

Addendum

ALLEGRETTO WAVETM

Scanning Spot LASIK Laser System

**Procedure Manual
Mixed Astigmatism Treatments
Information for professional use**

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All images are representative. The numbers shown in the images are just examples and may not represent typical values. Some sections of this manual may not apply for all devices. Such sections will be marked accordingly. Other manuals may apply as well for use of the device described hererin.

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USING THE ALLEGRETTO WAVE™ PROCEDURE MANUAL

This manual provides information for the intended clinical use of the ALLEGRETTO WAVE™ Laser System.

This manual provides only information that is specific for mixed astigmatism LASIK. Refer to the Operator's Manual of the Laser Console, to its addendums, its Procedure Manual and to the user's manuals of the approved accessories for information regarding these components.

Carefully read and understand this manual and all related documents and instructions before using the ALLEGRETTO WAVE™ Laser System for performing mixed astigmatism LASIK treatments.

Observe all warnings, precautions and contra-indications as described in these documents.

Do not perform adjustments and procedures other than those described in these documents. Failure to do so may result in harm to patient and / or user.

Consult the Table of Contents, Appendices or Index for specific information.

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TYPOGRAPHICAL CONVENTIONS

The following conventions are used in this manual for Warnings, Precautions and Notes:

**WARNING**

A Warning alerts the user to potential serious outcomes to the patient or the user.

**CAUTION**

Precautions alert the user to exercise special care necessary for the safe and effective use of the device.

NOTE

Notes provide user with helpful or supplementary information.

NOTICE TO USERS

RESTRICTIONS BY US FEDERAL LAW



CAUTION

US Federal law restricts this device to sale by or on the order by a physician or licensed eye care practitioner.

US Federal law restricts the use of this device to practitioners who have been trained in its operation, test and calibration and who have experience in the surgical management and treatment of refractive errors of the human eye.

RESTRICTIONS BY MANUFACTURER

There are no rightful claims to system upgrades in the event of the introduction of product improvements based on new technological developments.



CAUTION

Read and understand this Procedure Manual, the Operators Manual and all related manuals of the Laser System and its approved accessories before starting to use the ALLEGRETTO WAVE Laser System!



CAUTION

The system user alone is responsible for having sufficient medical knowledge for carrying out all surgical procedures!



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2 INDICATIONS, CONTRAINDICATIONS, WARNINGS, PRECAUTIONS AND ADVERSE EVENTS

2.1 Indications for Use

The ALLEGRETTO WAVE Laser System is indicated for use in Laser Assisted In-Situ Keratomileusis (LASIK) treatments for:

- The reduction or elimination of naturally occurring mixed astigmatism of up to 6.0 diopters (D) at the spectacle plane;
- Patients who are 21 years of age or older; and
- Patients with documentation of a stable manifest refraction defined as ≤ 0.5 D preoperative spherical equivalent shift over one year prior to surgery

2.2 Contraindications

LASIK treatments are 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 to keratoconus
- Patients who are taking one or both of the following medications: isotretinoin (Accutane®¹); amiodarone hydrochloride (Cordarone®²)

¹ Accutane® is a registered trademark of Hoffmann-La Roche Inc.

² Cordarone® is a registered trademark of Wyeth Inc.

2.3 Warnings

LASIK treatment is not recommended in patients who have any of the following:

- Systemic diseases likely to affect wound healing, such as connective tissue disease, insulin dependent diabetes, severe atopic disease or an immunocompromised status
- A history of Herpes simplex or Herpes zoster keratitis
- Significant dry eye that is unresponsive to treatment
- Severe allergies

2.4 Precautions

2.4.1 General

Safety and effectiveness of the ALLEGRETTO WAVE Laser System has not been established for patients:

- With progressive mixed astigmatism, ocular disease, previous corneal or intraocular surgery, or trauma in the ablation zone
- With corneal abnormalities including, but not limited to, scars, irregular astigmatism and corneal warpage
- With residual corneal thickness after ablation of less than 250 microns due to an increased risk for corneal ectasia
- With history of glaucoma or ocular hypertension of > 23 mmHg
- Taking the medication sumatriptan succinate (Imitrex®³)
- Under 21 years of age
- Over the long term (more than 12 months after surgery)
- With media problems, corneal, lens and/or vitreous opacities including, but not limited to cataract

³ Imitrex® is a registered trademark GlaxoSmithKline Inc.

- With iris problems including , but not limited to, coloboma and previous iris surgery compromising proper eyetracking;
- Taking medications likely to affect wound healing including, but not limited to, antimetabolites;
- For treatments with an optical zone below 6.0 millimeters and above 6.5 millimeters in diameter. While the ALLEGRETTO WAVE has the potential for additional ranges of optical and ablation zones, no information is available regarding their level of safety and/or effectiveness;
- With mixed astigmatism greater than 6 Diopters
- In cylinder amounts >4 to ≤ 6 D due to the lack of large numbers of patients in the general population, there are few subjects with cylinder amounts in this range to be studied. Not all complications, adverse events, and levels of effectiveness may have been determined.

Pupil sizes should be evaluated under mesopic illumination conditions. Effects of treatment on vision under poor illumination cannot be predicted prior to surgery. Some patients may find it more difficult to see such in conditions as very dim light, rain, fog, snow and glare from bright lights. This has been shown to occur more frequently in the presence of residual refractive error and perhaps in patients with pupil sizes larger than the optical zone size.

