SUMMARY OF SAFETY AND EFFECTIVENESS FOR A PREMARKET APPROVAL APPLICATION

I. GENERAL INFORMATION

Device Generic Name:	Ophthalmic Medical Laser System (193 nanometer wavelength)
Device Trade Name:	WaveLight ALLEGRETTO WAVE™ Excimer Laser System
Applicant's Name and Address:	SurgiVision® Refractive Consultants, LLC 5 Timber Lane North Reading, MA 01864
Panel Recommendation:	None (see Section XII.)
Premarket Approval (PMA) Application Number:	P030008
Date of Notice of Approval to Applicant:	OCT 10 2003

II. INDICATIONS FOR USE

The WaveLight ALLEGRETTO WAVE™ Excimer Laser System is intended for Laser Assisted in situ Keratomileusis (LASIK) treatments for:

- the reduction or elimination of hyperopic refractive errors up to +6.0 diopters (D) of sphere with and without astigmatic refractive errors up to 5.0 D at the spectacle plane, with a maximum manifest refraction spherical equivalent (MRSE) of +6.0 D;
- patients who are 18 years of age or older; and
- patients with documentation of a stable manifest refraction defined as $\leq$0.50 D of preoperative spherical equivalent shift over one year prior to surgery, exclusive of changes due to unmasking latent hyperopia.

III. CONTRAINDICATIONS, WARNINGS AND PRECAUTIONS

LASIK surgery is contraindicated in:

- pregnant or nursing women;
- patients with a diagnosed collagen vascular, autoimmune or immunodeficiency disease;
- patients with diagnosed keratoconus or any clinical pictures suggestive of keratoconus; and
- patients who are taking one or both of the following medications: isotretinoin (Accutane®[1]); amiodarone hydrochlorid (Cordarone®[2]).

IV. WARNINGS AND PRECAUTIONS

The warnings and precautions can be found in the device labeling.

V. DEVICE DESCRIPTION

A. Laser System

The WaveLight ALLEGRETTO WAVE™ Excimer Laser System is a scanning-spot excimer laser system which includes an excimer laser with high pulse repetition rate, a pair of precise galvanometer scanners for positioning the laser spots and an eye-tracker for determining eye location and laser-beam position. The integrated eye-tracker permits the system to accurately track fast eye movements or to interrupt the treatment when the eye moves out of a predetermined range.

The specially shaped profile of the treatment beam and the small spot diameter assure the necessary accuracy to achieve the desired contour of the treated surface. The spot patterns for all treatment parameters are stored in memory inside the laser. The ablation contours are based on sophisticated numerical algorithms. In addition, the ablation profiles are "Wavefront Optimized" meaning that the initial profiles, which can be mathematically calculated, were refined by empirical research with a wavefront aberrometer.

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[1] Accutane® is a registered trademark of Hoffmann-La Roche Inc.
[2] Cordarone® is a registered trademark of Sanofi-Synthelabo Inc.

Since the small spot diameter allows for a low pulse energy, a compact excimer laser source with a small gas volume and low gas consumption is integrated into the laser console.

The operative laser parameters for Model 1008 are summarized as follows:

Pulse repetition rate: 200 Hz
Fluence: 200 mJ/cm^2 (average)
400 m J/cm^2 (peak)
Optical zone: 6.0 - 7.0 mm for hyperopic treatments (only a 6.5 mm OZ was studied in the clinical trial)
Ablation zone: 9.0 mm for all hyperopic treatments
Ablation spot diameter : 0.95 + 0.10 mm

The software versions in the laser system are as follows:

a. Notebook Software	NB_032101
b. Firmware Software	PR-031001
c. Treatment Lists	NG-033701
d. Eyetracker	4.03

B. Microkeratome

The LASIK procedure requires the use of a commercially available microkeratome that has been cleared for marketing via premarket notification. The device used in this study consists of a sterilization/storage tray which includes the shaper head, a left/right eye adapter, suction ring, suction handle, blade handling pin, and corneal reference marker. The instrument motor, tonometer, cleaning brush, disposable blades, power/suction supply unit with vacuum and motor footswitches and power cords are provided as separate components in an accessory stand and equipment suitcase which complete the system.

VI. ALTERNATIVE PRACTICES AND PROCEDURES

Conventional methods in correcting farsightedness with and without astigmatism are: spectacles, contact lenses, photorefractive keratectomy (PRK), or other types of refractive surgery.

