PROFESSIONAL USE INFORMATION

LASER IN SITU KERATOMILEUSIS (LASIK)

TOPOGRAPHY-ASSISTED LASIK TREATMENT FOR NEARSIGHTEDNESS (MYOPIA) WITH ASTIGMATISM

NIDEK EC-5000
EXCIMER LASER SYSTEM

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CAUTION

Restricted Device:

U.S. Federal Law restricts this device to sale by or on the order of a physician or properly licensed practitioner.

U.S. Federal Law restricts the use of this device to practitioners who have been trained in the surgical treatment and management of the cornea or refractive errors, and in the operation, maintenance, and calibration of this system.

This manual is supplied to provide information on the intended clinical use of the Nidek EC-5000 Excimer Laser System. For complete information concerning laser system components, laser safety, installation, maintenance, and troubleshooting, refer to the NIDEK EC-5000 Excimer Laser Operator's Manual.

WARNING*:*

The user is responsible for reading all instructions before use of this system. Observe all warnings, contraindications, and precautions noted in this Professional Use Information, the Operator's Manual, and other related materials. Failure to do so may result in harm to a patient or user of the system.

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1.0 BRIEF DEVICE DESCRIPTION

The 193 nm Nidek EC-5000 Excimer Laser System is intended to perform ablation on exposed corneal tissue to modify corneal curvature for vision correction of myopia, hyperopia, and astigmatism. The Nidek EC-5000 laser performs optical correction by recontouring the exposed intrastromal surface of the cornea with a process referred to as photoablative decomposition. By controlling the shape and depth of the ablation, the EC-5000 changes the corneal curvature to correct refractive errors.

The excimer laser output is produced by electronically exciting a mixed molecular gas combination of argon and fluorine. This produces radiation in a far-ultraviolet wavelength which causes photodecomposition of molecular bonds. This process permanently removes tissue from the cornea.

2.0 INTENDED USE

The Nidek EC-5000 Excimer Laser System is indicated for topography-assisted Laser-Assisted In-Situ Keratomileusis (LASIK) treatment using the Final Fit™ custom ablation treatment planning software:

- for the reduction or elimination of myopic refractive errors from >-1.00 to -4.00 D of sphere with astigmatic refractive errors from >-0.5 to -2.0 D at the spectacle plane with manifest refraction spherical equivalent (MRSE) of >-1.0 to -5.0 D;
- in patients 21 years of age or older; and,
- in patients with documented stability of manifest refraction over the prior year, demonstrated by a change in manifest refraction spherical equivalent (MRSE) not greater than ±0.5 D.

3.0 CONTRAINDICATIONS

LASIK surgery is contraindicated in:

- Patients with severe dry eye;
- Patients with recurrent corneal erosion;
- Patients with advanced Glaucoma;
- Patients with collagen vascular, autoimmune or immunodeficiency diseases;
- Pregnant or nursing women;
- Patients with signs of keratoconus, keratoconus suspect, or unstable central keratometry readings with irregular mires;

- Uncontrolled Diabetes;
- Eyes that have a calculated residual stromal bed thickness that is less than 250 microns; or
- Eyes for which a preoperative OPDScan that contains the torsional error detection measurements for eye orientation cannot be obtained.
- Patients with uncontrolled eye movements (nystagmus) or another condition that prevents a steady gaze

4.0 WARNINGS

To avoid corneal ectasia, residual corneal bed thickness remaining after laser ablation must be calculated preoperatively to be 250 microns or greater.

The risk of post-operative complications may increase if LASIK is performed on patients who:

- Have dry eyes;
- Have a condition or taking medication that affects the immune system.
- Are taking isotretinoin (Accutane®)

5.0 PRECAUTIONS

Caution should be taken when performing LASIK on patients who:

- Have had prior ocular surgery;
- Are taking sumatripan (e.g.,Imitrex®) or amiodarone hydrochloride (e.g, Cordaron®)
- Have large pupils (>8mm diameter pupil).

5.1 Patient Selection

Caution should be exercised when selecting patients for treatment with the Nidek EC-5000 Excimer Laser System. The following should be considered when evaluating patients as candidates for LASIK refractive surgery:

- Each prospective patient must be given the Patient Information Booklet and provided with the opportunity to read it thoroughly and to have all their questions answered to assure their understanding before giving consent to have LASIK performed with the Nidek EC-5000 Excimer Laser System.
- A complete baseline ocular examination must be performed, including cycloplegic evaluation. The lens must be evaluated (especially in older patients)

to ensure that no lens opacities exist prior to LASIK treatment. Baseline examinations should be performed within 60 days of the laser refractive surgery.