The refraction is determined in the spectacle plane, but treated in the corneal plane. In order to determine the right treatment program to achieve the right correction, assessment of the vertex distance during refraction test is recommended.

Preoperative evaluation for dry eyes should be performed. Patients should be advised of the potential for dry eyes post LASIK surgery.



2.4.2 Patient Selection

In addition to previously described contraindications, warnings and general precautions, the following should be considered in order to find good candidates for LASIK and to get sufficient information for the treatment plan:

- Mixed astigmatism treatments are to be performed when the magnitude of cylinder is greater than the magnitude of sphere and the cylinder and sphere have opposite signs.
- A complete baseline exam including, but not limited to, cycloplegic refraction within 60 days prior to surgery is necessary.
- A slit lamp exam has to be performed. The status of the lens has to be evaluated to ensure that neither nuclear sclerosis nor other lens opacities are present. These opacities may adversely affect final visual result.
- Dilated fundus exam by indirect ophthalmoscopy has to be performed, as retinal pathology is more likely in patients with myopia
- Optical nerve and intraocular pressure have to be examined as glaucoma is more common in subjects with optical errors than in emmetropic subjects. If elevated pressure or signs of glaucomatous damage are found, topical steroids should be used only under careful medical supervision or the patient should not be treated.
- In order to exclude corneal abnormalities careful videokeratography (topography) is essential.

For contact lens wearers, the following must additionally be considered:

- Contact lens wearers must discontinue wearing hard or gas permeable lenses for at least 3 weeks and soft lenses for at least 3 days **prior to preoperative evaluation**.
- Contact lens wearers must also discontinue wearing hard or gas permeable lenses for at least 3 weeks and soft lenses for at least 3 days **prior to surgery**.

The patients must meet certain general requirements for the treatment:

- The patient must be able to lie flat in a supine position
- Topical or local anesthesia must be tolerated.
- The patient must be able to fixate steadily.
- The patient must be able to understand and give the informed consent and sign the informed consent form.

The patient must be informed about and understand all alternatives to the to the LASIK procedure for correcting mixed astigmatism: with glasses or contact lenses, or other surgical procedures such as radial keratotomy, automated lamellar keratoplasty or clear lens exchange.

Additionally patients should be instructed not to wear makeup at the day of surgery, because this poses risk for contamination of the stromal interface. Patients must not use perfumes, aftershave, Eau de Cologne or other substances applied to the skin containing alcohol at that day.

2.4.3 Procedure

Ablation Details

During ablation spherical and astigmatic error are treated separately. The spherical portion of the refractive treatment is myopic. This portion is applied first. The astigmatic portion is hyperopic and follows immediately without interruption. The myopic treatment is enrolled by creating the full amount of intended correction during the first few seconds, but in a diameter smaller than the full Optical Zone. During the course of the ablation the zone already corrected is enlarged to the programmed Optical Zone diameter. The currently achieved diameter with full correction is not indicated.

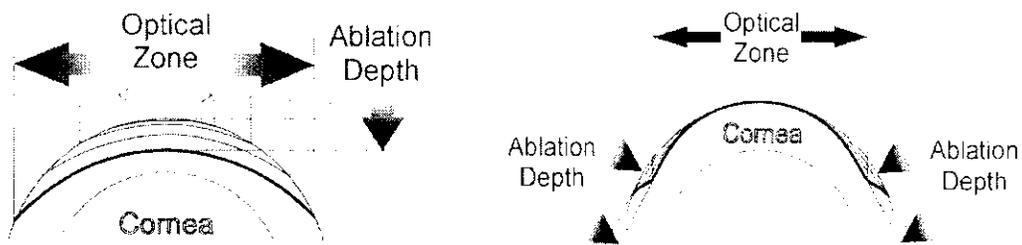


Figure 1: Evolution of Ablation Myopic (left) and Hyperopic (right) Treatment Part

In the hyperopic astigmatic treatment part, the profile is corrected immediately over the full optical zone and only depth is increased. The currently achieved depth is not indicated.

Mixed astigmatism treatment s flattens the axis of the (positive) cylinder and steepen the axis 90° apart from the axis of the (positive) cylinder.

Typical Treatment Profiles

The following figure shows a typical ablation depth profile of a mixed astigmatism treatment (the higher the profile or the 'hotter' the color, the deeper the ablation).

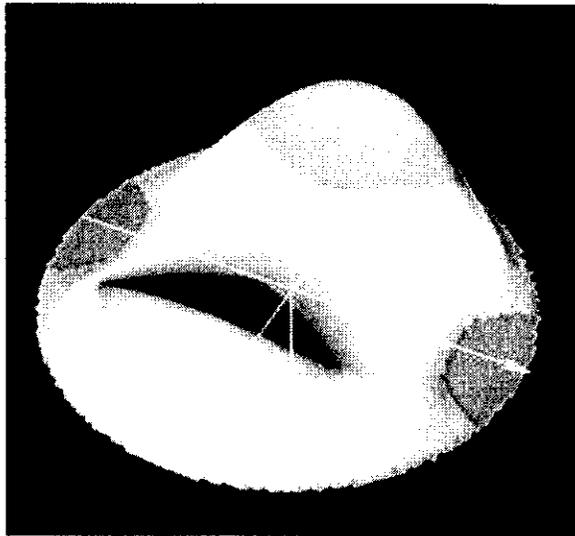


Figure 2: Mixed Astigmatism Ablation Depth Profile

Optical Zones

The Optical Zone is the area where the intended correction treatment is applied. The Optical Zones of all mixed astigmatism treatments are circular. It is surrounded by a blend zone, called Transition Zone. Both add up to the Ablation Zone. The Ablation Zone determines the area hit by laser pulses. The shapes of Transition and Ablation Zone are circular for mixed astigmatism treatments.

