SUMMARY OF SAFETY AND EFFECTIVENESS DATA (SSED)

I. GENERAL INFORMATION

Device Generic Name: Opthalmic Excimer Laser System
Ophthalmic Refractometer

Device Trade Name: ***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 Application (PMA) Number: P930016/S048

Date of FDA Notice of Approval: June 30, 2017

The ***iDESIGN®* *Advanced WaveScan Studio*** System was approved with the ***STAR S4 IR®*** Excimer Laser System for wavefront-guided LASIK for the correction of myopic refractive errors on May 6, 2015, in P930016/S044 and on November 14, 2016, in P930016/S045, for the correction of mixed astigmatic refractive errors.

This Panel-Track Supplement P930016/S048 expands the indication for use to include wavefront-guided LASIK in patients with hyperopia, with and without 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 hyperopia with and without astigmatism as measured by ***iDESIGN®* *Advanced WaveScan Studio®*** System up to +4.00 D spherical equivalent, with up to 2.00 D cylinder
- 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 corneal abnormalities including signs of keratoconus, abnormal corneal topography, epithelial basement membrane disease (EBMD) and degenerations of the structure of the cornea.
- in patients with symptoms of significant dry eyes. 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 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 (AWS) Studio*** System labeling.

V. DEVICE DESCRIPTION

A. ***iDESIGN***®***AWS Studio*** System

The ***iDESIGN***® ***AWS 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-Shackwavefront 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® AWS Studio*** system imaging, the system incorporates a fogged fixation target.

The ***iDESIGN® AWS 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® AWS*** 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® AWS*** 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® AWS*** 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 hyperopia with and without 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® AWS*** 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 above 6.0 D spherical equivalent and above 4.0 D cylinder as measured by ***iDESIGN® AWS*** System.

The final commercial release versions for Advanced CustomVue are ***iDESIGN® AWS*** System software version 1.3 and ***STAR S4 IR®*** software version 5.32. The ***iDESIGN® AWS*** System software is capable of calculating hyperopia 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® AWS*** 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
- 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

There are several other alternatives for the correction of hyperopia. Alternative methods of correcting of visual correction include: glasses, contact lenses, conventional LASIK, PRK and incisional cornea surgeries. Each alternative has its own advantages and disadvantages. A patient should fully discuss these alternatives with his/her physician to select the method that best meets expectations and lifestyle.

VII. MARKETING HISTORY

The ***iDESIGN®*** ***AWS*** System is currently approved in the United States for wavefront-guided LASIK in patients with myopia and mixed astigmatism. The ***iDESIGN®*** ***AWS*** 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

Below is a list of the potential adverse effects (e.g., complications) associated with the use of the device. 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.

For the specific adverse events that occurred in the clinical study, please see Section X below.

IX. SUMMARY OF NONCLINICAL STUDIES

For a summary of the nonclinical studies, please refer to the SSED of the original PMA P930016 (http://www.accessdata.fda.gov/cdrh_docs/pdf/p930016.pdf) and P930016/S44 (http://www.accessdata.fda.gov/cdrh_docs/pdf/P930016S044b.pdf).

X. SUMMARY OF PRIMARY CLINICAL STUDY

The applicant performed a clinical study to establish a reasonable assurance of safety and effectiveness of Wavefront-guided LASIK Correction of Hyperopic Refractive Errors with the ***iDESIGN® AWS*** System and ***STAR S4 IR®*** Excimer Laser System in the US under IDE # G120164. Data from this clinical study were the basis for the PMA approval decision. A summary of the clinical study is presented below.

A. Study Design

Subjects were treated between December 2012 and November 2014. The database for this Panel Track Supplement reflected data collected through March 24, 2016 and included 135 eyes (of 69 subjects). There were 8 investigational sites. As refractive stability was reached at 12 months (and confirmed at 24 months), the key safety and effectiveness endpoints are evaluated at 12 months, and will be considered the critical time point for analysis for the PMA supplement submission.

The study was a 2-year, prospective, multi-center, open-label, non-randomized clinical study. 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).

1. Clinical Inclusion and Exclusion Criteria

   Enrollment in the STAR-111-IDHP study was limited to patients who met the following inclusion 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® AWS*** System measured hyperopia with and without astigmatism with spherical equivalent up to +6.00D with cylinder between 0.00 and +4.00 D cylinder.

Subject Inclusion Criteria

- At least 18 years of age and give written informed consent.
- The refractive error, based on the ***iDESIGN***® System displayed refraction selected for treatment ("4.0 Rx calc" at 12.5 mm) must be hyperopia with or without astigmatism with a maximum spherical equivalent of +6.00 D and cylinder between 0.00 and +4.00 D.
- Anticipated postoperative stromal bed thickness of at least 250 microns.
- BSCVA of 20/20 or better.
- Difficulty maintaining Uncorrected Visual Acuity (UCVA) of 20/40 as evidenced by the need for constant contact lens or spectacle wear.
- 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 at least 1 week prior to the first refraction to establish stability.
- Agreement between manifest refraction (adjusted for optical infinity) and ***iDESIGN***® ***AWS*** System refraction chosen for treatment

Patients were not permitted to enroll in the STAR-111-IDHP study if they met any of the following 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

All patients were scheduled to return for follow-up examinations as follows:

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®*** ***AWS*** System measurements, slit-lamp evaluation of the anterior segment, subjective questionnaires, and determination of adverse events (AEs) and complications. Treatment plans were based on preoperative ***iDESIGN®*** ***AWS*** System measurements and all eyes were targeted for emmetropia.

Preoperatively, study procedures included:

- Directed symptom assessment (monocular assessment)
- The National Eye Institute-Refractive Error Quality of Life instrument (NEI-RQL-42) subjective questionnaire (binocular assessment)
- iDesign system measurement (refraction, aberrometry, topography, keratometry, pupillometry)
- Distance UCVA
- Manifest refraction
- Distance BSCVA
- Auto or manual keratometry
- Corneal topography
- Contrast sensitivity
- Anterior segment examination
- Applanation tonometry
- Pachymetry (ultrasound)
- Cycloplegic refraction
- Dilated fundus examination

Postoperatively, the objective parameters measured during the study included:

- Directed symptom assessment
- UCVA
- Manifest refraction
- BSCVA *(1 week only)*
- Anterior segment examination
- NEI-RQL-42 subjective questionnaire *(at 3-, 6-, 12-, and 24-month exams)*
- ***iDESIGN*** System measurement (refraction, aberrometry, topography, keratometry, pupillometry)
- Distance UCVA
- BSCVA (if ≥2 line loss in BSCVA at 3 months or later, a rigid contact lens over refraction or pin-hole visual acuity should be obtained)
- Auto or manual keratometry
- Corneal topography
- Contrast sensitivity *(at 3-, 6-, 12-, and 24-month exams)*
- Anterior segment examination
- Applanation tonometry
- Pachymetry (ultrasound) *(at 6-month exam only)*
- Cycloplegic refraction *(at 6-, 12-, and 24-month exams)*
- Dilated fundus examination *(at 6-, 12-, and 24-month exams)*

AEs and complications were recorded at all visits.

The key timepoints are shown below in the tables summarizing safety and effectiveness.

3. Clinical Endpoints

With regards to safety, the key endpoint targets, evaluated at the time of refractive stability, are:

a) PRIMARY: <5% of eyes with a loss of >2 lines of 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 diopters (D)

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

With regards to effectiveness, the key endpoint targets, evaluated at the time of refractive stability, are:

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

b) 50% of eyes with a 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 12 months and confirmed at the 24 month visit; therefore, the key safety and effectiveness study endpoints were evaluated at 12 months as the primary study analysis.

B. Accountability of PMA Cohort

At the time of database lock, of 69 patients enrolled in the PMA study, 97% (131/135) patients are available for analysis at the completion of the study, the 12-month visit post-operative visit. 88 eyes (65.2%; 88/135) completed the 24-month exam. The majority of subjects were bilaterally treated; 66 subjects (95.7%; 66/69) had both eyes treated, and three subjects (4.3;3/69) had a single eye treated.**Table 1** presents the accountability to date for the 135 eyes treated in this study.