- Refractive stability must be evaluated in patients. For this purpose, eyes to be treated should have a rate of change that is no greater ±0.5 D MRSE or does not exceed a rate of change of 0.04 D/month during the 12 months prior to LASIK surgery.
- Contact lens wearers must discontinue spherical soft lenses for at least 3 days, soft toric lenses for at least 2 weeks, and rigid gas permeable and hard lenses for at least 4 weeks or longer prior to the preoperative eye examination. Contact lens wearers must exhibit a stable refraction at two exams that are at least 7 days apart. A stable refraction is first determined as one in which the manifest refraction measurement and the topography (i.e., average SIM K readings from the topography) taken at the first visit do not differ by more than 0.5 D MRSE from the respective measurements taken at the second exam. Once a stable manifest refraction is confirmed, a cycloplegic refraction should be performed, which should be within 0.75 D SE of this last manifest refraction. The last manifest refraction that is used to confirm stability should be used in the surgical treatment plan calculation.
- Preoperative corneal topography is necessary on all patients to screen for potential topographical abnormalities. Corneal mapping may detect the presence of keratoconus and other corneal irregularities, including those that may be due to corneal warpage in those patients with a history of contact lens usage.
- A minimum of three corneal topographies are needed for each patient to confirm stability that provides the most accurate postoperative topography in the Final Fit software.
- Accurate pachymetry measurements must be performed preoperatively. Eyes with a preoperative central corneal thickness that is less than 475 microns, or those in which the residual corneal bed thickness remaining after the laser ablation is calculated preoperatively to be less than 250 microns, have a greater risk of developing postoperative corneal ectasia.
- Mesopic pupil size should be measured preoperatively. Mesopic pupil diameters that are greater than 8 mm may have a higher incidence of glare and halos or associated problems with driving at night.
- Laser surgery is generally performed using a topical anesthetic. Patients should be able to tolerate topical or local anesthesia.
- Patients should be able to lie in a supine position without difficulty.
- Patients should be able to demonstrate and maintain a steady gaze throughout the surgical procedure.
- Patients must be able to understand and give an informed consent for the surgery. All other alternatives to the correction, reduction, or potential elimination of their

condition must be clearly communicated to each patient before the informed consent is obtained.

5.2 Procedure

As with all laser output devices, the Nidek EC-5000 Excimer Laser System presents a potential hazard to patients and operators. Avoid inadvertent direct exposure of skin and eyes to the laser. Healthcare personnel who may approach the path of the primary beam should wear protective eyewear.

Confirm the data input for each procedure to assure that any previously stored or default values are used only where indicated. If surgery is paused or terminated, the input parameter values remain in the system memory for use or reference.

5.2.1 Before Laser Surgery

The following general recommendations should be observed before performing any LASIK refractive treatment:

- Care should be taken to plan the surgery so as to preserve a residual stromal bed thickness of at least 250 microns to reduce the risk of corneal ectasia secondary to LASIK.
- If a microkeratome is used to perform the keratectomy, carefully clean and assemble the microkeratome before each procedure, following the specific instructions in the Operator's Manual provided by the microkeratome manufacturer. Only an experienced surgeon, nurse or technician who is trained on the use of the microkeratome should handle and prepare it.
- Inspect the microkeratome blade under the microscope to detect nicks or irregularities. After the microkeratome has been reassembled, check the base plate thickness and the position of the translation stopper (if used). Test the microkeratome to verify that a smooth translation occurs in both directions.
- The use of any blowing gas on or across the cornea during laser treatment is not recommended.
- Verify the refractive astigmatism treatment axis entered into the EC-5000 against the preoperative topographic map and calculated treatment plan.
- Additional detailed procedures on the use of the Nidek EC-5000 Excimer Laser system during the laser portion of LASIK treatment are described in the Operator's Manual. Follow the procedures described in the manual to ensure safe and proper operation.

6.0 SAFETY INFORMATION FOR CATZ-1 MYOPIC ASTIGMATISM CLINICAL STUDY

A total of 135 eyes in 74 subjects were treated in a clinical study between December 14, 2005 and September 28, 2006. All eyes in the study were treated using the EC-5000 model of the Nidek EC-5000 Excimer Laser System. All eyes in the study are completed through the 12-month postoperative visit. There were three investigational sites in the U.S. and one investigational site in Mexico that provided data for analysis. The clinical study conducted with this device did not assess the effect of the OATz aspheric ablation algorithm on clinical outcomes.

6.1 Adverse Events

Table 1 below lists all primary safety variables for all treated eyes by postoperative visit. Other than at the 3-month visit, none of the eyes in the study had a loss of two or more lines of BSCVA at any visit nor did any study eyes have a BSCVA of 20/25 or worse if 20/20 or better preoperatively. None of the treated eyes had a postoperative BSCVA worse than 20/40. Percentage confidence intervals were calculated at the 95% level.