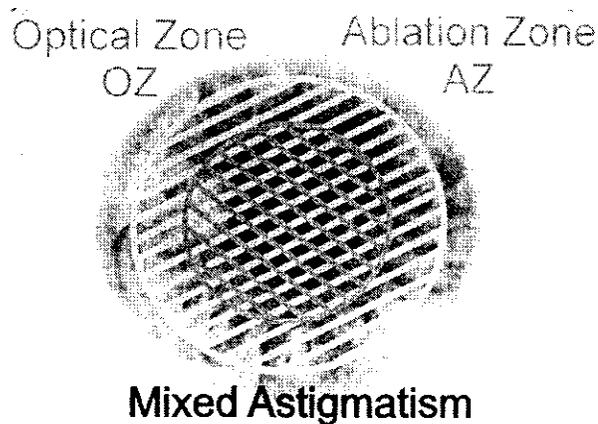


Figure 3: Optical and Ablation Zone Mixed Astigmatism Treatments



2.5 Adverse Events

Certain adverse events and complications have been noticed after mixed astigmatism LASIK surgery. No protocol-defined adverse events occurred during this clinical trial. Two events were reported to FDA and the IRB as adverse events during the follow-up period of this clinical trial. The first event involved a patient who postoperatively was subject to blunt trauma to the treatment eye 6 days after surgery. The patient was found to have an intact globe with no rupture, inflammation or any dislodgement of the flap. UCVA was decreased due to this event. The second event involved the treatment of an incorrect axis of astigmatism. The axis was treated at 60 instead of 160 degrees.

The following adverse events did not occur: corneal infiltrate or ulcer requiring treatment; corneal epithelial defect involving the keratectomy at 1 month or later; corneal edema at 1 month or later visible in the slit lamp exam; epithelium of > 1 mm² in the interface with loss of 2 lines or more of BSCVA; lost, misplaced or misaligned flap or any flap/cap problems that require surgical intervention beyond 1 month; decrease in BSCVA of > 10 letters not due to irregular astigmatism as shown by hard contact lens refraction; any complication leading to intraocular surgery; melting of the flap of > 1 mm sq; uncontrolled IOP rise; and retinal detachment or retinal vascular accident.

No complications occurred at the time of surgery.

Table 2 list complications that occurred during the follow-up period.

Table 2
Complications Summary Table

Complications	1 Month		3 Months		6 Months	
	%	n N=161	%	n N=142	%	n N=111
Corneal edema between 1 week and 1 month after the procedure	0.0	0	0.0	0	0.0	0
Corneal epithelial defect at 1 month or later	0.0	0	0.0	0	0.0	0
Any epithelium in the interface	0.0	0	0.0	0	0.0	0
Foreign body sensations at 1 month or later	1.2	2	0.0	0	0.0	0
Pain at 1 month or later	0.0	0	0.0	0	0.0	0
Ghosting or double images in the operative eye at stability or beyond			0.0	0	1.8	2
Need for lifting and/or reseating of the flap/cap prior to 1 month	0.0	0	0.0	0	0.0	0

3 STUDY DATA

The Sponsor performed a clinical study of the WaveLight ALLEGRETTO WAVE Excimer Laser System at six U.S. clinical sites under the auspices of an Investigational Device Exemption (IDE) G040113. The data from this study served as the basis for the approval decision. Specifically, safety and effectiveness outcomes at 3 months postoperatively were assessed, as stability was reached at that time. Outcomes at 6 months postoperatively were also evaluated for confirmation of stability. The IDE study is described in detail as follows.

3.1 Study Objectives

The objectives of the study were to determine the safety and effectiveness of the WaveLight ALLEGRETTO WAVE Excimer Laser System for LASIK treatment of mixed astigmatism refractive errors up to 6.0 D.

3.2 Study Design

The study was a prospective, non-randomized, 6 center, 7 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).

3.3 Inclusion And Exclusion Criteria

Subjects in the LASIK for mixed astigmatism study must have met all of the following inclusion criteria to qualify for enrollment:

- Subjects must be undergoing LASIK surgery for the correction of mixed astigmatism in either or both eyes
- Intended treatment from 0.5 to 6 D of manifest mixed astigmatism.
- BSCVA of 20/40 or better in each eye.
- Subjects must have had a stable refraction (0.5 D or less change in spherocylindrical) for the last twelve (12) months, objectively documented (by previous clinical records, eyeglass prescriptions, etc.). Serial topographies shall not be required.
- Subjects who are 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 must be at least eighteen (18) years of age.
- Corneal topography must be normal, as judged by the operating investigator.
- Subjects must sign 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 which conform to the standard of care for Informed Consent practices.
- Subjects must be able to return for scheduled follow-up examinations for 6 months after surgery.

Subjects with the following conditions were not eligible for enrollment in the LASIK for mixed 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.
- Participation in other ophthalmic clinical trials during this clinical investigation.
- Subjects with colobomas of the iris or other irregularities of the pupil margin.