TABLE 1
Accountability of All Hyperopic Eyes (N=135)

	1 day	1 week	1 month	3 months	6 months	9 months	12 months	24 months
Subject Status	**n %**	**n %**	**n %**	**n %**	**n %**	**n %**	**n %**	**n %**
Available for Analysis	135 100	135 100	134 99.3	135 100	134 99.3	130 96.3	131 97.0	88 65.2
- In Interval - (included in - analysis)	135 100	133 98.5	130 96.3	135 100	134 99.3	128 94.8	124 91.9	88 65.2
- Out of Interval - (included in - analysis)	0 0.0	2 1.5	4 3.0	0 0.0	0 0.0	2 1.5	7 5.2	0 0.0
Missing	0 0.0	0 0.0	1 0.7	0 0.0	1 0.7	5 3.7	4 3.0	19 14.1
- Discontinued	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1[a] 0.7	2[a] 1.5
- Missed visit	0 0.0	0 0.0	1 0.7	0 0.0	1 0.7	4 3.0	2 1.5	0 0.0
- Not seen but - accounted for	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
- Lost-to- - follow-up	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.7	1 0.7	17 12.6
Active	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	28 20.7
- Active (not - yet in visit interval)	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	12 8.9
- In interval or - past interval (form - not yet received)	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	16 11.9
Percent Accountability[*] (ANSI Z80.11-2012)	100%	100%	99.3%	100%	99.3%	96.3%	97.8%	83.8%

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

[a] A total of two eyes were retreated with the ***iDESIGN***® System during the study and are considered discontinued from the original-treatment study following retreatment. Both eyes were followed through 12 months after retreatment in accordance with the protocol.

C. Study Population Demographics and Baseline Parameters

The demographics of the study population are typical for a hyperopic study performed in the US.

Subject demographics are presented in **Table 2**. The mean age was 42.7 years (SD 11.8 years) and the majority of subjects were Caucasian (84.1; 58/69). There were approximately equal numbers of males (49.3%; 34/69) and females (50.7%; 35/69). Most subjects (72.5%; 50/69) did not wear contact lenses preoperatively.

TABLE 2
Demographic Characteristics

Category	Classification	All Subjects (n=69)	
Gender	Male	34	(49.3%)
	Female	35	(50.7%)
Race	Caucasian	58	(84.1%)
	Black/African Descent	4	(5.8%)
	Native American/Inuit	0	(0.0%)
	Asian	1	(1.4%)
	Pacific Islander	0	(0.0%)
	Other[a]	6	(8.7%)
Age (Years)	Mean	42.7	
	SD	11.8	
	Min	19	
	Max	62	
Contact Lens History	No	50	(72.5%)
	Soft	14	(20.3%)
	Rigid/Toric	5	(7.2%)

[a] Other race includes Indian and Hispanic.

Table 3 presents the mean preoperative manifest and ***iDESIGN® AWS Studio*** System measured refractive error for the 135 treated eyes. Mean preoperative refractive measurements were comparable between manifest refraction and ***iDESIGN® AWS Studio*** System refraction.

TABLE 3
Mean Preoperative Manifest and *iDESIGN®* AWS Refractive Errors in Diopters, All Hyperopic Eyes (N=135)

Refractive Variable	Mean	Std Dev	Median	Min	Max
Manifest Refraction Spherical Equivalent (MRSE)	2.66	1.23	2.38	0.38	5.38
Manifest Refractive Cylinder (MRC)	1.00	0.91	0.50	0.00	3.75
***iDESIGN*® Spherical Equivalent (IDSE)**	2.91	1.31	2.58	0.53	5.81
***iDESIGN*® Refractive Cylinder (IDC)**	1.01	0.89	0.69	0.08	3.89

Tables 4 and **5** present the preoperative refractive error bin distributions for the study population based on preoperative ***iDESIGN®*AWS *Studio*** System measurements.

TABLE 4
Preoperative Refractive Error Stratified by *iDESIGN*® *AWS* Sphere and Cylinder.All Hyperopic Eyes (N=135)

	***iDESIGN*® Cylinder**					
***iDESIGN*® Sphere**	**>0 to ≤0.5 D**	**>0.5 to ≤1 D**	**>1 to ≤2 D**	**>2 to ≤3 D**	**>3 to ≤4 D**	**Total**
	n %	**n %**	**n %**	**n %**	**n %**	**n %**
0 to +1 D	3 2.2%	5 3.7%	3 2.2%	4 3.0%	5 3.7%	20 14.8%
>+1 to +2 D	11 8.1%	15 11.1%	9 6.7%	2 1.5%	2 1.5%	39 28.9%
>+2 to +3 D	18 13.3%	8 5.9%	2 1.5%	1 0.7%	2 1.5%	31 23.0%
>+3 to +4 D	4 3.0%	10 7.4%	7 5.2%	3 2.2%	1 0.7%	25 18.5%
>+4 to +5 D	7 5.2%	6 4.4%	2 1.5%	0 0.0%	0 0.0%	15 11.1%
>+5 to +6 D	3 2.2%	2 1.5%	0 0.0%	0 0.0%	0 0.0%	5 3.7%
Total	**46 34.1%**	**46 34.1%**	**23 17.0%**	**10 7.4%**	**10 7.4%**	**135 100%**

% Percentage is calculated by dividing the total number of eyes in the bin (n)/ by the total number of eyes N(135)

TABLE 5
Preoperative Refractive Error Stratified by *iDESIGN*® *AWS* Spherical Equivalent (SE), and Cylinder, All Hyperopic Eyes (N=135)

***iDESIGN*®**	***iDESIGN*® Cylinder**					
Spherical Equivalent	**>0 to ≤0.5 D**	**>0.5 to ≤1 D**	**>1 to ≤2 D**	**>2 to ≤3 D**	**>3 to ≤4 D**	**Total**
	n %	**n %**	**n %**	**n %**	**n %**	**n %**
0 to +1 D	1 0.7%	2 1.5%	1 0.7%	0 0.0%	0 0.0%	4 3.0%
>+1 to +2 D	11 8.1%	15 11.1%	5 3.7%	3 2.2%	2 1.5%	36 26.7%
>+2 to +3 D	19 14.1%	9 6.7%	6 4.4%	1 0.7%	4 3.0%	39 28.9%
>+3 to +4 D	5 3.7%	11 8.1%	2 1.5%	2 1.5%	2 1.5%	22 16.3%
>+4 to +5 D	4 3.0%	5 3.7%	8 5.9%	4 3.0%	2 1.5%	23 17.0%
>+5 to +6 D	6 4.4%	4 3.0%	1 0.7%	0 0.0%	0 0.0%	11 8.1%
Total	**46 34.1%**	**46 34.1%**	**23 17.0%**	**10 7.4%**	**10 7.4%**	**135 100%**

% Percentage is calculated by dividing the total number of eyes in the bin (n)/ by the total number of eyes N(135)

D. Safety and Effectiveness Results

As refractive stability was achieved at 12 months, and confirmed at 24 months, the key safety and effectiveness study endpoints were evaluated at 12 months for all treated eyes (N = 135).

1. Safety Results

The analysis of safety was based on the safety cohort of 135 subject eyes available for the 12 month evaluation. The key safety outcomes for this study are presented below in **Tables 6 to 12**. Adverse effects are reported in Table 8.

a) *Less than 5% of eyes with a loss of >2 lines BSCVA:* At 12 months, 2/131 eyes (1.5%) lost >2 lines of BSCVA, meeting the safety criterion 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%; 0/131) had preoperative BSCVA of 20/20 or better but worse than 20/40 postoperatively at 12 months, 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 12 months, no eyes (0%; 0/131) had induced manifest refractive astigmatism >2.00 D, meeting the safety criterion of <5% of eyes with induced manifest refractive astigmatism >2.00 D.

d) *Less than 1% of eyes with AEs (serious, non-flap related):* The serious, non-flap related AE target rate was <1% per type. Two eyes experienced serious AEs of different types.