Table 1: Primary Safety Variables for All Treated Eyes

	Statistic	Week 1	Month 1	Month 3	Month 6	Month 9	Month 12
Safety Variables							
Loss of 2 or more lines (>=10 letters) in BSCVA	n/N	0/131	0/133	2/123	0/127	0/109	0/103
	%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 2.8)%	(0.0, 2.7)%	(0.2, 5.8)%	(0.0, 2.9)%	(0.0, 3.3)%	(0.0, 3.5)%
BSCVA worse than 20/40	n/N	0/131	0/133	0/123	0/127	0/109	0/103
	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 2.8)%	(0.0, 2.7)%	(0.0, 3.0)%	(0.0, 2.9)%	(0.0, 3.3)%	(0.0, 3.5)%
BSCVA worse than 20/25 if 20/20 or better preop	n/N	0/104	0/106	2/97	0/100	0/87	0/81
	%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 3.5)%	(0.0, 3.4)%	(0.3, 7.3)%	(0.0, 3.6)%	(0.0, 4.2)%	(0.0, 4.5)%

One subject had a transient 2-line loss of BSCVA in both eyes at the 3-month postoperative visit only, resulting in a BSCVA of 20/32.

The adverse events that occurred during the clinical study are summarized in Table 2. Table 2 below lists all adverse events, including adverse events both related and unrelated to the LASIK topography-assisted treatment, observed during the PMA clinical study with incidence rate and number in descending order of clinical importance, as determined by their severity and/or incidence. Any and all observations of the clinical reviewer are included in Table 2. There were no adverse events that led to any device design modifications during the PMA clinical study.

Table 2: Adverse Events in Descending Order of Overall Incidence for All Treated Patients

Preferred Term	Intraop (N=74)	Day 1 (N=74)	Wk 1 (N=74)	Mo 1 (N=74)	Mo 3 (N=70)	Mo 6 (N=73)	Mo 9 (N=64)	Mo 12 (N=63)	Mo 18 (N=15)	Mo 24 (N=6)	Overall (N=74)
Any AE	3 (4%)	20 (27%)	34 (46%)	27 (36%)	27 (39%)	15 (21%)	14 (22%)	15 (24%)	7 (47%)	1 (17%)	59 (80%)
Dry eye	0	1 (1%)	5 (7%)	10 (14%)	10 (14%)	6 (8%)	5 (8%)	3 (5%)	3 (20%)	0	36 (49%)
Halo vision	0	6 (8%)	9 (12%)	8 (11%)	6 (9%)	0	3 (5%)	0	0	0	19 (26%)
Glare	0	5 (7%)	7 (9%)	5 (7%)	5 (7%)	1 (1%)	2 (3%)	0	0	0	15 (20%)
Corneal striae	1 (1%)	3 (4%)	5 (7%)	3 (4%)	1 (1%)	0	0	0	0	0	12 (16%)
Punctate keratitis	0	4 (5%)	3 (4%)	2 (3%)	6 (9%)	1 (1%)	2 (3%)	2 (3%)	2 (13%)	0	12 (16%)
Photopsia[1]	1 (1%)	0	5 (7%)	0	1 (1%)	1 (1%)	1 (2%)	2 (3%)	0	0	10 (14%)
Foreign body sensation in eyes	0	2 (3%)	3 (4%)	4 (5%)	0	0	1 (2%)	0	0	0	9 (12%)
Corneal opacity	0	3 (4%)	1 (1%)	1 (1%)	2 (3%)	1 (1%)	1 (2%)	0	0	0	8 (11%)
Vision blurred	0	2 (3%)	3 (4%)	0	2 (3%)	0	0	1 (2%)	0	1 (17%)	8 (11%)
Eye pain	0	0	2 (3%)	3 (4%)	0	0	2 (3%)	0	1 (7%)	0	7 (9%)
Visual acuity reduced transiently	0	2 (3%)	2 (3%)	1 (1%)	1 (1%)	0	0	0	1 (7%)	0	6 (8%)
Meibomian gland discharge	0	1 (1%)	3 (4%)	0	0	0	0	1 (2%)	0	0	5 (7%)
Corneal deposits	0	1 (1%)	3 (4%)	1 (1%)	0	0	0	0	0	0	4 (5%)
Diplopia	0	0	3 (4%)	1 (1%)	0	0	1 (2%)	0	1 (7%)	0	4 (5%)
Headache	0	0	1 (1%)	1 (1%)	1 (1%)	0	1 (2%)	0	0	0	4 (5%)
Photophobia	0	1 (1%)	1 (1%)	2 (3%)	1 (1%)	1 (1%)	0	2 (3%)	0	0	4 (5%)
Keratitis	0	2 (3%)	0	1 (1%)	0	0	0	0	0	0	3 (4%)
Visual acuity reduced	0	0	0	0	0	1 (1%)	1 (2%)	0	1 (7%)	0	3 (4%)
Asthenopia	0	0	1 (1%)	0	1 (1%)	0	0	0	0	0	2 (3%)
Blepharospasm	0	0	0	1 (1%)	1 (1%)	0	0	0	0	0	2 (3%)
Conjunctival haemorrhage	0	1 (1%)	1 (1%)	0	0	0	0	0	0	0	2 (3%)

[1] Photopsia denotes “starbursts”.