3.4 Study Plan, Patient Assessments And Efficacy Criteria

Subjects were evaluated preoperatively and postoperatively at 1 day, 1 month, 3 months, and 6 months. 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, measurement of angle kappa 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 myopic 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).

3.5 Study Period, Investigational Sites And Demographic Data

3.5.1 Study Period

A total of 162 eyes in 96 subjects were treated between 9/14/04 and 7/29/05.

3.5.2 Demographics And Baseline Characteristics

More males than females were treated with 67.3% (109/162) of the cases being male and 32.7% (53/162) being female. Overall, 85.8% (139/162) of eyes treated were in Caucasian subjects, 8.0% (13/162) in Hispanics, 3.7% (6/162) in Blacks, 1.2% (2/162) in Arabs, and 1.2% (1/162) in American Indians. The mean age of the patients treated was 39.0±9.4 years with a range from 22 to 70.

Table 6
Demographic Characteristics
(N=162)

Category	Classification	%	n
Gender	Female	32.7	53
	Male	67.3	109
Race	Caucasian	85.8	139
	Black	3.7	6
	Asian	0.0	0
	Hispanic	8.0	13
	Other	2.4	4
	Not Reported	0.0	0
Eyes	OD	50.6	82
	OS	49.4	80
CL History	Soft	22.3	36
	RGP	2.5	4
	PMMA	0.0	0
	Glasses	74.1	120
	Unknown	1.2	2
Age (in Years)	Average	39.0	
	Standard Deviation	9.4	
	Minimum	22	
	Maximum	70	

3.6 Data Analysis And Results

3.6.1 Baseline Characteristics

Table 7 contains a summary of the preoperative refractive errors of the entire cohort.

Table 7
Preoperative Refractive Error Stratified by Sphere and Cylinder
(N=162)

Sphere	Cylinder (Minus Cylinder Notation)												Total	
	0 to ≤1 D		>1 to ≤2 D		>2 to ≤3 D		>3 to ≤4 D		>4 to ≤5 D		>5 to ≤6 D			
	%	n	%	n	%	n	%	n	%	n	%	n	%	n
0 to <1 D	6.8	11	31.5	51	21.6	35	6.2	10	1.2	2	0.6	1	67.9	110
>1 to <2 D	0.0	0	4.9	8	6.2	10	6.2	10	1.9	3	0.0	0	19.1	31
>2 to <3 D	0.0	0	0.0	0	1.9	3	4.9	8	3.1	5	0.6	1	10.5	17
>3 to <4 D	0.0	0	0.0	0	0.0	0	0.0	0	1.2	2	0.6	1	1.9	3
>4 to <5 D	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.6	1	0.6	1
>5 to <6 D	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Total	6.8	11	36.4	59	29.7	48	17.3	28	7.4	12	2.4	4	100	162

3.7 Postoperative Characteristics And Results

3.7.1 Patient Accountability

There were 162 eyes treated. Accountability was 99.4% (161/162) at 1-month, 96.0% (142/148) at 3-months, and 100% (111/104) at 6-months. The following cohorts were used for analysis:

- Safety-all eyes (162)
- Effectiveness-all eyes (162)
- Stability-subset of all eyes seen at any two consecutive visits, and subset of all eyes seen at 1, 3 and 6-months (142 and 105)

3.7.2 Stability Of Outcome

In the 1-3 and 3-6 month windows, greater than 98% of eyes experienced a change of MRSE not exceeding 1.0 D. Furthermore, the mean of the paired difference of MRSE was 0.07 D in the 1 to 3-month time period and 0.01 D in the 3 to 6-month time period. Thus, stability was demonstrated at 3-months postoperatively.

Table 8
Refractive Stability
(Eyes with 1, 3 and 6 Month Visits (n=105))

Change in MRSE	1 and 3 Months		3 and 6 Months	
	%	n	%	n
≤ 1.00 D	99.0	104	98.1	103
95% CI for %	98.1%, 100%		96.8%, 99.4%	
MRSE (D)				
Mean	+0.07 D		+0.01 D	
SD	0.34		0.32	
95% CI for Mean	0.00, +0.13		-0.05, +0.07	

Please note that the confidence interval gives an estimated range of values which is likely to include an unknown population parameter, the estimated range being calculated from a given set of data. The width of the confidence interval gives us some idea about how uncertain we are about the parameter.

3.7.3 Effectiveness Outcomes

The analysis of effectiveness was based on the 142 eyes evaluable at the 3-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 9 and 10**.

Table 9
Summary of Key Efficacy Variables Over Time

Efficacy Variables	1 Month		3 Months		6 Months	
	%	n	%	n	%	n
	95% CI		95% CI		95% CI	
	N=161		N=142		N=111	
UCVA 20/20 or better*	59.6	96	67.6	96	69.4	77
	55.8%, 63.5%		63.7%, 71.5%		65.0%, 73.7%	
UCVA 20/40 or better*	96.9	156	95.8	136	97.3	108
	95.5%, 98.3%		94.1%, 97.5%		95.8%, 98.8%	
MRSE + 0.50 D	91.3	147	95.8	136	91.0	101
	89.1%, 93.5%		94.1%, 97.5%		88.3%, 93.7%	
MRSE + 1.00 D	99.4	160	100	142	97.3	108
	98.8%, 100%		100%, 100%		95.8%, 98.8%	
MRSE + 2.00 D	100	161	100	142	100	111
	100%, 100%		100%, 100%		100%, 100%	

* For all eyes minus those intentionally treated for monovision.