TABLE 6
Key Safety Variables Over Time All Hyperopic Eyes (N=135)

Safety Variable	1 week (n=135) n %	1 Month (n=134) n %	3 Months (n=135) n %	6 Months (n=134) n %	9 Months (n=130) n %	12 Months (n=131) n %	24 Months (n=88) n %
Loss of > 2 lines BSCVA[a]	6 4.4%	0 0.0%	1 0.7%	2 1.5%	1 0.8%	2 1.5%	0 0.0%
Loss of ≥ 2 lines BSCVA	20 14.8%	3 2.2%	2 1.5%	4 3.0%	3 2.3%	4 3.1%	0 0.0%
BSCVA worse than 20/25	8 5.9%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 0.8%	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%	1 0.7%	0 0.0%	0 0.0%	0 0.0%
Serious, non-flap related AE[d]	0 0.0%	0 0.0%	1 0.7%	0 0.0%	0 0.0%	1 0.8%	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

[d] **Safety endpoint target:** <1% of eyes with an adverse event (serious, non-flap related) by type (1 eye experienced loss of BSCVA > 2 or more lines at 3 months not caused by irregular astigmatism, and 1 eye experienced severe glare and cataract at an unscheduled visit following the 12 month exam)

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

e) *BSCVA Preservation*

Table 7 shows that 97% of the pateints in the clinical study saw 20/20 or better with glasses at 12 months after treatment.

Table 7. Change of Visual Acuity After Treatment

Visual Acuity	1 Month (n=134)	3 Months (n=135)	6 Months (n=134)	9 Months (n=130)	12 Months (n=131)	24 Months (n=88)
20/12.5 or better	10%	13%	13%	15%	11%	13%
20/16 or better	50%	56%	57%	62%	58%	53%
20/20 or better	88%	91%	96%	99%	97%	98%
20/25 or better	100%	100%	100%	100%	99%	100%

The change in lines of BSCVA postoperatively compared to preoperatively for all hyperopic eyes is presented in **Table 8**. At 12 months, 79.4% (104/131) of eyes had either no change or an improvement in BSCVA compared to preoperative. Two eyes (1.5%; 2/131) had a decrease in BSCVA of >2 lines, which met the primary endpoint safety target of <5% of eyes with a loss of >2 lines of BSCVA.

TABLE 8. Change in BSCVA Over Time vs. Preoperative
All Hyperopic Eyes (N=135)

	1 Week (n=135)	1 Month (n=134)	3 Months (n=135)	6 Months (n=134)	9 Months (n=130)	12 Months (n=131)	24 Months (n=88)
Acuity	**n %**	**n %**	**n %**	**n %**	**n %**	**n %**	**n %**
Decrease =4 lines	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 0.8%	0 0.0%
Decrease =3 lines	6 4.4%	0 0.0%	1 0.7%	2 1.5%	1 0.8%	1 0.8%	0 0.0%
Decrease =2 lines	14 10.4%	3 2.2%	1 0.7%	2 1.5%	2 1.5%	2 1.5%	0 0.0%
Decrease =1 line	40 29.6%	43 32.1%	37 27.4%	23 17.2%	22 16.9%	23 17.6%	18 20.5%
No Change	65 48.1%	67 50.0%	66 48.9%	78 58.2%	69 53.1%	74 56.5%	48 54.5%
Increase =1 line	10 7.4%	19 14.2%	28 20.7%	27 20.1%	34 26.2%	27 20.6%	19 21.6%
Increase =2 lines	0 0.0%	2 1.5%	2 1.5%	2 1.5%	2 1.5%	3 2.3%	3 3.4%
Increase =3 lines	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Not Reported	0	0	0	0	0	0	0
Total	135	134	135	134	130	131	88

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

f) Adverse effects that occurred in the PMA clinical study:

A summary of serious and non-serious AEs (following the ANSI Guidance Document for Corneal Reshaping, Z80.11-2012) is presented in **Table 9**. During the study, the most frequent AEs were severe glare, dry eye or halos at 3 months or later (with a cumulative rate of 8.1%; 11 eyes/135 eyes). At the stability time point of 12 months, the most frequent AEs were also severe glare, dry eye or halos (1.5%; 2/131 eyes). Some eyes experienced more than one event.

Seven eyes experienced decrease in BSCVA of greater than or equal to 2 lines (≥10 letters ETDRS). One of the seven eyes was considered an AE because it was a decrease in BSCVA of greater than or equal to 2 lines (≥10 letters ETDRS) not due to irregular astigmatism as shown by hard contact lens refraction (or pin hole acuity if hard contact lens refraction is not medically advisable) at 3 months or later. One eye with loss of 3 lines of vision improved with hard contact lens refraction, two eyes with loss of 2 and 3 lines of vision improved with pinhole, and

three eyes with loss of 2 and 3 lines of vision did not undergo hard contact lens refraction or pinhole because of adequate postoperative BSCVA (20/20 or better) after 6 months.

TABLE 9: Summary of AEs Over Time; All Hyperopic Eyes[*] (N=135)

	<1 Month (n=135)		1 Month (n=134)		3 Months (n=135)		6 Months (n=134)		9 Months (n=130)		12 Months (n=131)		24 Months (n=88)		Cumulative (n=135)	
Adverse Event	n	%	n	%	n	%	N	%	n	%	n	%	n	%	n	%
Corneal infiltrate or ulcer	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7
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	1	0.7	0	0.0	0	0.0	0	0.0	1	0.7	0	0.0	2	1.5
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					2	1.5	4	3.0	2	1.5	2	1.5	0	0.0	11	8.1
[**] Decrease in BSCVA of greater than or equal to 2 lines (≥10 letters ETDRS) not due to irregular astigmatism, at 3 months or later					1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7
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:																
Blepharitis requiring medication treatment	0	0.0	0	0.0	0	0.0	0	0.0	2	1.5	0	0.0	0	0.0	2	1.5
Erythema of the lid	0	0.0	2	1.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.5
Cataracts	0	0.0	0	0.0	2	1.5	0	0.0	0	0.0	1	0.8	0	0.0	3	2.2
Epiretinal membrane	0	0.0	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	1	0.7
Epithelial ingrowth requiring non-refractive intervention	0	0.0	3	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	2.2
Trace DLK requiring medication treatment	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7

Shaded areas represent time frames outside event definition.

[*] Some eyes experienced more than one event. % Percentage is calculated by dividing the number of eyes in the cell / by the total number of eyes per time period.

[**] Six eyes also experienced decrease inBSCVA of greater than or equal to 2 lines (≥10 letters ETDR):

a. One eye with loss of 3 lines of vision improved with hard contact lens refraction.

b. 2 eyes with loss of 2 and 3 lines of vision improved with pinhole.

c. 3 eyes with loss of 2 and 3 lines of vision did not undergo hard contact lens refreaction or pinhole because of adequate postoperative BSCVA (20/20 or better) after 6 months

g) *Postoperative Complications*

Complications are defined as anticipated, transient, and non-sight-threatening events. **Table 10** presents a summary of complications (per the statistical plan and consistent with the ANSI Guidance Document for Corneal Reshaping, Z80.11-2012) over time for all hyperopic eyes.

There were no reports of corneal epithelial defects or diffuse lamellar keratitis (DLK; grade 2 or less) at 1 month or later. One case of trace DLK at 1 week required medication treatment and was reported as an AE. There were reports of epithelium in the interface (epithelial ingrowth) over time (0.8% at 12 months). At approximately 1 month postoperatively, three cases of epithelial ingrowth underwent non-refractive intervention and were reported as AEs. There were also reports of foreign body sensation and pain at 1 month or later (3.1 % and 7.6% at 12 months, respectively) but most of these were reported as mild.