VII. MARKETING HISTORY

The ALLEGRETTO WAVE™ Excimer Laser Systems has been commercially distributed in approximately 31 countries (Austria, Australia, Bahrain, Belgium, Brazil, Canada, China, France, Germany, Great Britain, Greece, Hong Kong, India, Ireland, Israel, Italy, Japan, Korea, Lebanon, Mexico, Netherlands, Norway, Russia, Saudi Arabia, Singapore, Slovenia, Spain, Sri Lanka, Sweden, and Switzerland).

The WaveLight ALLEGRETTO WAVE™ has not been withdrawn from any country or market for reasons of safety or effectiveness of the device.

VIII. POTENTIAL ADVERSE EFFECTS OF THE DEVICE ON HEALTH

Potential adverse effects associated with LASIK include: loss of best spectacle corrected visual acuity, overcorrection, increase in refractive cylinder, worsening of patient complaints such as double vision and glare, sensitivity to bright lights, increased difficulty with night vision, fluctuation in vision, increase in intraocular pressure, corneal haze, corneal infection/ulcer/infiltrate, corneal decompensation/edema, problems associated with the flap including a lost, misplaced or misaligned flap, retinal detachment, and retinal vascular accidents. The occurrence of many of these events may involve the necessity of secondary (additional) surgical intervention.

Please refer to the complete list of adverse events and complications observed during the clinical study, which are presented in the clinical study section.

IX. SUMMARY OF PRECLINICAL STUDIES

Please refer to the SSED for PMA P020050.

X. SUMMARY OF CLINICAL STUDIES

The sponsor performed a clinical study of the WaveLight ALLEGRETTO WAVE™ Excimer Laser System at ten U.S. clinical sites under the auspices of an Investigational Device Exemption (IDE) G990317. The data from this study served as the basis for the approval decision. Specifically, safety and effectiveness outcomes at 6 months postoperatively were assessed, as stability was reached at that time. Outcomes at 12 months postoperatively were also evaluated for confirmation of stability. The IDE study is described in detail as follows.

A. Study Objective

The objective of the study was to determine the safety and effectiveness of the WaveLight ALLEGRETTO WAVE™ Excimer Laser System for LASIK treatment of hyperopic refractive errors up to +6.0 D with and without astigmatic refractive errors up to 6.0 D, with a maximum manifest refraction spherical equivalent of +6.0 D.

B. Study Design

The study was a prospective, non-randomized, 10 center, 11 surgeon study where the primary control was the preoperative status of the treated eye (i.e.,

comparison of pretreatment and post-treatment visual parameters in the same eye).

C. Inclusion and Exclusion Criteria

Enrollment in the WaveLight LASIK for hyperopia and hyperopic astigmatism was limited to:

- Subjects undergoing LASIK surgery for the correction of hyperopia.
- Intended treatment from 0 to +6.0 D of spherical equivalent hyperopia or hyperopia with astigmatism, with up to +6.0 D of spherical component and up to 6.0 D of astigmatic component. (All refractions measured at the spectacle plane).
- Subjects with bilateral physiologic hyperopia.
- Subjects with BSCVA of 20/40 or better in each eye.
- Subjects with a stable refraction (0.5 D or less change in MRSE) for the last 12 months, objectively documented (by previous clinical records, eyeglass prescriptions, etc.), exclusive of changes determined by the investigator to be due to unmasking of latent hyperopia.
- Subjects who were contact lens wearers must have hard or gas permeable lenses discontinued for 3 weeks and soft lenses discontinued for 3 days prior to the preoperative evaluation.
- Subjects at least 18 years of age.
- Subjects with normal corneal topography, as judged by the operating investigator.
- Subjects who signed a written Informed Consent form acknowledging their awareness of their participation in this study, the alternative treatments available, the risks involved, and the investigative nature of LASIK, and other issues that conform to the standard of care for Informed Consent practices.
- Subjects able to return for scheduled follow-up examinations for 24 months after surgery.

Subjects with the following conditions were not eligible for enrollment in the LASIK for hyperopia and hyperopic astigmatism study:

- Subjects with anterior segment pathology
- Subjects with residual, recurrent or active ocular disease
- Subjects who have undergone previous intraocular or corneal surgery involving the stroma in the eye to be operated.
- Subjects who have a history of herpes keratitis
- Subjects with diagnosed autoimmune disease, systemic connective tissue diseases or atopic syndrome, diabetes mellitus, or taking systemic medications (i.e., corticosteroids or antimetabolites) likely to affect wound healing.