Table 10
Summary of Key Efficacy Variables
at 3 Months (Stratified by Preoperative MRSE)

Efficacy Variable	0 to 1.0 D	>1.0 to 2.0 D	>2.0 to 3.0 D	>3.0 to 4.0 D	>4.0 to 5.0 D	>5.0 to 6.0 D	>6.0 to 7.0 D	Total ≤7 D
	%	%	%	%	%	%	%	%
	n	n	n	n	n	n	n	n
	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI
	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI
	N=132	N=10	N=0	N=0	N=0	N=0	N=0	N=142
UCVA 20/20 or better*	68.9 91 64.9% 73.0%	50.0 5 34.2% 65.8%	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%	67.6 96 63.7% 71.5%
UCVA 20/40 or better*	96.2 127 94.6% 97.9%	90.0 9 80.5% 99.5%	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%	95.8 136 94.1% 97.5%
MRSE ± 0.50 D	97.0 128 95.5% 98.5%	80.0 8 67.4% 92.7%	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%	95.8 136 94.1% 97.5%
MRSE ± 1.00 D	100 132 100% 100%	100 10 100% 100%	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%	100 142 100% 100%
MRSE ± 2.00 D	100 132 100% 100%	100 10 100% 100%	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%	100 142 100% 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 11 and 12.

Table 11
Reduction Of Absolute (Non-Vector) Cylinder

Preoperative Cylinder	Reduction of Absolute Cylinder		
	Month 1	Month 3	Month 6
	Mean ¹ Range	Mean ¹ Range	Mean ¹ Range
0.00 to < 0.50 D			
> 0.50 to < 1.00 D	72.7% 33.3% 100%	83.3% 50.0% 100%	96.4% 75.0% 100%
> 1.00 to < 2.00 D	82.2% 40.0% 133.3%	84.1% 37.5% 100%	83.1% 28.6% 100%
> 2.00 to < 3.00 D	82.8% 9.1% 100%	85.4% 33.3% 100%	87.1% 55.6% 100%
> 3.00 to < 4.00 D	85.6% 50.0% 100%	87.5% 68.8% 100%	82.3% 50.0% 100%
> 4.00 to < 5.00 D	91.2% 77.8% 100%	88.3% 76.5% 100%	92.4% 83.3% 100%
> 5.00 to < 6.00 D	85.4% 81.8% 90.5%	72.5% 58.3% 81.8%	71.0% 58.3% 77.3%
Total	83.1% 9.1% 133.3%	85.0% 33.3% 100%	85.2% 28.6% 100%

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 -2.44 ± 1.10 D. The Surgically Induced Refractive Correction (“SIRC”) had a mean of -2.50 ± 1.10 D. The vector magnitude ratio (SIRC/IRC) was 1.04 at 3-months. The Panel has found 0.82 acceptable for correction efficacy (SIRC/IRC) at stability.

Table 12
Cylinder Correction Efficacy Stratified by Preoperative Cylinder
3 Months (N=142)

Preoperative Cylinder	Achieved vs. Intended Vector Magnitude Ratio (Achieved/Intended)	
	n	Mean
ALL	142	1.04
0 to 0.50 D	NA	NA
>0.50 to ≤ 1.00 D	9	0.90
>1.00 to ≤ 2.00 D	51	1.09
>2.00 to ≤ 3.00 D	45	1.03
>3.00 to ≤ 4.00 D	24	1.03
>4.00 to ≤ 5.00 D	10	0.98

Preoperative Cylinder	N	Postoperative Cylinder (D)			Postoperative BSCVA			Postoperative UCVA		
		Mean	SD	p	Mean	SD	p	Mean	SD	p
≤4.00 D	129	0.35	0.43	<0.05	20/17	0.9 lines	NS	20/20	1.5 lines	NS
>4.00 to 6.00 D	13	0.77	0.68		20/17.7	0.7 lines		20/21.9	1.5 lines	

In cylinder amounts >4 to ≤6 D due to the lack of large numbers of patients in the general population, there are few subjects with cylinder amounts in this range to be studied. Not all complications, adverse events, and levels of effectiveness may have been determined.

As can be seen in Table 13, the mean residual postoperative cylinder amount was higher in this group, however, no significant differences were seen in UCVA and BSCVA outcomes for the 13 eyes in the >4 to 6.00 D range compared with the remainder of eyes in the study.

3.7.4 Key Safety Results

The analysis of safety was based on the 142 eyes that have had the 3-month examination. The key safety results for this study are presented in **Tables 13** and **14**. Overall the device was deemed reasonably safe.

