6 moderate reports at 1 month. All reports at 3, 6, 9, 12, and 24 months were mild. No marked or severe reports.

[d] Most reports were mild; 1 moderate report at 1 month, 2 moderate reports at 3 months, and 1 moderate report at 24 months. All reports at 6, 9, 12, and 24 months were mild. No marked or severe reports.

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per time period.

g) *Directed Visual Symptoms*

Table 10 presents subjective visual symptoms at preoperative, 3 months and 6 months from the "directed symptom assessment" as reported by subjects when specifically queried about each symptom at study visits. The directed symptom assessment questionnaire was not evaluated for its ability to validly assess patient- reported visual symptoms. Reports of subjective visual symptoms were typical following LASIK refractive procedures. Preoperatively, night glare, halos and difficulty driving at night were reported with the highest severity ("Severe"). At 3 months, there were no reports of "severe" symptoms and the visual symptoms reported with the highest severity ("marked") included photophobia, and dryness. There were no "marked" or "severe" reports at 6 months or later.

Post-hoc analyses of the change in the number of reports of moderate, marked, and severe reports at 3 months vs. preoperative and at 6 months vs. preoperative (**Table 11**) showed an increase in reports of dryness (7.4% at 3 months; 6.3% at 6 months) as well as reductions in reports of photophobia (-4.2% at 6 months), day glare (-4.7% at 3 months; -6.3% at 6 months), night glare (-10.7% at 3 months; -16.7% at 6 months,), halos (-10.7% at 3 months; -12.5% at 6 months), and driving at night (-15.4% at 3 months; -25.0% at 6 months).

TABLE 10
Directed Visual Symptoms at Preoperative, 3 Months, and 6 Months
All Eyes (N=149)

		None		Mild		Moderate		Marked		Severe	
Symptom	**Visit**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Pain	Preop	138	92.6%	11	7.4%	0	0.0%	0	0.0%	0	0.0%
	3 Months	146	98.0%	1	0.7%	2	1.3%	0	0.0%	0	0.0%
	6 Months	92	95.8%	4	4.2%	0	0.0%	0	0.0%	0	0.0%
Tearing	Preop	127	85.2%	22	14.8%	0	0.0%	0	0.0%	0	0.0%
	3 Months	140	94.0%	7	4.7%	2	1.3%	0	0.0%	0	0.0%
	6 Months	92	95.8%	4	4.2%	0	0.0%	0	0.0%	0	0.0%
Photophobia	Preop	132	88.6%	13	8.7%	3	2.0%	1	0.7%	0	0.0%
	3 Months	118	79.2%	26	17.4%	4	2.7%	1	0.7%	0	0.0%
	6 Months	82	85.4%	14	14.6%	0	0.0%	0	0.0%	0	0.0%
Foreign Body Sensation	Preop	147	98.7%	2	1.3%	0	0.0%	0	0.0%	0	0.0%
	3 Months	138	92.6%	11	7.4%	0	0.0%	0	0.0%	0	0.0%
	6 Months	94	97.9%	2	2.1%	0	0.0%	0	0.0%	0	0.0%
Dryness	Preop	100	67.1%	44	29.5%	5	3.4%	0	0.0%	0	0.0%
	3 Months	76	51.0%	57	38.3%	14	9.4%	2	1.3%	0	0.0%
	6 Months	42	43.8%	43	44.8%	11	11.5%	0	0.0%	0	0.0%
Fluctuation of Vision	Preop	120	80.5%	26	17.4%	3	2.0%	0	0.0%	0	0.0%
	3 Months	105	70.5%	39	26.2%	5	3.4%	0	0.0%	0	0.0%
	6 Months	74	77.1%	22	22.9%	0	0.0%	0	0.0%	0	0.0%
Day Glare	Preop	112	75.2%	30	20.1%	6	4.0%	1	0.7%	0	0.0%
	3 Months	137	91.9%	12	8.1%	0	0.0%	0	0.0%	0	0.0%
	6 Months	83	86.5%	12	12.5%	1	1.0%	0	0.0%	0	0.0%
Night Glare	Preop	87	58.4%	43	28.9%	16	10.7%	2	1.3%	1	0.7%
	3 Months	106	71.1%	40	26.8%	3	2.0%	0	0.0%	0	0.0%
	6 Months	73	76.0%	22	22.9%	1	1.0%	0	0.0%	0	0.0%
Binocular Diplopia	Preop	147	98.7%	0	0.0%	2	1.3%	0	0.0%	0	0.0%
	3 Months	145	97.3%	4	2.7%	0	0.0%	0	0.0%	0	0.0%
	6 Months	96	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Monocular Diplopia	Preop	147	98.7%	2	1.3%	0	0.0%	0	0.0%	0	0.0%
	3 Months	147	98.7%	2	1.3%	0	0.0%	0	0.0%	0	0.0%
	6 Months	96	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Ghosting	Preop	143	96.0%	4	2.7%	2	1.3%	0	0.0%	0	0.0%
	3 Months	142	95.3%	6	4.0%	1	0.7%	0	0.0%	0	0.0%
	6 Months	89	92.7%	7	7.3%	0	0.0%	0	0.0%	0	0.0%
Halos	Preop	74	49.7%	55	36.9%	18	12.1%	1	0.7%	1	0.7%
	3 Months	86	57.7%	59	39.6%	4	2.7%	0	0.0%	0	0.0%
	6 Months	64	66.7%	28	29.2%	4	4.2%	0	0.0%	0	0.0%
Difficulty Driving at Night	Preop	75	50.3%	46	30.9%	25	16.8%	2	1.3%	1	0.7%
	3 Months	122	81.9%	22	14.8%	5	3.4%	0	0.0%	0	0.0%
	6 Months	79	82.3%	17	17.7%	0	0.0%	0	0.0%	0	0.0%

Note: The non-shaded areas indicate reports of visual symptoms.
Note: Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes.