TABLE 10
Summary of Complications Over TimeAll Hyperopic Eyes (N=135)

Complication		<1 Month (n=135)		1 Month (n=134)		3 Months (n=135)		6 Months (n=134)		9 Months (n=130)		12 Months (n=131)		24 Months (n=88)		Cumulative (n=135)	
		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	0	0.0
Epithelium in the interface (epithelial ingrowth; trace/mild)	Total[a]	3	2.2	7[b]	5.2	5	3.7	3	2.2	2	1.5	1	0.8	1	1.1	8	5.9
	Cornea	*2*	*1.5*	*4[b]*	*3.0*	*3*	*2.2*	*3*	*2.2*	*2*	*1.5*	*1*	*0.8*	*1*	*1.1*	*6*	*4.4*
	Flap	*1*	*0.7*	*3[b]*	*2.2*	*2*	*1.5*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*5*	*3.7*
Diffuse Lamellar Keratitis (DLK, Grade 2 or less)	Total[a]	3[c]	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3[d]	2.2
	Cornea	*3[c]*	*2.2*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*3[d]*	*2.2*
	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*
Foreign body sensation at 1 month or later				19	14.2	16	11.9	12	9.0	9	6.9	4	3.1	6	6.8	47[e]	34.8
Pain at 1 month or later				3	2.2	12	8.9	1	0.7	1	0.8	10	7.6	4	4.5	23[f]	17.0

Shaded areas represent time frames outside complication definition.

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

[b] Three eyes experienced epithelial ingrowth requiring non-refractive intervention at approximately 1 month (2 on cornea, 1 on flap) which were reported as adverse events.

[c] One eye experienced trace diffuse lamellar keratitis requiring medication treatment at 1 week which was reported as an adverse event.

[d] All reports of DLK were Grade 1 (trace).

[e] Most reports were mild; moderate reports: 2 at 1, 6, 9 and 12 months; marked reports: 2 at 3 months; severe reports: 2 at 1 and 6 months.

[f] Most reports were mild; moderate reports: 2 at 1 month and 1 at 9 months; marked reports: 2 at 3 months and 12 months; no severe reports.

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

h) *Intraoperative Complications*

The majority of treated eyes (97.0%, 131/135) underwent uneventful treatment procedures with no significant complications. Two treated eyes (1.48%, 2/135) experienced a significant opaque bubble layer, which occurred in the superior one-third region in both cases. One treated eye (0.74%, 1/135) had intraoperative flap lift complications related to suction loss during the flap procedure . One treated eye (0.74%, 1/135; #10542) was noted to have a slightly temporal flap decentration, but full ablation was completed in the bed. There were no occurrences (0%, 0/135) of other problems with the flap or bed.

Of the 135 treated eyes, most eyes (77.0%, 104/135) were treated with iris registration engaged for the duration of treatment. Thirty-one eyes (23.0%, 31/135) underwent treatment without iris registration engaged. Laser treatment for two eyes was interrupted and resumed after a gas boost was performed. Two eyes had small epithelial defects at the hinge. One was noted as not clinically significant and the other received a bandage contact lens following surgery. Temporary, 3-month punctal plugs were inserted into 8 eyes of 4 subjects at one site during the surgical procedure to help with postoperative dryness.

i) *Visual Functioning and Well-being*

The NEI-RQL-42 was administered to subjects at the periodic study exams. The NEI-RQL-42 was not found to be a valid assessment of safety outcomes by the FDA. Results of the NEI-RQL-42 questionnaire assessing binocular subjective visual functioning and well-being showed no worsening following treatment with the ***iDESIGN®*** ***AWS Studio*** System.

j) *Directed Visual Symptoms*

Table 11 presents subjective visual symptoms at preoperative, 6 months and 12 months from the "directed symptom assessment."

Table 11
Summary of symptoms at at Preoperative, 6 Months, and 12 Months:
All Hyperopic Eyes, Preoperative (N=135)

		None		Mild		Moderate		Marked		Severe	
Symptom	**Visit**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Pain	Preop	130	96.30%	5	3.70%	0	0.00%	0	0.00%	0	0.00%
	6 Months	133	99.25%	1	0.75%	0	0.00%	0	0.00%	0	0.00%
	12 Months	121	92.37%	8	6.11%	0	0.00%	2	1.53%	0	0.00%
Tearing	Preop	126	93.33%	8	5.93%	1	0.74%	0	0.00%	0	0.00%
	6 Months	124	92.54%	8	5.97%	0	0.00%	2	1.49%	0	0.00%
	12 Months	112	85.50%	17	12.98%	2	1.53%	0	0.00%	0	0.00%
Photophobia	Preop	127	94.07%	6	4.44%	2	1.48%	0	0.00%	0	0.00%
	6 Months	108	80.60%	20	14.93%	4	2.99%	2	1.49%	0	0.00%
	12 Months	113	86.26%	12	9.16%	6	4.58%	0	0.00%	0	0.00%
Foreign Body Sensation	Preop	133	98.52%	2	1.48%	0	0.00%	0	0.00%	0	0.00%
	6 Months	122	91.04%	8	5.97%	2	1.49%	0	0.00%	2	1.49%
	12 Months	127	96.95%	2	1.53%	2	1.53%	0	0.00%	0	0.00%
Dryness	Preop	83	61.48%	40	29.63%	10	7.41%	2	1.48%	0	0.00%
	6 Months	49	36.57%	65	48.51%	16	11.94%	2	1.49%	2	1.49%
	12 Months	61	46.56%	48	36.64%	14	10.69%	6	4.58%	2	1.53%
Fluctuation of Vision	Preop	116	85.93%	17	12.59%	2	1.48%	0	0.00%	0	0.00%
	6 Months	70	52.24%	46	34.33%	16	11.94%	2	1.49%	0	0.00%
	12 Months	83	63.36%	41	31.30%	4	3.05%	2	1.53%	1	0.76%
Day Glare	Preop	118	87.41%	13	9.63%	2	1.48%	0	0.00%	2	1.48%
	6 Months	112	83.58%	16	11.94%	4	2.99%	0	0.00%	2	1.49%
	12 Months	113	86.26%	12	9.16%	4	3.05%	2	1.53%	0	0.00%
Night Glare	Preop	92	68.15%	33	24.44%	8	5.93%	0	0.00%	2	1.48%
	6 Months	83	61.94%	36	26.87%	13	9.70%	0	0.00%	2	1.49%
	12 Months	94	71.76%	29	22.14%	6	4.58%	2	1.53%	0	0.00%
Binocular Diplopia	Preop	135	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	6 Months	124	92.54%	6	4.48%	4	2.99%	0	0.00%	0	0.00%
	12 Months	124	94.66%	5	3.82%	2	1.53%	0	0.00%	0	0.00%
Monocular Diplopia	Preop	135	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	6 Months	129	96.27%	3	2.24%	2	1.49%	0	0.00%	0	0.00%
	12 Months	128	97.71%	3	2.29%	0	0.00%	0	0.00%	0	0.00%

		None		Mild		Moderate		Marked		Severe	
Symptom	**Visit**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Ghosting	Preop	133	98.52%	2	1.48%	0	0.00%	0	0.00%	0	0.00%
	6 Months	118	88.06%	7	5.22%	7	5.22%	0	0.00%	2	1.49%
	12 Months	117	89.31%	9	6.87%	5	3.82%	0	0.00%	0	0.00%
Halos	Preop	72	53.33%	44	32.59%	15	11.11%	4	2.96%	0	0.00%
	6 Months	72	53.73%	43	32.09%	14	10.45%	1	0.75%	4	2.99%
	12 Months	72	54.96%	50	38.17%	7	5.34%	2	1.53%	0	0.00%
Driving at night	Preop	72	53.33%	40	29.63%	18	13.33%	5	3.70%	0	0.00%
	6 Months	83	61.94%	37	27.61%	12	8.96%	2	1.49%	0	0.00%
	12 Months	87	66.41%	32	24.43%	10	7.63%	2	1.53%	0	0.00%
Other Sensations	Preop	133	98.52%	0	0.00%	2	1.48%	0	0.00%	0	0.00%
	6 Months	134	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	12 Months	129	98.47%	1	0.76%	1	0.76%	0	0.00%	0	0.00%
Blurry Vision	Preop	135	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	6 Months	131	97.76%	1	0.75%	1	0.75%	1	0.75%	0	0.00%
	12 Months	131	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Itchy	Preop	131	97.04%	4	2.96%	0	0.00%	0	0.00%	0	0.00%
	6 Months	134	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	12 Months	131	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%

% Percentage is calculated by dividing the number of eyes in the cell (n) / by the total number of eyes (N)

k) *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 12 months, mean changes in contrast sensitivity vs. preoperative ranged between -0.01 to >-0.09 log units under photopic without glare conditions, between >0.05 and <-0.06 log units under mesopic without glare conditions and between <-0.01 and ≥-0.03 log units under mesopic with glare conditions. None of the mean changes in contrast sensitivity at 12 months vs. preoperative under any of the three lighting conditions were statistically significant after adjusting for multiplicity.