Table 13
Summary of Key Safety Variables Over Time

Safety Variables	1 Month		3 Months		6 Months	
	%	n	%	n	%	n
	95% CI		95% CI		95% CI	
	N=161		N=142		N=111	
Loss of > 2 lines BSCVA	2.5	4	0.7	1	0.9	1
	1.3%, 3.7%		0.0%, 1.4%		0.0%, 1.8%	
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%	
	N=145		N=128		N=97	
BSCVA worse than 20/25 if 20/20 or better preoperatively	1.4	2	0.0	0	0.0	0
	0.4%, 2.4%		0.0%, 0.0%		0.0%, 0.0%	

Table 14
Summary of Key Safety Variables
at 3 Months (Stratified by Preoperative MRSE)

Safety Variables	0 to 1.0 D	>1.0 to 2.0 D	>2.0 to 3.0 D	>3.0 to 4.0 D	>4.0 to 5.0 D	>5.0 to 6.0 D	>6.0 to 7.0 D	Total <7 D
	%	%	%	%	%	%	%	%
	n	n	n	n	n	n	n	n
	95% CI							
	N=132	N=10	N=0	N=0	N=0	N=0	N=0	N=142
Loss of > 2 lines BSCVA	0.8 1 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%	0.7 1 0.0%
BSCVA worse than 20/40	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%
BSCVA worse than 20/25 if 20/20 or better preoperatively	0.0 0 0.0%							
	N=119	N=9	N=0	N=0	N=0	N=0	N=0	N=128

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3.7.5 Retreatment

A total of 3 eyes were retreated with the study laser. **Table 15** contains the outcomes for retreated eyes.

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

Efficacy Variables	1 Month		3 Months		6 Months	
	%	n	%	n	%	n
	95% CI		95% CI		95% CI	
	N=3		N=2		N=0	
UCVA 20/20 or better*	100	3	100	2	0	0
	100%, 100%		100%, 100%		0%, 0%	
UCVA 20/40 or better*	100	3	100	2	0	0
	100%, 100%		100%, 100%		0%, 0%	
	N=3		N=2		N=0	
MRSE + 0.50 D	100	3	100	2	0	0
	100%, 100%		100%, 100%		0%, 0%	
MRSE + 1.00 D	100	3	100	2	0	0
	100%, 100%		100%, 100%		0%, 0%	
MRSE + 2.00 D	100	3	100	2	0	0
	100%, 100%		100%, 100%		0%, 0%	
Safety Variables	N=3		N=2		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%	
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%	
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%	

* For all eyes minus those intentionally treated for monovision.

3.7.6 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 all improved after LASIK. The percent of subjects reporting “none” or “mild” of these symptoms improved after treatment.

Table 16
Patient Symptoms

	Preoperative						3 Months					
	None-Mild		Moderate		Marked-Severe		None-Mild		Moderate		Marked-Severe	
	%	n	%	n	%	n	%	n	%	n	%	n
	N=162		N=162		N=162		N=142		N=142		N=142	
Glare from Bright Lights	40.1	65	32.7	53	27.2	44	45.8	65	37.3	53	16.9	24
Halos	63.0	102	17.9	29	19.1	31	57.8	82	16.9	24	25.4	36
Light Sensitivity	56.8	92	19.8	32	23.5	38	47.2	67	25.4	36	27.5	39
Visual Fluctuations	67.9	110	19.1	31	13.0	21	57.0	81	24.7	35	18.3	26
Night Driving Glare	45.7	74	27.8	45	26.5	43	58.5	83	21.8	31	19.7	28



4 TREATMENT PLANNING

Observe all adverse event, indication, contraindication, precaution and warning information given in this manual.

4.1 Treatment Plan And Data Entry

4.1.1 Proven Parameter Range



4.1.2 Ablation Zone Mixed Astigmatism

Ablation Zones for mixed astigmatism treatments are all circular in shape with a diameter of 9.0 mm.

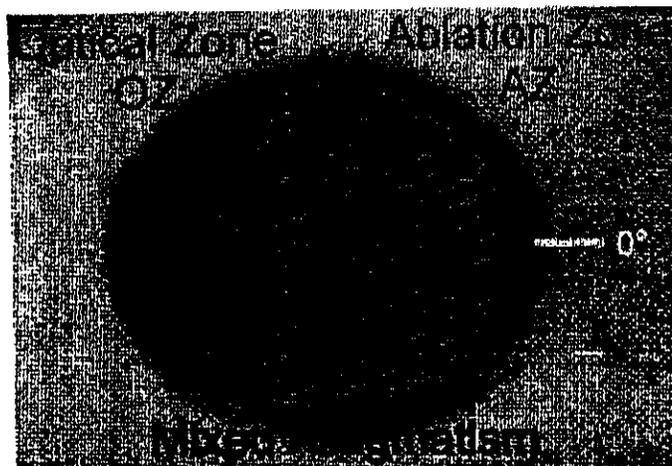


Figure 4: Ablation Zone Mixed Astigmatism

4.1.3 Ablation Depth And Remaining Stromal Thickness

Check resulting remaining stromal thickness indicated as 'Remaining' or 'Stroma'. The resulting value for the residual stroma is displayed in microns (μm).



CAUTION

Corneal Thickness

Corneal thickness should be measured in the center of the cornea for myopic treatments. However, A-CAT treatments may not have the area of deepest ablation exactly in the center of the cornea. Check the location of the deepest ablation after the treatment plan was completed and consider additional pachymetry at this spot on the cornea.

A warning will be displayed as soon as the set minimum value is be violated by actual treatment parameter. The manufacturer's setting for the alert level is $250\mu\text{m}$



CAUTION

Remaining Thickness

Exceeding the minimum thickness of 250 microns increases the risk for corneal ectasia following treatment.

4.2 Confirm, Save and Send Data

The Notebook Portal Software provides a summary screen. This screen will display treatment plan information, warnings and messages for final check and confirmation.