TABLE 11
Changes in Moderate/Marked/Severe Visual Symptoms vs. Preoperative
At 3 Months: All Eyes (N=149)

	Preoperative				3 Months				Difference[a] in Moderate, Marked & Severe Symptoms
	None & Mild		Moderate, Marked & Severe		None & Mild		Moderate, Marked & Severe		
Symptoms	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**%**
Pain Tearing	149	100.0%	0	0.0%	147	98.7%	2	1.3%	1.3%
Photophobia	149	100.0%	0	0.0%	147	98.7%	2	1.3%	1.3%
Foreign Body Sensation	145	97.3%	4	2.7%	144	96.6%	5	3.4%	0.7%
Dryness Vision	149	100.0%	0	0.0%	149	100.0%	0	0.0%	0.0%
Fluctuation Day	144	96.6%	5	3.4%	133	89.3%	16	10.7%	7.4%
Glare	146	98.0%	3	2.0%	144	96.6%	5	3.4%	1.3%
Night Glare	142	95.3%	7	4.7%	149	100.0%	0	0.0%	-4.7%
Binocular Diplopia	130	87.2%	19	12.8%	146	98.0%	3	2.0%	-10.7%
Monocular Diplopia	147	98.7%	2	1.3%	149	100.0%	0	0.0%	-1.3%
Ghosting	149	100.0%	0	0.0%	149	100.0%	0	0.0%	0.0%
Halos	147	98.7%	2	1.3%	148	99.3%	1	0.7%	-0.7%
Driving at night	129	86.6%	20	13.4%	145	97.3%	4	2.7%	-10.7%
	121	81.2%	28	18.8%	144	96.6%	5	3.4%	-15.4%

[a] Difference= 3 months minus preoperative

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes (149).

At 6 Months: All Eyes (N= 96)

	Preoperative				6 Months				Difference[b] in Moderate, Marked & Severe Symptoms
	None & Mild		Moderate, Marked & Severe		None & Mild		Moderate, Marked & Severe		
Symptoms	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**%**
Pain Tearing	96	100.0%	0	0.0%	96	100.0%	0	0.0%	0.0%
Photophobia	96	100.0%	0	0.0%	96	100.0%	0	0.0%	0.0%
Foreign Body Sensation	92	95.8%	4	4.2%	96	100.0%	0	0.0%	-4.2%
Dryness Vision	96	100.0%	0	0.0%	96	100.0%	0	0.0%	0.0%
Fluctuation Day	91	94.8%	5	5.2%	85	88.5%	11	11.5%	6.3%
Glare	93	96.9%	3	3.1%	96	100.0%	0	0.0%	-3.1%
Night Glare	89	92.7%	7	7.3%	95	99.0%	1	1.0%	-6.3%
Binocular Diplopia	79	82.3%	17	17.7%	95	99.0%	1	1.0%	-16.7%
Monocular Diplopia	96	100.0%	0	0.0%	96	100.0%	0	0.0%	0.0%
Ghosting	96	100.0%	0	0.0%	96	100.0%	0	0.0%	0.0%
Halos	94	97.9%	2	2.1%	96	100.0%	0	0.0%	-2.1%
Driving at night	80	83.3%	16	16.7%	92	95.8%	4	4.2%	-12.5%
	72	75.0%	24	25.0%	96	100.0%	0	0.0%	-25.0%

[b] Difference= 3 months minus preoperative

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes (96).

h) *Contrast Sensitivity*

Monocular best corrected distance contrast sensitivity was evaluated preoperatively and postoperatively at 3, 6, and 12 months under mesopic (3 cd/m^2) conditions with and without glare and photopic (85 cd/m^2) conditions without glare at 4 spatial frequencies (3, 6, 12, and 18 cycles per degree, cpd). As shown in **Table 12**, at 3 months, under all three lighting conditions, the mean changes in contrast sensitivity were all positive indicating an increase in contrast sensitivity postoperatively, and nearly all were statistically significant after adjusting for multiplicity (**$p \leq 0.036$**). Statistically significant improvements under all lighting conditions were found at the 12 cpd spatial frequency (**$p < 0.0001$**) with mean changes of up to 0.17 log units. Additionally, there were statistically significant improvements at the 6 cpd spatial frequency under mesopic conditions with and without glare conditions (**$p \leq 0.007$**) and at the 18 cpd spatial frequency under photopic and mesopic without glare condition (**$p \leq 0.006$**). **Table 13** presents the number of eyes unable to see the reference patterns at each spatial frequency and lighting condition at preoperative and 3,6,12 and 24 months. At 3 months, there were fewer eyes that were unable to see the reference patterns (up to 2.7%) compared to preoperatively (up to 8.1%). As shown in **Table 14**, most eyes (≥90%) had either no change or clinically significant improvements in contrast sensitivity (0.30 log units or more at two or more spatial frequencies) under all lighting conditions at 3 months vs. preoperative. Under all lighting conditions, there was approximately a three-fold increase in the proportions of eyes with clinically significant increases (14.8% to 30.2%) compared to decreases (4.7% to 8.7%) at 3 months. Overall, there were positive changes in mean contrast sensitivity postoperatively and most eyes experiencing either no change or an improvement in contrast sensitivity postoperatively compared to preoperatively.

TABLE 12
Mean Change in Contrast Sensitivity at 3,6,12 and 24 Months From Preoperative
All Eyes (N=149)

	Preoperative (n=149)				Change from Preoperative to 3 months (n=149)				Change from Preoperative to 6 months (n=96)			
Lighting Condition	**3 cpd**	**6 cpd**	**12 cpd**	**18 cpd**	**3 cpd**	**6 cpd**	**12 cpd**	**18 cpd**	**3 cpd**	**6 cpd**	**12 cpd**	**18 cpd**
Photopic w/o Glare												
Mean (Log units)	1.71	1.94	1.59	<1.13	0.03	0.04	0.09	>0.07	0.06	0.06	0.10	0.12
SE	0.015	0.016	0.024	>0.023	0.015	0.016	0.023	>0.022	0.018	0.022	0.033	0.031
P-Value	-	-	-	-	**0.036**	**0.018**	**0.000**	**0.001**	**0.001**	**0.011**	**0.002**	**0.000**
Adjusted P-value					0.075	0.072	**0.000**	**0.006**				
Mesopic w/o Glare												
Mean (Log units)	1.64	<1.69	<1.22	<0.75	0.04	>0.08	>0.13	>0.13	0.07	>0.13	>0.16	>0.18
SE	0.016	>0.021	>0.031	>0.030	0.019	>0.024	>0.033	>0.030	0.024	>0.029	>0.041	>0.036
P-Value	-	-	-	-	0.068	**0.001**	**0.000**	**0.000**	**0.005**	**0.000**	**0.000**	**0.000**
Adjusted P-value					0.075	**0.007**	**0.000**	**0.000**				
Mesopic w/ Glare												
Mean (Log units)	1.63	<1.66	<1.15	<0.76	0.03	>0.08	>0.17	>0.08	0.06	>0.14	>0.21	>0.09
SE	0.017	>0.024	>0.030	>0.030	0.015	>0.022	>0.034	>0.031	0.022	>0.032	>0.045	>0.040
P-Value	-	-	-	-	**0.025**	**0.000**	**0.000**	**0.010**	**0.008**	**0.000**	**0.000**	**0.024**
Adjusted P-value					0.075	**0.000**	**0.000**	0.050				

SE = standard error

Positive values for ‘change from preoperative' represent increase in contrast sensitivity scores.