TABLE 12
Mean Change in Contrast Sensitivity at 12 Months From Preoperative
All Eyes (N=131)

Lighting Condition	Mean Change 3 cpd	6 cpd	12 cpd	18 cpd
Photopic Without Glare				
Mean (Log units)	-.01	-.04	>-.09	-.08
Standard error	0.023	0.029	>0.038	0.034
Mesopic without Glare				
Mean (Log units)	-.04	<-.06	>0.01	>0.05
Standard error	0.023	>0.037	>0.048	>0.043
Mesopic with Glare				
Mean (Log units)	-.03	-.02	<-.01	>-.03
Standard error	0.022	0.035	>0.046	>0.041

Note: Positive values for "change from preoperative" represent increase in contrast sensitivity scores.
Note: Data for eyes that were unable to see the reference patterns were imputed. Mean scores contain a greater than (>) symbol when more eyes were unable to see the reference pattern preoperatively than postoperatively. Mean scores contain a less than (<) symbol when more eyes were unable to see the reference patterns post-operatively than preoperatively.

As shown in **Table 13**, most eyes (>68%) 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 12 months vs. preoperative. At 12 months, under all lighting conditions, approximately 30% of eyes experienced clinically significant decreases in contrast sensitivity at 12 months under each of the lighting conditions (31.3% [41/131] under photopic conditions without glare; 28.2% [37/131] under mesopic conditions without glare; and 29.8% [39/131], under mesopic conditions with glare). Overall, postoperatively, the mean changes in contrast sensitivity at 12 months vs. preoperative were not statistically significant.

TABLE 13
Clinically Significant Changes[a] in Contrast Sensitivity at 12 Months from PreoperativeAll Hyperopic Eyes (N=131)

Lighting Condition	Decrease n %	No change n %	Increase n %
Photopic without Glare	41 31.3%	71 54.2%	19 14.5%
Mesopic without Glare	37 28.2%	56 42.7%	38 29.0%
Mesopic with Glare	39 29.8%	64 48.9%	28 21.4%

[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.
% Percentage is calculated by dividing the number of eyes in the cell (n) / by the total number of eyes N (131)

2. Effectiveness Results

The analysis of effectiveness was based on the 131 evaluable eyes the 12-month time point. Key effectiveness outcomes are presented in **Tables 14 to 24**.

a) *85% of eyes with a UCVA of 20/40 or better:* At 12 months, UCVA of 20/40 or better was achieved in 93.9% (123/131) of eyes, exceeding the primary study effectiveness endpoint target of 85% of eyes with 20/40 or better UCVA. 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 12 months with 63.4% (83/131) of eyes having MRSE within 0.50 D of emmetropia and 83.2% (109/131) within 1.00 D, exceeding the study endpoint targets of 50% within 0.50 D and 75% within 1.00 D.

TABLE 14
Key Effectiveness Variables Over TimeAll Hyperopic Eyes (N=135)

	1 Month (n=134)		3 Months (n=135)		6 Months (n=134)		9 Months (n=130)		12 Months (n=131)		24 Months (n=88)	
Effectiveness Variable	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
UCVA 20/20 or better	62	46.3%	71	52.6%	74	55.2%	74	56.9%	86	65.6%	57	64.8%
UCVA 20/40 or better[a]	125	93.3%	126	93.3%	129	96.3%	124	95.4%	123	93.9%	85	96.6%
Sphere +/- 0.50 D	50	37.3%	55	40.7%	56	41.8%	58	44.6%	65	49.6%	50	56.8%
Sphere +/- 1.00 D	86	64.2%	89	65.9%	96	71.6%	98	75.4%	102	77.9%	71	80.7%
Cylinder +/- 0.50 D	83	61.9%	91	67.4%	82	61.2%	85	65.4%	93	71%	59	67%
Cylinder +/- 1.00 D	120	89.6%	121	89.6%	121	90.3%	114	87.7%	120	91.6%	79	89.8%
MRSE +/- 0.50 D[b]	71	53%	65	48.1%	75	56%	78	60%	83	63.4%	61	69.3%
MRSE +/- 1.00 D[c]	101	75.4%	104	77%	107	79.9%	107	82.3%	109	83.2%	77	87.5%

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

The key effectiveness variables at 12 months stratified by preoperative IDSE are presented in **Table 15**.

TABLE 15
Key UCVA and MRSE Variables at 12 Months by Preop *iDESIGN*® AWS Spherical Equivalent (IDSE) All Eyes (N=131)

Preoperative IDSE Diopter Group (n)	UCVA 20/20 or better	UCVA 20/40 or better[a]	MRSE within 0.50 D[b]	MRSE within 1.00 D[c]
	n %	n %	n %	n %
0 to +1 D (n=4)	3 75.0%	4 100%	4 100%	4 100%
>+1 to +2 D (n=32)	26 81.3%	32 100%	21 65.6%	30 93.8%
>+2 to +3 D (n=39)	30 76.9%	39 100%	30 76.9%	37 94.9%
>+3 to +4 D (n=22)	12 54.5%	21 95.5%	15 68.2%	18 81.8%
>+4 to +5 D (n=23)	10 43.5%	17 73.9%	9 39.1%	13 56.5%
>+5 to +6 D (n=11)	5 45.5%	10 90.9%	4 36.4%	7 63.6%
Total (n=131)	86 65.6%	123 93.9%	83 63.4%	109 83.2%

[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

% 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 12 months stratified by preoperative IDC are presented in **Table 16.**

TABLE 16
Key UCVA and MRSE Variables at 12 Months by Preoperative *iDESIGN*® AWS Cylinder (IDC), All Eyes (N=131)

Preoperative IDC Diopter Group (n)	UCVA 20/20 or better	UCVA 20/40 or better[a]	MRSE within 0.50 D[b]	MRSE within 1.00 D[c]
	n %	n %	n %	n %
>0 to <=0.5D (n=45)	31 68.9%	43 95.6%	30 66.7%	41 91.1%
>0.5 to <=1D (n=44)	29 65.9%	43 97.7%	30 68.2%	39 88.6%
>1 to <=2D (n=23)	14 60.9%	21 91.3%	12 52.2%	15 65.2%
>2 to <=3D (n=10)	6 60.0%	7 70.0%	6 60.0%	8 80.0%
>3 to <=4D (n=9)	6 66.7%	9 100%	5 55.6%	6 66.7%
Total (n=131)	86 65.6%	123 93.9%	83 63.4%	109 83.2%

[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

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

c) *UCVA*

Table 17 presents the distribution of UCVA results over time for all eyes. Postoperatively, the proportions of eyes that achieved UCVA of 20/40 or better (≥93%) exceeded the target rate (≥85%) across all postoperative study visits. Furthermore at 12 months, 65.6% (86/131) of eyes were 20/20 or better.