Double-check all data, messages and warnings. Accept data and possible warnings or consider a different plan for the patient.

If a treatment outside the proven parameter range is selected, a warning message will show. Use of such parameter outside the approved range can be confirmed in the summary window.

Parameter Limit	Warning Message
Mixed astigmatism cylinder of more than 6 Diopter	WARNING: There is no evidence of safety and effectiveness for LASIK treatments above CYL = 6 D
Optical Zone other than 6.5 mm	WARNING: There is no evidence of safety and effectiveness for LASIK treatments for optical zones below 6.0mm and above 6.5mm Diameter

Table 17: Warnings Parameter Range

5 APPENDIX

5.1 Table Effective Ablation Zone and Approximate Treatment Time

5.1.1 Mixed Astigmatism Optical Zone 6.0 mm

SPH [D]	CYL [D]														SPH [D]									
	0,25	0,50	0,75	1,00	1,25	1,50	1,75	2,00	2,25	2,50	2,75	3,00	3,25	3,50		3,75	4,00							
	AZ [mm]																							
0,25																		0,25						
-0,50			5	8,9	5	8,9	6	8,9	7	8,9	8	8,9	9	8,9	10	8,9	11	8,9	12	8,9	13	8,9	-0,50	
-0,75																							-0,75	
-1,00							8	8,9	9	8,9	10	8,9	11	8,9	12	8,9	13	8,9	14	8,9	14	8,9	-1,00	
-1,25																							-1,25	
-1,50										12	8,9	13	8,9	14	8,9	14	8,9	15	8,9	16	8,9	16	8,9	-1,50
-1,75																							-1,75	
-2,00															15	8,9	16	8,9	17	8,9	18	8,9	-2,00	
-2,25																							-2,25	
-2,50																						20	8,9	-2,50
-2,75																								-2,75
-3,00																								-3,00
-3,25																								-3,25
-3,50																								-3,50
-3,75																								-3,75
-4,00																								-4,00
-4,25																								-4,25
-4,50																								-4,50
-4,75																								-4,75
-5,00																								-5,00

t [sec]: approx. treatment time; AZ [mm]: Ablation Zone; Valid for Vertex distance = 0 mm, K = 43 D;

Mixed Astigmatism Optical Zone 6.0 mm continued.

SPH [D]	CYL [D]														SPH [D]												
	-2,25		-3,00		-3,75		-4,00		-4,25		-4,50		-4,75			-5,00											
	t [sec]	AZ [mm]		t [sec]	AZ [mm]																						
0,25																		0,25									
-0,50	14	8,9	14	8,9	15	8,9	16	8,9	17	8,9	18	8,9	19	8,9	20	8,9	21	8,9	22	8,9	23	8,9	23	8,9	-0,50		
0,75																									0,75		
-1,00	15	8,9	16	8,9	17	8,9	18	8,9	19	8,9	20	8,9	21	8,9	22	8,9	23	8,9	24	8,9	24	8,9	25	8,9	25	8,9	-1,00
-1,25																									-1,25		
-1,50	17	8,9	18	8,9	19	8,9	20	8,9	21	8,9	22	8,9	23	8,9	23	8,9	24	8,9	25	8,9	26	8,9	27	8,9	27	8,9	-1,50
1,75																									1,75		
-2,00	19	8,9	20	8,9	21	8,9	22	8,9	22	8,9	23	8,9	24	8,9	25	8,9	26	8,9	27	8,9	28	8,9	29	8,9	29	8,9	-2,00
2,25																									2,25		
-2,50	21	8,9	21	8,9	22	8,9	23	8,9	24	8,9	25	8,9	26	8,9	27	8,9	28	8,9	29	8,9	30	8,9	30	8,9	30	8,9	-2,50
2,75																									2,75		
-3,00			23	8,9	24	8,9	25	8,9	26	8,9	27	8,9	28	8,9	29	8,9	29	8,9	30	8,9	31	8,9	32	8,9	32	8,9	-3,00
3,25																									3,25		
-3,50					27	8,9	28	8,9	28	8,9	29	8,9	30	8,9	31	8,9	32	8,9	33	8,9	34	8,9	34	8,9	34	8,9	-3,50
3,75																									3,75		
-4,00																									-4,00		
4,25																									4,25		
-4,50																									-4,50		
4,75																									4,75		
-5,00																									-5,00		

t [sec]: approx. treatment time; AZ [mm]: Ablation Zone; Valid for Vertex distance = 0 mm, K = 43 D.

5.1.2 Mixed Astigmatism Optical Zone 6.5 mm

SPH [dpt]	CYL [D]												SPH [dpt]											
	0,25	0,50	0,75	1,00	1,25	1,50	1,75	2,00	2,25	2,50	2,75	3,00												
0,25															0,25									
-0,50			6	8,9	7	8,9	8	8,9	9	8,9	11	8,9	12	8,9	13	8,9	14	8,9	15	8,9	16	8,9	-0,50	
0,75																								0,75
-1,00																								-1,00
-1,25																								-1,25
-1,50																								-1,50
-1,75																								-1,75
-2,00																								-2,00
-2,25																								-2,25
-2,50																								-2,50
-2,75																								-2,75
-3,00																								-3,00
-3,25																								-3,25
-3,50																								-3,50
-3,75																								-3,75
-4,00																								-4,00
-4,25																								-4,25
-4,50																								-4,50
-4,75																								-4,75
-5,00																								-5,00

t [sec]: approx. treatment time; AZ [mm]: Ablation Zone; Valid for Vertex distance = 0 mm, K = 43 D.