Eyes that were unable to see the reference patterns were assigned the reference pattern scores. Therefore, mean scores at preoperative may be less than (<) values and SE maybe greater than (>) values if any eyes were unable to see the reference patterns. If no eyes were unable to see the reference patterns, then means and SEs are equal to the values. Mean changes from preoperative and standard errors are greater than (>) values when more eyes were unable to see the reference patterns preoperatively than postoperatively. P-values are based on one sample t-test. P-value of 0.000 represents p-value of <0.0001. Multiplicity adjusted p-values for the change from preoperative to 3 months based on the Bonferroni step-down (Holm's step-down) method.

(continued) Mean Change in Contrast Sensitivity

	Preoperative (n=149)				Change from Preoperative to 12 months (n=149)				Change from Preoperative to 24 months (n=96)			
Lighting Condition	**3 cpd**	**6 cpd**	**12 cpd**	**18 cpd**	**3 cpd**	**6 cpd**	**12 cpd**	**18 cpd**	**3 cpd**	**6 cpd**	**12 cpd**	**18 cpd**
Photopic w/o Glare												
Mean (Log units)	1.71	1.94	1.59	<1.13	0.03	0.07	0.15	0.13	0.05	0.01	<0.01	<-0.03
SE	0.015	0.016	0.024	>0.023	0.021	0.025	0.035	0.032	0.025	0.034	>0.055	>0.053
P-Value	-	-	-	-	0.105	**0.004**	**0.000**	**0.000**	0.063	0.846	0.904	0.627
Adjusted P-value												
Mesopic w/o Glare												
Mean (Log units)	1.64	<1.69	<1.22	<0.75	0.08	>0.17	>0.17	>0.17	0.05	>0.18	>0.18	0.14
SE	0.016	>0.021	>0.031	>0.030	0.022	>0.030	>0.052	>0.045	0.024	>0.035	>0.055	0.054
P-Value	-	-	-	-	**0.001**	**0.000**	**0.001**	**0.000**	0.052	**0.000**	**0.002**	**0.010**
Adjusted P-value												
Mesopic w/ Glare												
Mean (Log units)	1.63	<1.66	<1.15	<0.76	0.07	>0.16	>0.18	>0.19	0.06	>0.13	>0.14	<0.08
SE P-	0.017	>0.024	>0.030	>0.030	0.024	>0.032	>0.047	>0.044	0.025	>0.036	>0.055	>0.057
Value	-	-	-	-	**0.003**	**0.000**	**0.000**	**0.000**	**0.022**	**0.001**	**0.011**	0.178
Adjusted P-value												

SE = standard error

Positive values for ‘change from preoperative' represent increase in contrast sensitivity scores.

Eyes that were unable to see the reference patterns were assigned the reference pattern scores. Therefore, mean scores at preoperative may be less than (<) values and SE maybe greater than (>) values if any eyes were unable to see the reference patterns. If no eyes were unable to see the reference patterns, then means and SEs are equal to the values. Mean changes from preoperative and standard errors are greater than (>) values when more eyes were unable to see the reference patterns preoperatively than postoperatively. P-values are based on one sample t-test. P-value of 0.000 represents p-value of <0.0001. Multiplicity adjusted p-values for the change from preoperative to 3 months based on the Bonferroni step-down (Holm's step-down) method.

TABLE 13
Proportions of Eyes Unable to See the Contrast Sensitivity Reference Patterns at Preoperative and 3 Months
All Eyes (N=149)

Lighting Condition	Spatial Frequency	Preoperative n	Preoperative %	3 Months n	3 Months %
Photopic without Glare	3.0 cpd	0	0.0%	0	0.0%
	6.0 cpd	0	0.0%	0	0.0%
	12.0 cpd	0	0.0%	0	0.0%
	18.0 cpd	1	0.7%	0	0.0%
Mesopic without Glare	3.0 cpd	0	0.0%	0	0.0%
	6.0 cpd	3	2.0%	0	0.0%
	12.0 cpd	7	4.7%	1	0.7%
	18.0 cpd	12	8.1%	4	2.7%
Mesopic with Glare	3.0 cpd	0	0.0%	0	0.0%
	6.0 cpd	4	2.7%	0	0.0%
	12.0 cpd	9	6.0%	4	2.7%
	18.0 cpd	11	7.4%	4	2.7%

TABLE 14
Clinically Significant Changes[a] in Contrast Sensitivity at 3,6,12 and 24 Months from Preoperative

	3 Months (n=149)				6 Months (n=96)			
	Decrease n %	No change n %	Increase n %	Not reported n	Decrease n %	No change n %	Increase n %	Not reported n
Photopic without Glare	7 4.7%	120 80.5%	22 14.8%	0	7 7.3%	66 68.8%	23 24.0%	0
Mesopic without Glare	13 8.7%	91 61.1%	45 30.2%	0	8 8.3%	55 57.3%	33 34.4%	0
Mesopic with Glare	11 7.4%	101 67.8%	37 24.8%	0	9 9.4%	61 63.5%	26 27.1%	0

	12 Months (n=88)				24 Months (n=88)			
	Decrease n %	No change n %	Increase n %	Not reported n	Decrease n %	No change n %	Increase n %	Not reported n
Photopic without Glare	4 4.5%	62 70.5%	22 25.0%	0	10 14.5%	44 63.8%	15 21.7%	0
Mesopic without Glare	8 9.1%	46 52.3%	34 38.6%	0	4 5.8%	40 58.0%	25 36.2%	0
Mesopic with Glare	7 8.0%	44 50.0%	37 42.0%	0	9 13.0%	36 52.2%	24 34.8%	0

Confidence Intervals calculated based on Clopper-Pearson Exact method.