TABLE 17
UCVA Over Time, All Hyperopic Eyes (N=135)

Acuity	Preoperative (n=135) n %	1 Month (n=134) n %	3 Months (n=135) n %	6 Months (n=134) n %	9 Months (n=130) n %	12 Months (n=131) n %	24 Months (n=88) n %
20/10 or better	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
20/12.5 or better	0 0.0%	5 3.7%	8 5.9%	6 4.5%	6 4.6%	6 4.6%	7 8.0%
20/16 or better	0 0.0%	24 17.9%	35 25.9%	38 28.4%	40 30.8%	43 32.8%	28 31.8%
20/20 or better [a]	0 0.0%	62 46.3%	71 52.6%	74 55.2%	74 56.9%	86 65.6%	57 64.8%
20/25 or better	0 0.0%	101 75.4%	107 79.3%	102 76.1%	102 78.5%	104 79.4%	73 83.0%
20/32 or better	0 0.00%	114 85.1%	115 85.2%	118 88.1%	114 87.7%	118 90.1%	81 92.0%
20/40 or better [b]	33 24.4%	125 93.3%	126 93.3%	129 96.3%	124 95.4%	123 93.9%	85 96.6%
20/50 or better	58 43.0%	130 97.0%	132 97.8%	131 97.8%	130 100%	129 98.5%	88 100%
20/63 or better	78 57.8%	133 99.3%	134 99.3%	132 98.5%	130 100%	131 100%	88 100%
20/80 or better	96 71.1%	134 100%	135 100%	134 100%	130 100%	131 100%	88 100%
20/100 or better	118 87.4%	134 100%	135 100%	134 100%	130 100%	131 100%	88 100%
Worse than 20/100	17 12.6%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%

[a] Preoperatively, 0.0% (0/135) of eyes achieved UCVA of 20/20

[b] Preoperatively, 24.4% (33/135) of eyes achieved UCVA of 20/40

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

Table 18 presents the differences in postoperative UCVA achieved compared to preoperative BSCVA for all eyes. At 12 months, 47.3% (62/131) of eyes achieved the same or better acuity level postoperatively without correction as preoperatively with correction.

TABLE 18
Postoperative UCVA Compared to Preoperative BSCVA, All Hyperopic Eyes (N=135)

Acuity	1 Month (n=134)		3 Months (n=135)		6 Months (n=134)		9 Months (n=130)		12 Months (n=131)		24 Months (n=88)	
	n	%	n	%	n	%	n	%	n	%	n	%
3 lines better	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
2 lines better	1	0.7%	2	1.5%	2	1.5%	2	1.5%	1	0.8%	3	3.4%
1 line better	11	8.2%	14	10.4%	14	10.4%	13	10.0%	17	13.0%	10	11.4%
No change	23	17.2%	34	25.2%	37	27.6%	36	27.7%	44	33.6%	30	34.1%
1 lines worse	39	29.1%	33	24.4%	32	23.9%	34	26.2%	30	22.9%	22	25.0%
2 lines worse	31	23.1%	24	17.8%	20	14.9%	20	15.4%	16	12.2%	12	13.6%
≥ 3 lines worse	29	21.6%	28	20.7%	29	21.6%	25	19.2%	23	17.6%	11	12.5%

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

d) *Accuracy of Manifest Refraction*

Table 19 presents residual MRSE at all postoperative time points stratified by preoperative MRSE. A greater amount of residual MRSE was observed for eyes with higher preoperative MRSE. Overall, there was an overcorrection of MRSE of -0.43 D at 12 months postoperative.

Table 19
Residual MRSE at each Postoperative Visit Stratified by Preoperative MRSE

Preoperative MRSE	Residual MRSE											
	1 Month		3 Months		6 Months		9 Months		12 Months		24 Months	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
>0 to <=1	8	-0.24	8	-0.39	8	-0.33	8	-0.21	6	-0.17	3	-0.04
>1 to <=2	48	-0.64	49	-0.53	48	-0.49	48	-0.49	47	-0.39	31	-0.17
>2 to <=3	29	-0.61	29	-0.54	29	-0.38	28	-0.28	29	-0.32	22	-0.24
>3 to <=4	28	-0.74	28	-0.80	28	-0.78	28	-0.51	28	-0.53	16	-0.65
>4 to <=5	16	-0.78	16	-1.03	16	-0.71	15	-0.54	16	-0.58	12	-0.49
>5 to <=6	5	-1.00	5	-1.38	5	-1.10	3	-0.92	5	-0.68	4	-0.31
All	134	-0.66	135	-0.67	134	-0.57	130	-0.45	131	-0.43	88	-0.32

Table 20 presents the proportions of eyes with residual manifest cylinder magnitude at 12 months and the absolute shift in axis from preoperative. The table includes all eyes (n=86) in the cohort with nonzero preoperative astigmatism. At 12 months, an axis shift of >30° from preoperative was noted for 60.4% (52/86) of eyes; of which 20 eyes (38.5%; 20/52) had a residual cylinder magnitude >0.50 D.

Table 20
Residual Manifest Refractive Astigmatic Error at 12 Months

Residual Cylinder Magnitude	Absolute Shift in Axis						
	0º (n=20)	>0º to ≤ 5º (n=1)	>5º to ≤ 10º (n=5)	>10º to ≤ 15º (n=4)	>15º to ≤ 30º (n=4)	>30º (n=52)	Total (n=86)
	n %	n %	n %	n %	n %	n %	n %
0.0 D	17* 85.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	17 19.8%
>0 to ≤ 0.5 D	1 5.0%	1 100%	2 40.0%	2 50.0%	3 75.0%	32 61.5%	41 47.7%
>0.5 to ≤ 1.0 D	0 0.0%	0 0.0%	2 40.0%	2 50.0%	0 0.0%	13 25.0%	17 19.8%
>1.0 to ≤ 2.0 D	2 10.0%	0 0.0%	1 20.0%	0 0.0%	1 25.0%	5 9.6%	9 10.5%
>2.0 to ≤ 3.0 D	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	2[a,b] 3.8%	2 2.3%
Total	20 100	1 100	5 100	4 100	4 100	52 100	86 100

*Note: The axis shift is defined to be zero when the residual cylinder magnitude is zero.
[a] Eye; Preoperative MR +2.75 D +1.00 D x 004; 12 Month MR -1.50 D +3.00 D x 58; 12 Month UCVA 20/40
[b] Eye; Preoperative MR +3.50 D +1.00 D x 170; 12 Month MR -2.75 D +2.25 D x 60; 12 Month UCVA 20/50

e) *Stability of Outcome*

i. Stability of MRSE

Table 21 presents the stability of MRSE across visits for all eyes with at least two consecutive study visits. The defined criteria for refractive stability were met at the 12-month visit and confirmed at the 24-month visit. At least 95.0% of eyes had ≤1.00 D change in MRSE between 9 and 12 months and between 12 and 24 months, meeting the criterion of at least 95% of the treated eyes having a change of ≤1.00 D in MRSE at any two refractions performed at least 3 months apart.

Table 21. Stability of Manifest Refraction Spherical Equivalent (MRSE): All Hyperopic Eyes Consecutive Cohort

Distributions	Between 1 and 3 Months (n=134) n %	Between 3 and 6 Months (n=134) n %	Between 6 and 9 Months (n=130) n %	Between 9 and 12 Months (n=127) n %	Between 12 and 24 Months (n=88) n %
Change in MRSE by ≤ 0.5 D	104 77.6%	109 81.3%	102 78.5%	106 83.5%	70 79.5%
Change in MRSE by ≤1.0 D	124 92.5%	128 95.5%	121 93.1%	121 95.3%	84 95.5%
Mean Outcomes	D +/- SD	D +/- SD	D +/- SD	D +/- SD	D +/- SD
Mean Change in MRSE	-0.016 +/- 0.680	0.109 +/- 0.535	0.127 +/- 0.512	0.009 +/- 0.433	0.121 +/- 0.583
Mean Change Per Month	-0.008	0.036	0.042	0.003	0.010

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

ii. Stability of Refractive Cylinder

Table 22 presents the stability of absolute (non-vector) cylinder across visits for all eyes with data at two or more consecutive study visits. The defined criteria for refractive cylinder stability were met at the 12-month visit, and confirmed at the 24-month visit. For refractive cylinder stability, at least 96.1% (122/127) of eyes had ≤1.00 D change in MRC between consecutive visits, meeting criterion of at least 95% of the treated eyes having a change of ≤1.00 D in MRC between visits.