- Subjects with unstable central keratometry/topography readings with irregular topography patterns or keratometry mires, including signs of keratoconus.
- Subjects with known sensitivity to study medications.
- Subjects with intraocular pressure of > 23 mm Hg by Goldmann applanation tonometry, a history of glaucoma, or glaucoma suspect.
- Women who are pregnant or nursing or who plan to become pregnant over the course of their participation in this investigation.
- Subjects who intended to participate in other ophthalmic clinical trials during this clinical investigation
- Subjects with colobomas of the iris or other irregularities of the pupil margin.
- Gonioscopic angle measurement of Grade 2 or less, or occludable angle as judged by the investigator.

D. Study Plan, Patient Assessments, and Efficacy Criteria

Subjects were evaluated preoperatively and postoperatively at 1 day, 1 month, 3 months, 6 months, 9 months, 1 year, 18 months and 2 years. Preoperative objective measurements included: uncorrected distance and near visual acuity, manifest refraction, distance best spectacle corrected visual acuity, cycloplegic refraction, applanation tonometry, slit lamp examination, pupil size measurement in photopic and scotopic conditions, central keratometry, computerized corneal topography, pachymetry, dilated fundus examination, and patient questionnaire.

Postoperatively, objective measurements included: uncorrected distance and near visual acuity, manifest refraction, distance best spectacle corrected visual acuity, cycloplegic refraction, applanation tonometry, slit lamp examination, central keratometry, computerized corneal topography, dilated fundus examination, and patient questionnaire.

Subjects were permitted to have second eyes (fellow eyes) treated at the same time as the first eye (primary treatment). Subjects were eligible for retreatment no sooner than 3 months after surgery. Subjects were eligible for retreatment if the manifest refractive spherical equivalent was 0.5 D or greater (myopic or hyperopic), the manifest astigmatism was 0.5 D or more, the distance visual acuity was 20/30 or less, or due to any subjective complaints by the patient with treatable cause as determined by the investigator.

Effectiveness was evaluated based on improvement in uncorrected visual acuity and predictability of the manifest refraction spherical equivalent (MRSE).

E. Study Period, Investigational Sites and Demographic Data

1. Study Period

A total of 290 eyes in 151 subjects were treated between 9/24/01 and 12/11/02. All follow-up received by SurgiVision prior to February 26, 2003 was included in this PMA.

2. Demographics

The demographics for this study are very typical of a contemporary refractive surgery trial performed in the U.S. Gender of subjects treated was almost equally split with 51.0% (148/290) of the cases being female and 49.0% (142/290) being male. Overall, 91.4% (265/290) of eyes treated were in Caucasian subjects, 7.2% (21/290) in Hispanics, and 1.4% (4/290) were categorized as "other" races. The mean age of the patients treated was 51.6 ± 8.8 years with a range from 25 to 69.

Table 1
Demographic Characteristics
(N=290)

Category	Classification	%	n
Gender	Female	51.0	148
	Male	49.0	142
Race	Caucasian	91.4	265
	Black	0.0	0
	Asian	0.0	0
	Hispanic	7.2	21
	Other	1.4	4
	Not Reported	0.0	0
Eyes	OD	49.3	143
	OS	50.7	147
CL History	Soft	30.7	89
	RGP	3.4	10
	PMMA	0.3	1
	Glasses	65.5	190
	Unknown	0.0	0
Age (in Years)	Average	51.55	
	Standard Deviation	8.8	
	Minimum	25.0	
	Maximum	69.0	

F. Data Analysis and Results

1. Baseline characteristics

Table 2 contains a summary of the preoperative refractive errors of the entire cohort.

Table 2
Baseline Characteristics
All Eyes (n=290)

Spherical Equivalent Refraction	**%**	**n**
0.00 to 1.00 D	13.4	39
1.01 to 2.00 D	35.5	103
2.01 to 3.00 D	28.3	82
3.01 to 4.00 D	12.1	35
4.01 to 5.00 D	6.2	18
5.01 to 6.00 D	3.4	10
6.01 to 7.00 D	1.0	3
Cylinder		
0.00 D	25.5	74
0.25 D	13.4	39
0.50 D	21.7	63
0.75 D	14.5	42
1.00 D	9.3	27
1.25 D	3.8	11
1.50 D	2.1	6
1.75 D	2.1	6
2.00 D	3.1	9
2.25 D	1.4	4
2.50 D	0.7	2
2.75 D	0.0	0
3.00 D	0.3	1
3.25 D	0.3	1
3.50 D	1.0	3
3.75 D	0.0	0
4.00 D	0.3	1
4.25 D	0.0	0
4.50 D	0.3	1
4.75 D	0.0	0
>5.00 D	0.0	0