Percentages calculated based on non-missing values.

[a]A difference of ≥0.30 log units from preoperative at 2 or more spatial frequencies is considered a clinically significant change in contrast sensitivity.

i) Higher Order Aberrations

As shown in **Table 15**, analyses of higher order aberrations (HOA) showed that HOA root mean square (RMS; absolute value) increased postoperatively, mostly associated with an increase in secondary astigmatism. Spherical aberration (signed) was reduced postoperatively. All other higher order aberration terms, on average, increased by no more than 0.01 µm with 4 mm standardized wavefront diameters.

TABLE 15
Higher Order Aberrations (HOA) RMS (µm) at Preoperative and ,6,9, 12 and 24 Months with 4 mm Standardized Wavefront Diameters

	Preoperative (n=146) Mean +/- SD	1 Month (n=139) Mean +/- SD	3 Months (n=142) Mean +/- SD	6 Months (n=93) Mean +/- SD	9 Months (n=85) Mean +/- SD	12 Months (n=84) Mean +/- SD	24 Months (n=61) Mean +/- SD
HOA RMS (um)	0.12 +/- 0.05	0.15 +/- 0.08	0.14 +/- 0.09	0.14 +/- 0.07	0.13 +/- 0.06	0.13 +/- 0.07	0.13 +/- 0.06
Coma	0.07 +/- 0.04	0.08 +/- 0.06	0.08 +/- 0.06	0.08 +/- 0.06	0.07 +/- 0.05	0.08 +/- 0.05	0.08 +/- 0.05
Spherical Aberration	0.04 +/- 0.03	0.04 +/- 0.03	0.04 +/- 0.04	0.03 +/- 0.03	0.03 +/- 0.03	0.03 +/- 0.03	0.03 +/- 0.02
Trefoil	0.06 +/- 0.04	0.07 +/- 0.05	0.07 +/- 0.06	0.07 +/- 0.05	0.07 +/- 0.05	0.07 +/- 0.04	0.07 +/- 0.04
Secondary Coma	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01
Secondary Astigmatism	0.03 +/- 0.02	0.05 +/- 0.04	0.04 +/- 0.04	0.04 +/- 0.03	0.04 +/- 0.03	0.04 +/- 0.03	0.04 +/- 0.03
Secondary Spherical	0.00 +/- 0.00	0.00 +/- 0.00	0.00 +/- 0.00	0.00 +/- 0.00	0.00 +/- 0.00	0.00 +/- 0.00	0.00 +/- 0.00
Tetrafoil	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01
Fifth Order	0.01 +/- 0.01	0.02 +/- 0.01	0.02 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.02 +/- 0.01
Sixth Order	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01
Spherical Aberration	0.03 +/- 0.03	-0.01 +/- 0.05	-0.01 +/- 0.05	0.00 +/- 0.04	0.00 +/- 0.04	0.00 +/- 0.05	0.01 +/- 0.04
iDesign Spherical Equivalent (D)a	-0.43 +/- 0.83	0.18 +/- 0.58	0.15 +/- 0.47	0.16 +/- 0.45	0.21 +/- 0.44	0.17 +/- 0.45	0.15 +/- 0.47
iDesign Cylinder magnitude (D)a	2.99 +/- 1.14	0.51 +/- 0.30	0.51 +/- 0.31	0.55 +/- 0.27	0.55 +/- 0.28	0.58 +/- 0.29	0.57 +/- 0.30

[a] Low order aberrations from 4.0 mm iDesign measurements collected by sites.

2. Effectiveness Results

A summary of the key effectiveness variables over time is presented in **Table 16** for all eyes.

a) *85% of eyes with a UCVA of 20/40 or better:* At 3 months, UCVA of 20/40 or better was achieved in 100% (149/149) of eyes, exceeding the primary study effectiveness endpoint target of 85% of eyes with 20/40 or better UCVA. Furthermore at 3 months, 91.9% (137/149) of eyes were 20/20 or better and 57.0% (85/149) were 20/16 or better. Overall, the proportions of eyes that achieved UCVA of 20/40 or better exceeded the target rate (85%) across all postoperative study visits.

b) *Proportion of eyes with an MRSE within 0.50 D and 1.00 D of intended correction:* The secondary effectiveness endpoints pertaining to the accuracy of treatment were met at 3 months with 90.6% (135/149) of eyes having MRSE within 0.50 D of emmetropia and 97.3% (145/149) within 1.00 D, exceeding the study endpoint targets of 50% within 0.50 D and 75% within 1.00 D. Additionally at 3 months, all eyes (100.0%; 149/149) had MRSE within 2.00 D.

The key effectiveness variables at 3 months stratified by preoperative IDSE are presented in **Table 17**. UCVA and MRSE effectiveness endpoints were met for all preoperative IDSE groups with 100.0% of eyes achieving UCVA of 20/40 or better (target ≥85%), ≥82.8% of eyes achieving MRSE within 0.50 D (target ≥50%), and ≥89.7% of eyes achieving MRSE within 1.00 D (target ≥75%).

TABLE 16
Key Effectiveness Variables Over Time
All Eyes (N=149)

Effectiveness Variable	1 Month (n=146) n %	3 Months (n=149) n %	6 Months (n=96) n %	9 Months (n=89) n %	12 Months (n=88) n %	24 Months (n=69) n %
UCVA 20/16 or better	74 50.7%	85 57.0%	61 63.5%	55 61.8%	55 62.5%	45 65.2%
UCVA 20/20 or better	134 91.8%	137 91.9%	88 91.7%	82 92.1%	81 92.0%	60 87.0%
UCVA 20/40 or better[a]	145 99.3%	149 100%	96 100%	89 100%	88 100%	67 97.1%
MRSE +/- 0.50 D[b]	127 87.0%	135 90.6%	80 83.3%	80 89.9%	75 85.2%	56 81.2%
MRSE +/- 1.00 D[c]	144 98.6%	145 97.3%	95 99.0%	87 97.8%	87 98.9%	66 95.7%
MRSE +/- 2.00 D	146 100%	149 100%	96 100%	89 100%	88 100%	69 100%

[a] **Study endpoint target**: 85% of eyes 20/40 or better UCVA

[b] **Study endpoint target:** 50% of eyes within 0.50 D MRSE

[c] **Study endpoint target**: 75% of eyes within 1.00 D MRSE

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per time period.