Table 22. Stability of Absolute (Non-vector) Cylinder, All Hyperopic Eyes Consecutive Cohort

Magnitude of Change in Non-vector Cylinder Distributions	Between 1 and 3 Months (n=134) n %	Between 3 and 6 Months (n=134) n %	Between 6 and 9 Months (n=130) n %	Between 9 and 12 Months (n=127) n %	Between 12 and 24 Months (n=88) n %
Eyes with ≤0.5D Change	110 82.1%	124 92.5%	117 90.0%	116 91.3%	81 92.0%
Eyes with ≤1.0D Change	130 97.0%	132 98.5%	127 97.7%	122 96.1%	87 98.9%
Mean Outcomes (D)					
Mean Change between Visits	-0.011	0.047	-0.035	-0.026	0.014
SD	0.448	0.392	0.376	0.469	0.387
Mean Change Per Year	-0.067	0.187	-0.138	-0.102	0.014
Mean Change Per Month	-0.006	0.016	-0.012	-0.009	0.001

Change is defined as current visit value minus previous visit value.
* Includes only eyes with data at two consecutive visits.

f) *Effectiveness of Correction of Astigmatism*

Vector analysis summary statistics at 12 months are presented in **Table 23.** With correction ratios (CR) above 1.0, the results indicate a systematic overcorrection of cylinder for eyes with preoperative cylinder of ≤1.00 D.

Table 23
Vector analysis Summary at 12 Months for All Eyes, (N=131)

Preoperative Cylinder	n	|IRC|^ (Mean +/- SD)	|SIRC|^ (Mean +/- SD)	|EV| (Mean +/- SD)	CR (Mean +/- SD)	ER (Mean +/- SD)
All (N)	131	0.99 +/- 0.91	1.20 +/- 0.99	0.52 +/- 0.47	1.33 +/- 0.73	0.78 +/- 0.84
>0.0D to ≤0.5D	66	0.36 +/- 0.18	0.53 +/- 0.30	0.39 +/- 0.30	1.40 +/- 0.83	1.03 +/- 0.97
>0.5D to ≤1.0D	29	0.87 +/- 0.13	1.40 +/- 0.78	0.82 +/- 0.72	1.58 +/- 0.81	0.93 +/- 0.78
>1.0D to ≤2.0D	18	1.56 +/- 0.25	1.65 +/- 0.55	0.51 +/- 0.33	1.06 +/- 0.34	0.34 +/- 0.23
>2.0D to ≤3.0D	10	2.53 +/- 0.25	2.38 +/- 0.76	0.70 +/- 0.54	0.95 +/- 0.30	0.28 +/- 0.21
>3.0D to ≤4.0D	8	3.41 +/- 0.19	3.59 +/- 0.44	0.34 +/- 0.19	1.05 +/- 0.09	0.10 +/- 0.05

IRC = intended refractive change
SIRC = surgically induced refractive change
EV = error vector (IRC-SIRC)
CR = correction ratio (SIRC/IRC)
ER = error ratio (EV/IRC)

g) *Higher Order Aberrations (HOA) (HOA)*

The higher order aberration (HOA) root mean square (RMS) values over time for all hyperopic eyes with 4 mm standardized wavefront diameters are presented in **Table 24.** There was an increase in mean HOA RMS (ranging from +0.14 to +0.17 µm) at all postoperative visits compared to preoperative. The increases in HOA RMS were mostly associated with increases in mean coma (+0.13 to +0.16 µm).

Table 24.
HOA RMS (µm) Over Time Eyes with 4mm Standarized Wavefront Diameters-All Hyperopic Eyes

	Preoperative (n=135) Mean +/- SD	1 Month (n=126) Mean +/- SD	Months (n=128) Mean +/- SD	Months (n=126) Mean +/- SD	9 Months (n=126) Mean +/- SD	12 Months (n=126) Mean +/- SD	24 Months (n=77) Mean +/- SD
HOA RMS (µm)	0.13 +/- 0.04	0.28 +/- 0.15	0.28 +/- 0.15	0.27 +/- 0.15	0.27 +/- 0.15	0.28 +/- 0.15	0.30 +/- 0.16
Coma	0.07 +/- 0.04	0.21 +/- 0.13	0.20 +/- 0.13	0.20 +/- 0.13	0.20 +/- 0.13	0.20 +/- 0.13	0.23 +/- 0.15
Spherical Aberration	0.04 +/- 0.03	0.11 +/- 0.09	0.12 +/- 0.10	0.11 +/- 0.09	0.11 +/- 0.09	0.12 +/- 0.10	0.12 +/- 0.10
Trefoil	0.07 +/- 0.04	0.09 +/- 0.07	0.09 +/- 0.07	0.08 +/- 0.06	0.08 +/- 0.05	0.08 +/- 0.06	0.09 +/- 0.06
Secondary Coma	0.01 +/- 0.00	0.02 +/- 0.02	0.02 +/- 0.02	0.02 +/- 0.02	0.02 +/- 0.02	0.02 +/- 0.02	0.02 +/- 0.02
Secondary Astigmatism	0.02 +/- 0.02	0.06 +/- 0.04	0.06 +/- 0.04	0.06 +/- 0.04	0.05 +/- 0.04	0.05 +/- 0.04	0.05 +/- 0.04
Secondary Spherical Aberration	0.00 +/- 0.00	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01	0.01 +/- 0.01
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	0.03 +/- 0.02	0.03 +/- 0.02	0.03 +/- 0.02	0.03 +/- 0.02	0.03 +/- 0.02	0.03 +/- 0.02
Sixth Order	0.01 +/- 0.01	0.02 +/- 0.01	0.02 +/- 0.01	0.02 +/- 0.01	0.02 +/- 0.01	0.02 +/- 0.01	0.02 +/- 0.01
Spherical Aberration Signed	0.04 +/- 0.03	-0.11 +/- 0.10	-0.12 +/- 0.10	-0.11 +/- 0.10	-0.11 +/- 0.10	-0.12 +/- 0.10	-0.12 +/- 0.10
IDESIGN® Spherical Equivalent (D)[a]	2.91 +/- 1.31	-0.22 +/- 0.85	-0.22 +/- 0.79	-0.16 +/- 0.88	-0.09 +/- 0.74	-0.06 +/- 0.75	0.12 +/- 0.70
iDESIGN® Cylinder magnitude (D)[a]	1.01 +/- 0.89	0.72 +/- 0.44	0.67 +/- 0.43	0.68 +/- 0.44	0.62 +/- 0.43	0.66 +/- 0.47	0.66 +/- 0.40

[a] Low order aberrations from 4.0 mm ***iDESIGN***® measurements collected by sites.

h) *Refractive Retreatments*

Two eyes of two subjects underwent retreatment, one after the 9-month visit, and another after the 12-month visit. Data from these eyes, prior to retreatment, are included in all analyses. Two retreatments are insufficient to yield clinically useful information; however, caution should be taken to assure refractive stability before performing additional procedures.

3. Subgroup Analyses

The following preoperative characteristics were evaluated for potential association with outcomes: gender and site.

Evaluation of site homogeneity showed statistically significant differences among sites for race, age and preoperative IDSE. These differences were not unexpected, and using logistic regression while controlling for site in the covariate analyses showed that these factors were not significant predictors of outcomes; therefore, data from all sites are considered poolable.

Some statistically significant differences were found in the key effectiveness study outcomes at 12 months among gender, preoperative ***iDESIGN***® refractive parameters (IDSE, IDS, and IDC), laser room temperature, site/surgeon, and clinically relevant protocol deviations.

Based on covariate analyses, there were no statistically significant site interactions with any of these factors, whereas gender differences were found. The female population had better outcomes with respect to MRSE within 0.50 D. There was a statistically significant effect of gender on achieving MRSE within 0.50 D (**p=0.0308**) with results for females improved (73%; 46/63) over males (54.4%; 37/68), however, the results for both genders exceeded the target value of 50%. There were no other statistically significant differences between males and females and both genders achieved the targets for the remaining key effectiveness or safety parameters.