2. Postoperative Characteristics and Results

a. Patient Accountability

There were 290 eyes treated. Accountability information is provided in Table 3. Accountability for All Eyes treated was 98.3% (285/290) at 1-month, 95.2% (276/290) at 3-months, 93.9% (262/279) at 6-months, and 69.9% (100/143) at 1-year. The following cohorts were used for analysis:

- Safety-all eyes (290)
- Effectiveness-all eyes (290)
- Stability-subset of all eyes seen at any two consecutive visits, and subset of all eyes seen at 1, 3 and 6-months (279 and 249)

Table 3
Accountability

		1 Day (N=290)	1 Month (N=290)	3 Months (N=290)	6 Months (N=290)	1 Year (N=290)
Available for Analysis	%	97.2	98.3	95.2	90.3	34.5
	n	282	285	276	262	100
Discontinued-Deceased	%	0.0	0.0	0.0	0.0	0.0
	n	0	0	0	0	0
Discontinued-Retreated	%	0.0	0.0	0.0	1.0	4.5
	n	0	0	0	3	13
Discontinued-Total (Cumulative)	%	0.0	0.0	0.0	1.0	5.5
	n	0	0	0	3	16
Not Yet Eligible for Interval	%	0.0	0.0	0.0	2.8	45.2
	n	0	0	0	8	131
Expected	%	100	100	100	96.2	49.3
	n	290	290	290	279	143
Lost to Follow-Up (Cumulative)	%	0.0	0.0	0.0	0.0	0.3
	n	0	0	0	0	1
Missed Visit	%	2.8	1.7	4.8	5.9	14.5
	n	8	5	14	17	42
% Accountability	%	97.2	98.3	95.2	93.9	69.9
	n	282	285	276	262	100

b. Stability of Outcome

In the 3-6 month window, greater than 95% of eyes experienced a change of MRSE not exceeding 1.0 D. Furthermore, the mean of the paired difference of MRSE was +0.01 D in the 3 to 6-month time period. Thus, stability was demonstrated at 6-months postoperatively.

Table 4 Refractive Stability (Eyes with 1, 3 and 6 Month Visits (n=249)		
Change in MRSE	**1 and 3 Months**	**3 and 6 Months**
	% n **95% CI**	**% n** **95% CI**
≤1.00 D **95% CI for %**	96.0 239 94.8%, 97.2%	98.0 244 97.1%, 98.9%
MRSE (D)		
Mean	+0.12 D	+0.01 D
SD	0.40	0.37
95% CI for Mean	+0.07, +0.17	-0.04, +0.05

c. Effectiveness Outcomes

The analysis of effectiveness was based on the 260 eyes evaluable at the 6-month stability time point. Key efficacy outcomes over the course of the study and at the point of stability stratified by diopter of MRSE are presented in Tables 5 and 6.

Table 5 Summary of Key Efficacy Variables Over Time				
	1 Month **% n** **95% CI**	**3 Months** **% n** **95% CI**	**6 Months** **% n** **95% CI**	**1 Year** **% n** **95% CI**
Efficacy Variables	**N=232**	**N=225**	**N=212**	**N=80**
UCVA 20/20 or better*	61.6 143 58.5%, 64.8%	68.9 155 65.8%, 72.0%	67.5 143 64.2%, 70.7%	67.5 54 62.3%, 72.7%
UCVA 20/40 or better*	96.6 224 95.4%, 97.8%	96.4 217 95.2%, 97.7%	95.3 202 93.8%, 96.7%	98.8 79 97.5%, 100%
	N=285	**N=276**	**N=260**	**N=98**
MRSE ± 0.50 D	72.6 207 70.0%, 75.3%	71.0 196 68.3%, 73.8%	72.3 188 69.5%, 75.1%	65.3 64 60.5%, 70.1%
MRSE ± 1.00 D	94.4 269 93.0%, 95.8%	93.8 259 92.4%, 95.3%	90.4 235 88.6%, 92.2%	90.8 89 87.9%, 93.7%
MRSE ± 2.00 D	99.7 284 99.3%, 100%	99.6 275 99.3%, 100%	100 260 100%, 100%	100 98 100%, 100%

*For all eyes minus those intentionally treated for monovision.