TABLE 17
Key UCVA and MRSE Variables at 3 Months by Preop iDesign AWS Spherical Equivalent (IDSE), All Eyes (N=149)

Preoperative IDSE Diopter Group (n)	UCVA 20/20 or better n %	UCVA 20/40 or better[a] n %	MRSE within 0.50 D[b] n %	MRSE within 1.00 D[c] n %
>1 D (n=10)	8 80.0%	10 100%	9 90.0%	10 100%
≤ 1 to > 0 D (n=25)	22 88.0%	25 100%	23 92.0%	24 96.0%
≤ 0 to ≥ -1 D (n=82)	79 96.3%	82 100%	76 92.7%	82 100%
<-1 to ≥ -2 D (n=29)	26 89.7%	29 100%	24 82.8%	26 89.7%
<-2 to ≥ -3 D (n=3)	2 66.7%	3 100%	3 100%	3 100%
Total (N=149)	137 91.9%	149 100%	135 90.6%	145 97.3%

[a] Study endpoint target: 85% of eyes 20/40 or better UCVA

[b] Study endpoint target: 50% of eyes within 0.50 D MRSE

[c] Study endpoint target: 75% of eyes within 1.00 D MRSE

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per diopter row.

The key effectiveness variables at 3 months stratified by preoperative IDC are presented in **Table 18**. UCVA and MRSE effectiveness endpoints were met

for all preoperative IDC groups with 100.0% of eyes achieving UCVA of 20/40 or better (target ≥85%), ≥80.0% of eyes achieving MRSE within 0.50 D (target ≥50%), and ≥90.0% of eyes achieving MRSE within 1.00 D (target ≥75%).

TABLE 18
Key UCVA and MRSE Variables at 3 Months
by Preoperative iDesign AWS Cylinder (IDC)
All Eyes (N=149)

Preoperative IDC Diopter Group (n)	UCVA 20/20 or better	UCVA 20/40 or better[b]	MRSE within 0.50 D[c]	MRSE within 1.00 D[d]
	n %	n %	n %	n %
>1[a] to ≤ 2 D (n=26)	26 100%	26 100%	23 88.5%	26 100%
>2 to ≤ 3 D (n=63)	60 95.2%	63 100%	59 93.7%	63 100%
>3 to ≤ 4 D (n=30)	26 86.7%	30 100%	29 96.7%	29 96.7%
>4 to ≤ 5 D (n=20)	17 85.0%	20 100%	16 80.0%	18 90.0%
>5 to ≤ 6 D (n=10)	8 80.0%	10 100%	8 80.0%	9 90.0%
Total (N=149)	137 91.9%	149 100%	135 90.6%	145 97.3%

[a] Includes one eye with iDesign Cylinder <1D (0.87 D)

[b] Study endpoint target: 85% of eyes 20/40 or better UCVA

[d] Study endpoint target: 50% of eyes within 0.50 D MRSE

[d] Study endpoint target: 75% of eyes within 1.00 D MRSE

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per diopter row.

Table 19 presents the distribution of UCVA results over time for all eyes. Postoperatively, the proportions of eyes that achieved UCVA of 20/40 or better (≥97%) exceeded the target rate (≥85%) across all postoperative study visits. The majority (≥51%) of eyes achieved 20/16 or better UCVA across all postoperative study visits.

TABLE 19
UCVA Over Time
All Eyes (N=149)

Acuity	Preoperative (n=149) n %	1 Month (n=146) n %	3 Months (n=149) n %	6 Months (n=96) n %	9 Months (n=89) n %	12 Months (n=88) n %	24 Months (n=69) n %
20/10 or better	0 0.0%	0 0.0%	3 2.0%	3 3.1%	3 3.4%	2 2.3%	2 2.9%
20/12.5 or better	0 0.0%	16 11.0%	19 12.8%	14 14.6%	19 21.3%	11 12.5%	7 10.1%
20/16 or better	0 0.0%	74 50.7%	85 57.0%	61 63.5%	55 61.8%	55 62.5%	45 65.2%
20/20 or better	0 0.0%	134 91.8%	137 91.9%	88 91.7%	82 92.1%	81 92.0%	60 87.0%
20/25 or better	0 0.0%	143 97.9%	146 98.0%	90 93.8%	86 96.6%	86 97.7%	65 94.2%
20/32 or better	4 2.7%	145 99.3%	149 100%	95 99.0%	88 98.9%	86 97.7%	66 95.7%
20/40 or better	20 13.4%	145 99.3%	149 100%	96 100%	89 100%	88 100%	67 97.1%
20/50 or better	57 38.3%	146 100%	149 100%	96 100%	89 100%	88 100%	68 98.6%
20/63 or better	91 61.1%	146 100%	149 100%	96 100%	89 100%	88 100%	69 100%
20/80 or better	107 71.8%	146 100%	149 100%	96 100%	89 100%	88 100%	69 100%
20/100 or better	130 87.2%	146 100%	149 100%	96 100%	89 100%	88 100%	69 100%
Worse than 20/100	19 12.8%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%

[a] Preoperatively, 0.0% (0/149) of eyes achieved UCVA of 20/20
[b] Preoperatively, 13.4% (20/149) of eyes achieved UCVA of 20/40

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per time period

Table 20 presents the differences in postoperative UCVA achieved compared to preoperative best spectacle corrected visual acuity (BSCVA) for all eyes. At 3 months, 83.9% (125/149) of eyes achieved the same or better acuity level postoperatively without correction as preoperatively with correction.