Mixed Astigmatism Optical Zone 6.5 mm continued.

SPH [dpt]	CYL [D]												SPH [dpt]																
	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.00																	
	t [sec]	AZ [mm]	t [sec]	AZ [mm]																									
-0.25															-0.25														
-0.50	18	8,9	19	8,9	20	8,9	21	8,9	22	8,9	23	8,9	24	8,9	26	8,9	27	8,9	28	8,9	29	8,9	30	8,9	-0.50				
-0.75																										-0.75			
-1.00	20	8,9	21	8,9	23	8,9	24	8,9	25	8,9	26	8,9	27	8,9	28	8,9	30	8,9	31	8,9	32	8,9	33	8,9	-1.00				
-1.25																										-1.25			
-1.50	23	8,9	24	8,9	25	8,9	26	8,9	27	8,9	29	8,9	30	8,9	31	8,9	32	8,9	33	8,9	34	8,9	35	8,9	-1.50				
-1.75																										-1.75			
-2.00	25	8,9	26	8,9	28	8,9	29	8,9	30	8,9	31	8,9	32	8,9	33	8,9	34	8,9	36	8,9	37	8,9	38	8,9	-2.00				
-2.25																										-2.25			
-2.50	28	8,9	29	8,9	30	8,9	31	8,9	32	8,9	33	8,9	35	8,9	36	8,9	37	8,9	38	8,9	39	8,9	40	8,9	-2.50				
-2.75																										-2.75			
-3.00			31	8,9	32	8,9	33	8,9	35	8,9	36	8,9	37	8,9	38	8,9	39	8,9	40	8,9	42	8,9	43	8,9	-3.00				
-3.25																										-3.25			
-3.50							36	8,9	37	8,9	38	8,9	39	8,9	41	8,9	42	8,9	43	8,9	44	8,9	45	8,9	-3.50				
-3.75																										-3.75			
-4.00													42	8,9	43	8,9	44	8,9	45	8,9	46	8,9	48	8,9	-4.00				
-4.25																									-4.25				
-4.50																					47	8,9	48	8,9	49	8,9	50	8,9	-4.50
-4.75																										-4.75			
-5.00																								52	8,9	-5.00			

t [sec]: approx. treatment time; AZ [mm]: Ablation Zone; Valid for Vertex distance = 0 mm, K = 43 D.

Mixed Astigmatism Optical Zone 7.0 mm continued.

SPH [D]	CYL [D]																SPH [D]								
	-3,25		-3,50		-3,75		-4,00		-4,25		-4,50		-4,75		-5,00										
	t [s]	AZ [mm]	t [s]	AZ [mm]	t [s]	AZ [mm]	t [s]	AZ [mm]	t [s]	AZ [mm]	t [s]	AZ [mm]	t [s]	AZ [mm]	t [s]	AZ [mm]	t [s]	AZ [mm]							
-0,25																			-0,25						
-0,50	23	8,9	25	8,9	26	8,9	28	8,9	29	8,9	31	8,9	33	8,9	34	8,9	36	8,9	38	8,9	40	8,9	-0,50		
-0,75																							-0,75		
-1,00	27	8,9	29	8,9	30	8,9	32	8,9	33	8,9	35	8,9	36	8,9	38	8,9	40	8,9	42	8,9	43	8,9	43	8,9	-1,00
-1,25																							-1,25		
-1,50	30	8,9	32	8,9	33	8,9	35	8,9	37	8,9	38	8,9	40	8,9	42	8,9	43	8,9	45	8,9	47	8,9	47	8,9	-1,50
-1,75																							-1,75		
-2,00	34	8,9	36	8,9	37	8,9	39	8,9	40	8,9	42	8,9	43	8,9	45	8,9	47	8,9	49	8,9	50	8,9	50	8,9	-2,00
-2,25																							-2,25		
-2,50	37	8,9	39	8,9	40	8,9	42	8,9	44	8,9	45	8,9	47	8,9	49	8,9	50	8,9	52	8,9	54	8,9	54	8,9	-2,50
-2,75																							-2,75		
-3,00			42	8,9	44	8,9	45	8,9	47	8,9	49	8,9	50	8,9	52	8,9	54	8,9	55	8,9	57	8,9	57	8,9	-3,00
-3,25																							-3,25		
-3,50							49	8,9	50	8,9	52	8,9	54	8,9	55	8,9	57	8,9	59	8,9	61	8,9	61	8,9	-3,50
-3,75																							-3,75		
-4,00																							-4,00		
-4,25																							-4,25		
-4,50																							-4,50		
-4,75																							-4,75		
-5,00																							-5,00		

t [sec]: approx. treatment time; AZ [mm]: Ablation Zone; Valid for Vertex distance = 0 mm, K = 43 D:

5.2 Table of Optical and Ablation Zones

The following table shows Optical Zone Diameters and related Ablation Zones Diameters provided with the ALLEGRETTO WAVE™ Laser System.

Mixed Astigmatism	ABLATION ZONE
OPTICAL ZONE	Circular shape
6.0 mm	9.0 mm
6.5 mm	9.0 mm
7.0 mm	9.0 mm

- END -