Table 6 Summary of Key Efficacy Variables at 6 Months (Stratified by Preoperative MRSE)								
	0 to 1.0 D **% n** **95% CI**	**>1.0 to 2.0 D** **% n** **95% CI**	**>2.0 to 3.0 D** **% n** **95% CI**	**>3.0 to 4.0 D** **% n** **95% CI**	**>4.0 to 5.0 D** **% n** **95% CI**	**>5.0 to 6.0 D** **% n** **95% CI**	**>6.0 to 7.0 D** **% n** **95% CI**	**Total ≤7 D** **% n** **95% CI**
Efficacy Variables	**N=27**	**N=76**	**N=60**	**N=24**	**N=16**	**N=7**	**N=2**	**N=212**
UCVA 20/20 or better*	77.8 21 69.8%, 85.8%	79.0 60 74.3%, 83.6%	63.3 38 57.1%, 69.6%	37.5 9 27.6%, 47.4%	50.0 8 37.5%, 62.5%	71.4 5 54.4%, 88.5%	100.0 2 100%, 100%	67.5 143 64.2%, 70.7%
UCVA 20/40 or better*	96.3 26 92.7%, 99.9%	97.4 74 95.5%, 99.2%	95.0 57 92.2%, 97.8%	91.7 22 86.0%, 97.3%	93.8 15 87.7%, 99.8%	85.7 6 72.5%, 98.9%	100.0 2 100%, 100%	95.3 202 93.8%, 96.7%
	N=37	**N=96**	**N=73**	**N=28**	**N=16**	**N=8**	**N=2**	**N=260**
MRSE ± 0.50 D	91.9 34 87.4%, 96.4%	76.0 73 71.7%, 80.4%	64.4 47 58.8%, 70.0%	71.4 20 62.9%, 80.0%	62.5 10 50.4%, 74.6%	50.0 4 32.3%, 67.7%	0.0 0 0.0%, 0.0%	72.3 188 69.5%, 75.1%
MRSE ± 1.00 D	97.3 36 94.6%, 100%	95.8 92 93.8%, 97.9%	83.6 61 79.2%, 87.9%	85.7 24 79.1%, 92.3%	100 16 100%, 100%	75.0 8 59.7%, 90.3%	0.0 0 0.0%, 0.0%	90.4 235 88.6%, 92.2%
MRSE ± 2.00 D	100 37 100%, 100%	100 96 100%, 100%	100 73 100%, 100%	100 28 100%, 100%	100 16 100%, 100%	100 8 100%, 100%	100 2 100%, 100%	100 260 100%, 100%

*For all eyes minus those intentionally treated for monovision.

Analysis of the correction of the cylindrical component of the astigmatic eyes is presented in Tables 7 and 8. The Ophthalmic Devices Panel (the Panel), at the January 14, 1997 meeting, assessed outcomes from a myopic astigmatic treatment and provided FDA with recommendations as to acceptable effectiveness rates. The mean reduction in absolute cylinder at 6-months is consistent with what the Panel considered acceptable mean reduction in absolute cylinder at the point of stability.

Table 7
Cylinder Correction Efficacy Stratified by Preoperative Cylinder

	6 Months	
Preoperative Cylinder	**Reduction of Absolute Cylinder**	
	% Reduction Mean[1]	**Ratio Mean[2]**
≤ 1.00 D	69.9%	0.63
> 1.00 to ≤ 2.00 D	75.1%	0.17
> 2.00 to ≤ 3.00 D	68.5%	0.22
> 3.00 to ≤ 4.00 D	80.7%	0.07
> 4.00 to ≤ 5.00 D	72.2%	-0.28
Total	70.9%	0.53

[1] [(Postoperative cylinder – Preoperative cylinder) / Preoperative cylinder] x 100
[2] Postoperative cylinder / Preoperative cylinder]

Looking at the intended versus achieved vector magnitude cylinder, the Intended Refractive Correction ("IRC") had a mean of –1.01 ± 0.79 D. The Surgically Induced Refractive Correction ("SIRC") had a mean of –1.09 ± 0.80 D. The vector magnitude ratio (SIRC/IRC) was 1.16 at 6-months. The Panel has found 0.82 acceptable for correction efficacy (SIRC/IRC) at stability.