TABLE 20
Postoperative UCVA Compared to Preoperative BSCVA All Eyes (N=149)

Acuity	1 Month (n=146)		3 Months (n=149)		6 Months (n=96)		9 Months (n=89)		12 Months (n=88)		24 Months (n=69)	
	N	%	n	%	n	%	n	%	n	%	n	%
> 2 lines better	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
2 lines better	2	1.4%	6	4.0%	8	8.3%	10	11.2%	3	3.4%	2	2.9%
1 line better	38	26.0%	46	30.9%	27	28.1%	30	33.7%	34	38.6%	22	31.9%
No change	86	58.9%	73	49.0%	43	44.8%	31	34.8%	33	37.5%	29	42.0%
1 lines worse	14	9.6%	20	13.4%	12	12.5%	14	15.7%	15	17.0%	11	15.9%
2 lines worse	5	3.4%	4	2.7%	5	5.2%	1	1.1%	1	1.1%	2	2.9%
> 2 lines worse	1	0.7%	0	0.0%	1	1.0%	3	3.4%	2	2.3%	3	4.3%
Not Reported	0		0		0		0		0		0	

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per time period

c) *95% of eyes achieve refractive stability:* Refractive stability was achieved at the 3 month study visit based on analyses performed using both a consecutive cohort (eyes with data at for at least two (2) consecutive study visits) and a consistent cohort (eyes with data at all periodic study exams through the stability point and at the confirmatory point). Results were similar between the two (2) cohorts and the criteria for determining refractive stability for both MRSE and MRC were met at 3 months, and confirmed at 6 months, in both cohorts. As shown in **Tables 21-22**, at least 95% of eyes had ≤1.00 D of change in MRSE (≥97.3%) and MRC (98.6%) between any two (2) visits, meeting the criterion of ≥95% of eyes with ≤1.00 D of change in MRSE and MRC. The mean rate of change was ≤0.007 D/month for MRSE and MRC between consecutive visits, meeting the criterion of ≤0.04 D/month. Also, the 95% confidence intervals of the mean rates of change in MRSE and MRC between consecutive exams included zero or a rate of change attributable to normal aging.

TABLE 21
Stability of Manifest Refraction Spherical Equivalent (MRSE)
Consecutive Cohort[a]

Distributions	Between 1 & 3 Months (n=146) n %	Between 3 & 6 Months (n=96) n %	Between 6 & 9 Months (n=89) n %	Between 9 & 12 Months (n=87) n %	Between 12 & 24 Months (n=69) n %
Change in MRSE by <=0.50 D	133 91.1%	87 90.6%	82 92.1%	86 98.9%	65 94.2%
Change in MRSE by <=1.00 D	142 97.3%	96 100%	89 100%	86 98.9%	68 98.6%
Mean Outcomes	D +/-SD	D +/-SD	D +/-SD	D +/-SD	D +/-SD
Mean Change in MRSE	0.007 +/- 0.347	-0.058 +/- 0.327	0.063 +/- 0.260	-0.046 +/- 0.244	-0.022 +/- 0.298
Mean Change Per Month	0.003	-0.019	0.021	-0.015	-0.002

Change defined as current visit value minus previous visit value

Confidence Intervals calculated based on Clopper-Pearson Exact method

[a] Includes only eyes with data at two consecutive visits

TABLE 22
Stability of Absolute (Non-vector) Cylinder Consecutive Cohort[a]

Magnitude of Change in Non-vector Cylinder Distributions	Between 1 & 3 Months (n=146) n %	Between 3 & 6 Months (n=96) n %	Between 6 & 9 Months (n=89) n %	Between 9 & 12 Months (n=87) n %	Between 12 & 24 Months (n=69) n %
Eyes with <=0.50 D Change	142 97.3%	92 95.8%	88 98.9%	85 97.7%	67 97.1%
Eyes with <=1.00 D Change	146 100%	96 100%	89 100%	87 100%	68 98.6%
Mean Outcomes (D)					
Mean Change between Visit	-0.014	0.003	0.042	0.052	-0.022
SD	0.252	0.289	0.259	0.253	0.308
Mean Change Per Year	-0.082	0.01	0.169	0.207	-0.022
Mean Change Per Month	-0.007	0.001	0.014	0.017	-0.002

Change defined as current visit value minus previous visit value
Confidence Intervals calculated based on Clopper-Pearson Exact method
[a] Includes only eyes with data at two consecutive visits

Mean manifest refractive outcomes over time are presented in **Table 23**. At 3 months, mean MRSE was -0.13 D (SD 0.39 D).

TABLE 23
Mean Refractive Outcomes Over Time
All Eyes (N=149)

Variable	Preoperative n=149	1 Month n=146	3 Months n=149	6 Months n=96	9 Months n=89	12 Months n=88	24 Months n=69
MRSE (D) +/-SD	-0.58 +/- 0.84	-0.14 +/- 0.38	-0.13 +/- 0.39	-0.16 +/- 0.39	-0.08 +/- 0.40	-0.13 +/- 0.42	-0.17 +/- 0.47
MRS (D) +/-SD	-2.07 +/- 1.05	-0.29+/- 0.39	-0.27+/- 0.40	-0.34+/- 0.39	-0.27+/- 0.36	-0.34+/- 0.39	-0.36+/- 0.46
MRC (D) +/-SD	2.99 +/- 1.16	0.30+/- 0.30	0.29+/- 0.29	0.34+/- 0.30	0.38+/- 0.33	0.42+/- 0.33	0.38+/- 0.32

MRSE = manifest refraction spherical equivalent
MRS = manifest refractive sphere
MRC = manifest refractive cylinder

Table 24 presents the proportions of eyes with residual manifest cylinder magnitude at 3 months and the absolute shift in axis from preoperative. At 3 months, an axis shift of >30^{o} from preoperative was noted for 26.8% (40/149) of eyes, and ten (25%; 10/40) of these eyes had a residual cylinder magnitude >0.50 D to 1.00 D. Nine (9) of these eyes achieved a UCVA of 20/25 or better; one (1) eye achieved a UCVA of 20/32.

TABLE 24
Residual Astigmatic Axis Error (Non-Vector) at 3 Months
All Eyes (N=149)

Residual Manifest Cylinder Magnitude	Absolute Shift in Axis							
	-- Change[a] (n=56)	0° (n=5)	>0 to ≤ 5° (n=11)	>5 to ≤ 10° (n=10)	>10 to ≤ 15° (n=9)	>15 to ≤ 30° (n=18)	>30° (n=40)	Total (N=149)
	n %	n %	n %	n %	n %	n %	n %	n %
0.00 D	56 100%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	56 37.6%
>0.00 to ≤ 0.50 D	0 0.0%	1 20.0%	9 81.8%	8 80.0%	7 77.8%	18 100%	30 75.0%	73 49.0%
0.00 to ≤ 1.00 D	0 0.0%	4 80.0%	2 18.2%	2 20.0%	2 22.2%	0 0.0%	10 25.0%	20 13.4%
Total	**56 100**	**5 100**	**11 100**	**10 100**	**9 100**	**18 100**	**40 100**	**149 100**

Percentage is calculated based on non-missing values.