4. Pediatric Extrapolation

In this premarket application, existing clinical data was not leveraged to support approval of a pediatric patient population.

5. Device Failures and Replacements

There were no laser failures or replacements during the course of this study. There were five (5) ***iDESIGN***® ***AWS Studio*** System failures during the course of this study. None of these replaced units impacted patient outcomes or were associated with adverse events. Two 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 ***iDESIGN® AWS Studio*** System were replaced due to software issue or hardware malfunction/failure isolated to the specific device. Two hardware related failures were due to a faulty USB port. The third failure was due to the installed software that was not enabled.

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 pivotal clinical study included 9 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® AWS Studio*** System was conducted that included the treatment of eyes with hyperopia. 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® AWS Studio*** System. Of the 143 eyes treated in the study, 19 underwent treatment for hyperopia and were evaluated through 6 months. All eyes (100%; 19/19) achieved UCVA of 20/40 or better and 84.2% (16/19) achieved 20/20 or better. Intended versus achieved MRSE met FDA target values, with 73.7% within 0.50 D and 89.5% within 1.00 D. Evaluation of safety included the percentage of eyes that lost more than 2 lines of BSCVA (5.2%), the percentage of eyes that have a BSCVA worse than 20/40 (0%), and the percentage of eyes with induced manifest refractive astigmatism greater than 2.00 D of absolute cylinder power (0%). Based on this limited dataset, device performance and safety for the treatment of hyperopia was found to be acceptable.

XII. PANEL MEETING RECOMMENDATION AND FDA'S POST-PANEL ACTION

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 hyperopia with and without astigmatism with the ***iDESIGN® AWS Studio*** System and ***STAR S4 IR®***

Excimer Laser System, effectiveness outcomes exceeded study targets. Refractive stability was achieved at 12 months; at this time, the proportion of eyes with a UCVA of 20/40 or better (Target ≥85%; ***iDESIGN® AWS*** 93.9%), and the proportions of eyes that achieve MRSE within 0.50 D (Target ≥50%; ***iDESIGN® AWS*** 63.4%) and 1.00 D (Target ≥75%; ***iDESIGN® AWS*** 83.2%) also exceeded the target values.

Overall, study outcomes for the accuracy of treatment exceeded the key endpoint targets at 12 months for hyperopic eyes.

B. Safety Conclusions

The risks of the device are based on data collected in a clinical study conducted to support PMA approval as described above.

In the clinical investigation of wavefront-guided LASIK correction of hyperopia with and without astigmatism with the ***iDESIGN® AWS Studio*** System and ***STAR S4 IR®*** Excimer Laser System, safety outcomes were found to be acceptable and met the safety targets. At 12 months, the proportion of eyes with >2 line loss of BSCVA (Target <5%; ***iDESIGN®*** AWS 1.5%), 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%), were within target values. Two eyes experienced serious, non-flap, ocular adverse events; one eye (0.7%, 1/135) experienced a decrease in BSCVA of greater than or equal to 2 lines (≥10 letters ETDRS) not due to irregular astigmatism at 3 months or later, and one eye experienced severe glare and cataract (0.7%, 1/135), meeting the serious, non-flap related AE target rate of less than 1% per type. The most common adverse events that occurred during the study were reports of severe glare, dry eye or halos (with a cumulative rate of 8.1%; 11/135). For each type of AE, cumulative incidence did not exceed 1%. However, there was some uncertainty surrounding the incidence of "decrease in BSCVA of greater than or equal to 2 lines (≥10 letters ETDRS) not due to irregular astigmatism as shown by hard contact lens refraction (or pinhole acuity if hard contact lens refraction is not medically advisable) at 3 months or later." One eye had this AE confirmed.

Additionally 6 eyes also experienced decrease in BSCVA greater than or equal to 2 lines (≥10 letters ETDRS) as follows:

i. One eye (#8471) with loss of 3 lines of vision improved with hard contact lens refraction.
ii. Two eyes (#13461, #13462) with loss of 2 and 3 lines of vision improved with pinhole refraction and resolved.
iii. Three eyes (#11462, #15412, #15421) with loss of 2 and 3 lines of vision did not undergo hard contact lens refraction or pinhole because of adequate postoperative BSCVA (20/20 or better) after 6 months.

Therefore, a larger post-approval study in 300 eyes is intended to elucidate the incidence of adverse events in greater detail.

There were no statistically significant changes in contrast sensitivity at 12 months vs. preoperatively and the majority of eyes (>68%) experienced either no change or an improvement in contrast sensitivity.

The NEI-RQL-42 was administered to subjects at the periodic study exams. The NEI-RQL-42 was not found to be a valid assessment of safety outcomes by the FDA. Results of the NEI-RQL-42 questionnaire assessing binocular subjective visual functioning and well-being showed no worsening following treatment with the ***iDESIGN® AWS Studio*** System.

C. Benefit-Risk Determination

The probable benefits of the device are also 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 patient group with a non-life-threatening, well-characterized corneal refractive condition (hyperopia with and without astigmatism).
b. Improved uncorrected distance visual acuity.
c. Acceptable accuracy of treatment.
d. No statistically worsening in subjective visual functioning and well-being.
e. Acceptable safety profile and low occurrences of serious, device-related adverse events.

Additional factors to be considered in determining probable risks and benefits of wavefront-guided LASIK correction of hyperopia with and without astigmatism using the ***iDESIGN® AWS*** 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 acceptable, as can be seen in the achievement of all study endpoints.
d. Subjective patient-reported symptoms were generally favorable.
e. The risks associated with wavefront-guided LASIK correction of hyperopia with and without astigmatism using the ***iDESIGN® AWS Studio***
f. System and ***STAR S4 IR®*** Excimer Laser System are mitigated by controls such as testing, labeling, post-market product surveillance, and AE reporting.
g. Alternative treatments exist and include conventional LASIK, PRK, implants, glasses or contact lenses.

h. Device-related risks may be present, but these are tolerable to patients because these are disclosed, quantified, and outweighed by medical benefits such as improved uncorrected visual acuity.
i. The decision as to whether or not to undergo wavefront-guided LASIK treatment for hyperopia with and without 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 hyperopia with and without astigmatism for the proposed indication using the ***iDESIGN® AWS Studio*** System and ***STAR S4 IR®*** Excimer Laser System outweigh the risks.

1. Patient Perspectives

   Patient perspectives considered during the review included:

   The patient's perspective was assessed both preoperatively and postoperatively in the study using the NEI-RQL-42 as well as a directed symptom assessment. Both questionnaires were not considered to be valid assessments of safety in this trial. Results of the NEI-RQL-42 questionnaire assessing binocular subjective visual functioning and well-being showed no worsening following treatment with the ***iDESIGN® AWS Studio*** System. At 12 months, the NEI-RQL-42 showed no worsening of subjective visual functioning and well-being following hyperopia with and without astigmatism LASIK correction with the ***iDESIGN® AWS*** System and ***STAR S4 IR®*** Excimer Laser System.

In conclusion, given the available information above, the data support that for hyperopia with and without astigmatism the probable benefits outweigh the probable risks.

D. Overall Conclusions

The data in this application support the reasonable assurance of safety and effectiveness of this device when used in accordance with the indications for use. All safety and effectiveness endpoint targets at 12 months were achieved, demonstrating the ability of the ***iDESIGN® AWS*** Studio system in conjunction with the ***Star S4 IR®*** Excimer Laser System to provide acceptable outcomes.

Based on these results, there is reasonable assurance of the safety and effectiveness of wavefront-guided LASIK correction of hyperopic refractive errors for the proposed indication using the ***iDESIGN® AWS*** Studio System and ***Star S4 IR®*** Excimer Laser System.

XIV. CDRH DECISION

CDRH issued an approval order on June 30, 2017.

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 Requirements and Restrictions: See approval order.