Table 8
Cylinder Correction Efficacy Stratified by Preoperative Cylinder

	6 Months
Preoperative Cylinder	**Achieved vs. Intended Vector Magnitude Ratio (Achieved/Intended) Mean**
ALL	1.16
0 to 0.50 D	1.28
>0.50 to ≤ 1.00 D	1.24
>1.00 to ≤ 2.00 D	1.03
>2.00 to ≤ 3.00 D	0.98
>3.00 to ≤ 4.00 D	0.98
>4.00 to ≤ 5.00 D	0.83

Table 9 presents the accuracy of the sphere and cylinder components in a non-vector analysis, for each postoperative interval. Sphere accuracy is rated against the target sphere while cylinder accuracy is rated against zero.

Table 9
Accuracy of Sphere (To Target) and Cylinder (To Zero) Component (For Eyes Treated for Astigmatic Myopia)

	1 Month % n 95% CI	3 Months % n 95% CI	6 Months % n 95% CI	1 Year % n 95% CI
CYLINDER	**N=193**	**N=190**	**N=181**	**N=82**
<= 0.50 D	69.4 134 66.1%, 72.8%	74.2 141 71.0%, 77.4%	76.8 139 73.7%, 79.9%	73.2 60 68.3%, 78.1%
<=1.00 D	93.8 181 92.0%, 95.5%	92.6 176 90.7%, 94.5%	93.9 170 92.2%, 95.7%	89.0 73 85.6%, 92.5%
SPHERE				
± 0.50 D	74.1 143 70.9%, 77.3%	73.2 139 69.9%, 76.4%	74.0 134 70.8%, 77.3%	67.1 55 61.9%, 72.3%
± 1.00 D	94.8 183 93.2%, 96.4%	94.7 180 93.1%, 96.4%	91.2 165 89.1%, 93.3%	92.7 76 89.8%, 95.6%

d. Safety Outcomes

The analysis of safety was based on the 260 eyes that have had the 6-month examination. The key safety results for this study are presented in Tables 10 and 11, with all adverse events reported in Table 12. Overall the device was deemed reasonably safe.

Table 10 Summary of Key Safety Variables Over Time				
	1 Month % n 95% CI	3 Months % n 95% CI	6 Months % n 95% CI	1 Year % n 95% CI
Safety Variables	**N=285**	**N=276**	**N=260**	**N=98**
Loss of ≥ 2 lines BSCVA	3.2 9 2.1%, 4.2%	1.8 5 1.0%, 2.6%	1.5 4 0.8%, 2.3%	1.0 1 0.0%, 2.0%
BSCVA worse than 20/40	0.7 2 0.2%, 1.2%	0.4 1 0.0%, 0.7%	0.4 1 0.0%, 0.8%	0.0 0 0.0%, 0.0%
	N=92	**N=86**	**N=79**	**N=16**
Increase > 2 D Cylinder#	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%
	N=260	**N=251**	**N=241**	**N=90**
BSCVA worse than 20/25 if 20/20 or better preoperatively	0.4 1 0.0%, 0.8%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%

#For eyes treated for spherical correction only.

Table 11
Summary of Key Safety Variables
at 6 Months (Stratified by Preoperative MRSE)

	0 to 1.0 D % n 95% CI	>1.0 to 2.0 D % n 95% CI	>2.0 to 3.0 D % n 95% CI	>3.0 to 4.0 D % n 95% CI	>4.0 to 5.0 D % n 95% CI	>5.0 to 6.0 D % n 95% CI	>6.0 to 7.0 D % n 95% CI	Cum Total ≤7 D % n 95% CI
Safety Variables	**N=37**	**N=96**	**N=73**	**N=28**	**N=16**	**N=8**	**N=2**	**N=260**
Loss of ≥ 2 lines BSCVA	0.0 0 0.0%,0.0%	0.0 0 0.0%, 0.0%	2.7 2 0.8%, 0.7%	0.0 0 0.0%, 0.0%	6.3 1 0.2%,12.3%	12.5 1 0.8%,24.2%	0.0 0 0.0%, 0.0%	1.5 4 0.8%, 2.3%
BSCVA worse than 20/40	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	6.3 1 0.2%,12.3%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.4 1 0.0%, 0.8%
	N=11	**N=31**	**N=29**	**N=4**	**N=3**	**N=1**	**N=0**	**N=79**
Increase >2 D cylinder#	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%
	N=36	**N=93**	**N=72**	**N=21**	**N=11**	**N=6**	**N=2**	**N=241**
BSCVA worse than 20/25 if 20/20 or better preoperatively	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%

#For eyes treated for spherical correction only.