[a] No change in axis was calculated due to zero diopters (0.00 D) of manifest refractive cylinder at 3 months.

Note: % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per column

Vector analysis summary statistics at 3 months are presented in **Table 25**. At 3 months, the mean absolute error vector (EV) magnitude was less than 0.50 D (0.29 D; SD 0.29 D), the mean correction ratio (CR; ratio of surgically induced refractive change to intended refractive change) was close to 1.0 (0.98; SD 0.11) and the mean error ratio (ER) was close to zero (0.10; SD 0.10).

TABLE 25
Vector Analysis Summary at 3 Months
All Eyes (N=149)

Preoperative Cylinder Magnitude	n	|IRC| (Mean+/-SD)	|SIRC| (Mean+/-SD)	|EV| (Mean+/-SD)	CR (Mean+/-SD)	ER (Mean+/-SD)
All	149	2.99 +/- 1.16	2.90 +/- 1.10	0.29 +/- 0.29	0.98 +/- 0.11	0.10 +/- 0.10
≥ 1.00 D to ≤ 2.00 D	34	1.65 +/- 0.32	1.62 +/- 0.38	0.17 +/- 0.19	0.98 +/- 0.12	0.10 +/- 0.12
>2.00 D to ≤ 3.00 D	59	2.57 +/- 0.25	2.58 +/- 0.41	0.31 +/- 0.29	1.00 +/- 0.13	0.12 +/- 0.12
>3.00 D to ≤ 4.00 D	28	3.56 +/- 0.26	3.42 +/- 0.40	0.28 +/- 0.30	0.96 +/- 0.10	0.08 +/- 0.08
>4.00 D to ≤ 5.00 D	18	4.56 +/- 0.27	4.29 +/- 0.43	0.43 +/- 0.29	0.94 +/- 0.07	0.10 +/- 0.07
>5.00 D to ≤ 6.00 D	10	5.53 +/- 0.25	5.18 +/- 0.43	0.38 +/- 0.36	0.94 +/- 0.06	0.07 +/- 0.07

IRC = Intended refractive change
SIRC = Surgically induced refractive change
EV = Error vector (IRC-SIRC)
CR = Correction ratio (SIRC/IRC) ER = Error ratio (EV/IRC)

3. Factors Associated with Outcomes

Covariate analyses of the preoperative variables found to have a difference among sites (contact lens wear, preoperative IDSE and preoperative IDS) and the factors found to be associated with primary effectiveness outcomes (preoperative IDS and IDC, and site) were performed. The results showed that none of the interactions with site were statistically significant. Additionally, demographic and preoperative variables were not found to have statistically significant effects on outcomes and there were no differences in outcomes due to the modified inclusion criterion. Thus, all data from all sites are poolable. Covariate analyses of significant factors showed that preoperative ***iDesign Advanced WaveScan Studio*** system refractive cylinder (IDC) had an effect on the accuracy of postoperative MRSE within 1.00 D. However, all outcomes stratification results met or exceeded study targets based on the factors evaluated.

4. Device Failures and Replacements

There were no laser failures or replacements during the course of this study. There were six (6) ***iDesign Advanced WaveScan Studio*** system failures during the course of this study. None of these replaced units impacted patient outcomes or were associated with adverse events. Two (2) returns were not related to a device failure or malfunction. The first return was due to user dissatisfaction with the Hartman-Shack display screen on the device. The second return was for root cause analysis of a user workflow issue. The remaining four (4) ***iDesign Advanced WaveScan Studio*** system were replaced due to software issue or hardware malfunction/failure isolated to the specific device. Three (3) hardware related failures were due to a faulty USB port. The fourth failure was due to the installed software that was not enabled.

5. Pediatric Extrapolation

In this premarket application, existing clinical data was not leveraged to support approval of a pediatric patient population (18 to 21 years old).

E. Financial Disclosure

The Financial Disclosure by Clinical Investigators regulation (21 CFR 54) requires applicants who submit a marketing application to include certain information concerning the compensation to, and financial interests and arrangement of, any clinical investigator conducting clinical studies covered by the regulation. The clinical study, *A Prospective Study to Evaluate the Safety and Effectiveness of Wavefront-Guided Lasik Correction of Mixed Astigmatic Refractive Errors with the iDesign Advanced Wavescan Studio™ System and STAR S4 IR™ Excimer Laser System, Protocol STAR-112-IDMA,* included eight (8) investigators. None of the clinical investigators had disclosable financial interests/arrangements as defined in sections 54.2(a), (b), (c), and (f). The information provided does not raise any questions about the reliability of the data.

XI. SUMMARY OF SUPPLEMENTAL CLINICAL INFORMATION

One (1) prior clinical investigation on LASIK correction using the iDesign Advanced WaveScan Studio system was conducted that included the treatment of eyes with mixed astigmatism. An AMO-sponsored, prospective clinical investigation was conducted in Canada in 2011 under an Investigational Testing Authorization to evaluate performance and acceptability of LASIK treatment using the iDesign Advanced WaveScan Studio System. Of the 143 eyes treated in the study, 16 underwent treatment for mixed astigmatism and were evaluated through 6 months. All eyes (100%; 16/16) achieved UCVA of 20/20 or better and 81.3% (13/16) achieved 20/16 or better.

XII. PANEL RECOMMENDATIONS

In accordance with the provisions of section 515(c)(3) of the act as amended by the Safe Medical Devices Act of 1990, this PMA was not referred to the Ophthalmic Devices Panel, an FDA advisory committee, for review and recommendation because the information in the PMA substantially duplicates information previously reviewed by this panel.

XIII. CONCLUSIONS DRAWN FROM PRECLINICAL AND CLINICAL STUDIES

A. Effectiveness Conclusions

In the clinical investigation of wavefront-guided LASIK correction of mixed astigmatic refractive errors with the ***iDesign Advanced WaveScan Studio*** System and Star S4 IR™ Excimer Laser System, effectiveness outcomes exceeded study targets. Refractive stability was achieved at 3 months; at this time, the proportion of eyes with a UCVA of 20/40 or better (Target ≥85%; ***iDesign AWS*** 100%), and the proportions of eyes that achieve MRSE within 0.50 D (Target ≥50%; ***iDesign AWS*** 90.6%) and 1.00 D (Target ≥75%; ***iDesign AWS*** 97.3%) also exceeded the target values. Intended vs. achieved and

mean MRSE outcomes at 3 months were acceptable to meet the targets. Overall, the accuracy of treatment in this study exceeded all endpoint targets and all criteria for effectiveness were met.

B. Safety Conclusions

In the clinical investigation of wavefront-guided LASIK correction of mixed astigmatic refractive errors with the ***iDesign Advanced WaveScan Studio*** System and Star S4 IR™ Excimer Laser System, safety outcomes were found to be acceptable and met the safety targets. At 3 months, the proportion of eyes with >2 line loss of BSCVA (Target <5%; ***iDesign AWS*** 0.0%), the proportion of eyes with BSCVA worse than 20/40 (Target <1%; ***iDesign AWS*** 0%), the proportion of eyes with induced manifest refractive astigmatism >2.00 D (Target <5%; ***iDesign AWS*** 0.0%), and the rate of serious, ocular adverse events (Target <1%; ***iDesign AWS*** 0.0%) were within target values. Additionally, rates of typical LASIK-related complications and adverse events were low. Two (2) eyes (1.3%;2/149) experienced non-serious, device-related events.

Improvements in contrast sensitivity were found at 3 months. Subjective symptoms were typical following LASIK refractive procedures. Additionally, using the NEI-RQL-42 questionnaire, no worsening of vision-related well-being or visual functioning were found at 3 months following LASIK correction of mixed astigmatism with the iDesign Advanced WaveScan Studio system and Star S4 IR™ Excimer Laser system.

C. Benefit-Risk Determination

The probable benefits of wavefront-guided LASIK correction of mixed astigmatic refractive errors using the iDesign Advanced WaveScan Studio System and Star S4 IR Excimer Laser System, are based on data collected in a clinical study conducted to support PMA approval, as described above. The benefits of this treatment include the following:

a. Long-lasting benefit for a defined and predictable patient group with a non-life-threatening, well-characterized corneal refractive condition (mixed-astigmatism)
b. Improved uncorrected distance visual acuity
c. Excellent accuracy of treatment with early refractive stability (3 months)
d. No worsening in subjective visual functioning and well-being
e. Strong safety profile including maintenance of best corrected distance acuity, no induction of cylinder, and no occurrences of serious, device-related adverse events

Additional factors to be considered in determining probable risks and benefits of wavefront-guided LASIK correction of mixed astigmatic refractive errors using the iDesign Advanced WaveScan Studio System and Star S4 IR Excimer Laser System, include:

a. The results of the clinical study can be considered generalizable to the intended market or target patient population.
b. No significant study data quality or data integrity issues were identified in the study.
c. The magnitude of the benefit is substantial, as can be seen in the achievement of all study endpoints.
d. No test subject from the U.S. clinical study experienced serious adverse events.
e. The incidence of subjective reports of dryness was slightly higher postoperatively than preoperatively; however, the incidence rates of subjective reports of night glare, halos, and difficulty driving at night were lower postoperatively.
f. The risks associated with wavefront-guided LASIK correction of mixed astigmatic refractive errors using the iDesign Advanced WaveScan Studio System and Star S4 IR Excimer Laser System are mitigated by special controls such as appropriate testing, labeling, post-market product surveillance, and adverse event reporting.
g. Alternative treatments exist and include conventional LASIK, photorefractive keratectomy (PRK), incisional cornea surgeries or glasses/contacts.
h. Device-related risks may be present, but they are tolerable to patients because they are disclosed, quantified, and outweighed by medical benefits as evidenced by excellent clinical outcomes and improvements in subjective visual functioning.
i. The decision as to whether or not to undergo wavefront-guided LASIK treatment for mixed astigmatism is driven by surgeon opinion and patient preference.

Overall, based on the clinical trial results and published literature, there is reasonable assurance that the benefits of wavefront-guided LASIK correction of mixed astigmatic refractive errors for the proposed indication using the iDesign Advanced WaveScan Studio System and Star S4 IR Excimer Laser System outweigh the risks.

1. Patient Perspectives

The patient's perspective was assessed both preoperatively and postoperatively in the study using the National Eye Institute-Refractive Error Quality of Life instrument (NEI-RQL-42) as well as a directed symptom assessment. Both questionnaires could not be determined to be a reliable measure of visual well- being by FDA. Results of the NEI-RQL-42 questionnaire assessing binocular subjective visual functioning and well-being showed no worsening following treatment with the iDesign Advanced WaveScan Studio System. At 3 months, the NEI-RQL showed no worsening of subjective visual functioning and well-being following mixed astigmatic LASIK correction with the iDesign Advanced WaveScan Studio System and Star S4 IR Excimer Laser System. Reports of dryness increased postoperatively; however, reports of day glare, night glare, halos, difficulty driving at night and photophobia decreased postoperatively. Most

symptom reports were “mild” and there were no reports of “marked” or “severe” symptoms at 6 months or later.

D. **Overall Conclusions**

Results of the pre-clinical and clinical investigation demonstrate the safety and effectiveness of wavefront-guided LASIK correction of mixed astigmatic refractive errors with the ***iDesign Advanced WaveScan Studio*** System and Star S4 IR™ Excimer Laser System. All effectiveness endpoint targets at 3 months were exceeded demonstrating the ability of the ***iDesign Advanced WaveScan Studio*** system in conjunction with the Star S4 IR™ Excimer Laser to provide excellent uncorrected visual acuity with accurate and stable refractive outcomes. Additionally, all safety endpoint targets were achieved at 3 months with low rates of adverse events, no loss of BSCVA >2 lines or BSCVA worse than 20/40, no induced manifest refractive astigmatism >2.00 D, improved contrast sensitivity, and increased subjective vision-related well-being and visual functioning. Based on these results, there is reasonable assurance of the safety and effectiveness of wavefront-guided LASIK correction of mixed astigmatic refractive errors for the proposed indication using the ***iDesign Advanced WaveScan Studio*** System and Star S4 IR™ Excimer Laser System.

XIV. CDRH DECISION

CDRH issued an approval order on November 14, 2016.

The applicant’s manufacturing facilities have been inspected and found to be in compliance with the device Quality System (QS regulation (21 CFR 820).

XV. APPROVAL SPECIFICATIONS

Directions for use: See device labeling.

Hazards to Health from Use of the Device: See Indications, Contraindications, Warnings, Precautions, and Adverse Events in the device labeling.

Post-approval Requirement and Restrictions: See approval order.