Table 12 presents a summary of adverse events. The benchmark for each adverse event is a rate of less than 1% per event.

Table 12
Adverse Events

Adverse Event	1 Month %	1 Month n N=285	3 Months %	3 Months n N=276	6 Months %	6 Months n N=262	1 Year %	1 Year n N=100
Corneal infiltrate or ulcer requiring treatment	0.0	0	0.0	0	0.0	0	0.0	0
Lost, misplaced, or misaligned flap, or any flap/cap problems requiring surgical intervention beyond 1 month	0.0	0	0.0	0	0.0	0	0.0	0
Corneal edema at 1 month or later visible in the slit lamp exam	0.0	0	0.0	0	0.0	0	0.0	0
Any complication leading to intraocular surgery	0.0	0	0.0	0	0.0	0	0.0	0
Melting of the flap of >1 mm sq	0.0	0	0.0	0	0.0	0	0.0	0
Epithelium of > 1 mm2 in the interface with loss of 2 lines or more of BSCVA	0.0	0	0.0	0	0.0	0	0.0	0
Uncontrolled IOP rise with increase of > 5 mm Hg or any reading above 25 mm Hg	0.0	0	0.0	0	0.0	0	0.0	0
Retinal detachment or retinal vascular accident	0.0	0	0.4	1	0.0	0	0.0	0
Decrease in BSCVA of > 10 letters not due to irregular astigmatism as shown by hard contact lens refraction	0.0	0	0.0	0	0.0	0	0.0	0

Table 13 Complications Summary Table								
Complications	**1 Month**		**3 Months**		**6 Months**		**1 Year**	
	%	**n**	**%**	**n**	**%**	**n**	**%**	**n**
	(N=285)		**(N=276)**		**(N=262)**		**(N=100)**	
Corneal edema between 1 week and 1 month after the procedure	0.0	0	0.0	0	0.0	0	0.0	0
Corneal epithelial defect at 1 month or later	0.0	0	0.4	1	0.8	2	0.0	0
Any epithelium in the interface	1.1	3	0.7	2	0.8	2	0.0	0
Foreign body sensations at 1 month or later	0.0	0	0.0	0	0.0	0	0.0	0
Pain at 1 month or later	1.8	5	0.0	0	0.0	0	0.0	0
Ghosting or double images in the operative eye at stability or beyond			0.0	0	0.0	0	0.0	0
Need for lifting and/or reseating of the flap/cap prior to 1 month	0.0	0	0.0	0	0.0	0	0.0	0

Table 14 Change in Patient Symptoms at 6 Months						
	Worse		**No Change**		**Better**	
	%	**n**	**%**	**n**	**%**	**n**
	N=260		**N=260**		**N=260**	
Glare from Bright Lights	10.9	29	62.9	163	26.1	68
Halos	13.3	35	68.6	178	18.2	47
Light Sensitivity	12.9	34	67.4	175	19.7	51
Visual Fluctuations	29.5	77	62.5	162	8.0	21
Night Driving Glare	16.0	42	61.2	159	22.8	59

e. Retreatments

A total of 16 eyes were retreated with the study laser due primarily to undercorrection. One eye was retreated for overcorrection. Table 15 contains the outcomes for retreated eyes.

Table 15
Summary of Key Safety and Efficacy Variables Over Time for Retreated Eyes

	1 Month % n 95% CI	3 Months % n 95% CI	6 Months % n 95% CI	1 Year % n 95% CI
Efficacy Variables	**N=11**	**N=8**	**N=2**	**N=0**
UCVA 20/20 or better*	54.6 6 39.5%, 69.6%	75.0 6 59.7%, 90.3%	100 2 100%, 100%	0.0 0 0.0%, 0.0%
UCVA 20/40 or better*	100 11 100%, 100%	100 8 100%, 100%	100 1 100%, 100%	0.0 0 0.0%, 0.0%
	N=12	**N=10**	**N=3**	**N=0**
MRSE ± 0.50 D	83.3 10 72.6%, 94.1%	80.0 8 67.4%, 92.7%	66.7 2 39.5%, 93.9%	0.0 0 0.0%, 0.0%
MRSE ± 1.00 D	83.3 10 72.6%, 94.1%	90.0 9 80.5%, 99.5%	66.7 2 39.5%, 93.9%	0.0 0 0.0%, 0.0%
MRSE ± 2.00 D	91.7 11 83.7%, 99.7%	90.0 9 80.5%, 99.5%	66.7 2 39.5%, 93.9%	0.0 0 0.0%, 0.0%
Safety Variables	**N=12**	**N=10**	**N=3**	**N=0**
Loss of ≥ 2 lines 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 0.0%, 0.0%
BSCVA worse than 20/40	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%
BSCVA worse than 20/25 if 20/20 or better preoperatively	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%
	N=8	**N=7**	**N=2**	**N=0**
Increase >2 D cylinder#	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%	0.0 0 0.0%, 0.0%

*For all eyes minus those intentionally treated for monovision.
#For eyes treated for spherical correction only.

f. Factors Associated with Outcomes

The following are the results of the testing for association between several baseline characteristics and 3 month outcomes. In summary, enrollment was approximately equal between the sexes, and preoperative characteristics (age, refraction, BSCVA, etc.) were also similar. Women were twice as likely as men to have monovision targets. Results for the sexes were similar; however, men were significantly more likely than women to achieve 20/20 UCVA results despite similar refractive and mean UCVA outcomes. The clinical significance, if any, of this difference is uncertain. Significant preoperative differences were seen with age. Persons over 50 may seek refractive correction for hyperopia with a slightly smaller refractive error. MRSE, UCVA and BSCVA outcomes were not affected by age. There was a tendency for eyes with lower preoperative refractions to have slightly better preoperative BSCVA (20/18.2 v 20/20.9).

In this series, the mean result was for slight undercorrection (0.24 ± 0.54 D) with a greater tendency for undercorrection in the 2 to 4 D group. Eyes with smaller corrections were more likely to achieve a better UCVA result, and more likely to achieve a refractive result between ±0.50 D. BSCVA is not expected to improve with hyperopic LASIK because the loss of spectacle magnification causes the image size to decrease after correction. However, in this series, the mean outcome for BSCVA change was a net gain of 0.3 lines. Eyes with less than 2 D correction were more likely to gain BSCVA. In summary, eyes with smaller corrections achieve the best results, but the differences were small. No direct correlations for pupil size with preoperative and main postoperative target measures were found.

g. Patient Satisfaction

Subjects were asked to complete a patient questionnaire preoperatively and at 3-months, 6-months, and 1-year postoperatively. Responses were made by placing a mark or an "x" through the provided line. Each end of the line was marked with opposing answers such as "Never" versus "All the Time". A mark on either end of the bar represented an extreme answer (never on one end, all the time on the other end) and a mark in the middle indicated a scaled response between the extremes.

Patient reports of glare from bright lights and night driving glare improved after LASIK.

Table 16 Patient Symptoms						
	Preoperative			6 Months		
	None-Mild % n	Moderate % n	Marked-Severe % n	None-Mild % n	Moderate % n	Marked-Severe % n
	N=287	N=287	N=287	N=260	N=260	N=260
Glare from Bright Lights	50.9 46	27.5 79	21.6 62	65.4 170	20.8 54	13.8 36
Halos	70.4 202	15.3 44	14.3 41	71.2 185	15.0 39	13.9 36
Light Sensitivity	61.7 177	17.8 51	20.6 59	61.5 160	23.5 61	15.0 55
Visual Fluctuations	71.1 204	24.7 71	4.2 12	55.4 144	28.5 74	16.2 42
Night Driving Glare	78.0 223	10.5 30	11.5 33	83.0 216	8.5 22	8.5 22

XI. CONCLUSIONS DRAWN FROM THE CLINICAL STUDY

The data in this application support reasonable assurance of the safety and effectiveness of this device when used in accordance with the approved indications for use.

XII. PANEL RECOMMENDATIONS

In accordance with the provision of section 515(c)(2) 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. CDRH DECISION

CDRH issued an approval order on OCT 10 2003.

An inspection of the manufacturing facility determined that the applicant was in compliance with the Quality System Regulation (21 CFR 820).

XIV. APPROVAL SPECIFICATIONS

- Postapproval Requirement and Restrictions: see Approval Order
- Hazards to Health from Use of the Device: See Indication, Contraindication, Warnings, Precautions, and Adverse Events in the labeling
- Direction for use: see labeling