Hypersensitivity	0	0	0	1 (1%)	0	1 (1%)	0	0	0	0	2 (3%)
Loss of visual contrast sensitivity	0	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (2%)	0	0	0	2 (3%)
Meibomian gland dysfunction	0	1 (1%)	0	0	0	0	1 (2%)	0	0	0	2 (3%)
Vitreous floaters	0	0	0	0	0	0	0	1 (2%)	1 (7%)	0	2 (3%)
Allergy to animal	0	0	0	0	0	0	0	1 (2%)	0	0	1 (1%)
Astigmatism	0	0	0	0	0	1 (1%)	0	0	0	0	1 (1%)
Cardiac disorder	0	0	1 (1%)	0	0	0	0	0	0	0	1 (1%)
Chalazion	0	0	0	0	0	0	0	1 (2%)	0	0	1 (1%)
Conjunctivitis viral	0	1 (1%)	1 (1%)	0	0	0	0	0	0	0	1 (1%)
Corneal abrasion	0	0	0	0	0	0	0	0	1 (7%)	0	1 (1%)
Corneal epithelium defect	0	0	0	1 (1%)	0	0	0	0	0	0	1 (1%)
Corneal infiltrates	0	0	0	1 (1%)	0	0	0	0	0	0	1 (1%)
Corneal scar	0	1 (1%)	0	0	0	0	0	0	0	0	1 (1%)
Depression	0	0	0	0	0	1 (1%)	0	0	0	0	1 (1%)
Dizziness	0	0	0	0	0	0	0	1 (2%)	0	0	1 (1%)
Eye injury	0	0	0	1 (1%)	0	0	0	0	0	0	1 (1%)
Eye irritation	0	0	0	0	1 (1%)	0	0	0	0	0	1 (1%)
Eye laser scar	0	0	0	1 (1%)	0	0	0	0	0	0	1 (1%)
Eye pruritus	0	0	0	0	1 (1%)	0	0	0	0	0	1 (1%)
Facial palsy	0	0	0	1 (1%)	0	0	0	0	0	0	1 (1%)
Hepatitis	0	0	0	0	0	1 (1%)	0	0	0	0	1 (1%)
Hypermetropia	0	0	0	1 (1%)	0	0	0	0	0	0	1 (1%)
Hypothyroidism	0	0	1 (1%)	0	0	0	0	0	0	0	1 (1%)
Injury corneal	1 (1%)	0	0	0	0	0	0	0	0	0	1 (1%)
Intraocular pressure increased	0	0	1 (1%)	0	0	0	0	0	0	0	1 (1%)
Migraine	0	0	0	0	0	0	0	1 (2%)	0	0	1 (1%)
Migraine with aura	0	0	0	0	0	0	0	0	1 (7%)	0	1 (1%)
Nasopharyngitis	0	0	0	0	1 (1%)	0	0	0	0	0	1 (1%)
Ocular hyperaemia	0	0	1 (1%)	0	0	0	0	0	0	0	1 (1%)
Pain	0	0	0	0	1 (1%)	0	0	0	0	0	1 (1%)
Pregnancy	0	0	0	0	0	1 (1%)	0	0	0	0	1 (1%)
Presbyopia	0	0	0	0	1 (1%)	0	0	0	0	0	1 (1%)
Pruritus allergic	0	0	0	1 (1%)	0	0	0	0	0	0	1 (1%)
Retinal pigment epitheliopathy	0	0	0	0	0	1 (1%)	0	0	0	0	1 (1%)

Rib fracture	0	0	0	0	0	0	1 (2%)	0	0	0	1 (1%)
Seasonal allergy	0	0	0	0	0	0	0	1 (2%)	0	0	1 (1%)
Syncope	0	0	0	0	0	0	0	1 (2%)	0	0	1 (1%)
Upper limb fracture	0	0	0	0	0	1 (1%)	0	0	0	0	1 (1%)
Urticaria	1 (1%)	0	0	0	0	0	0	0	0	0	1 (1%)

Table 2 above indicates 80% (59/74) of study subjects reported adverse events during the study. The most common adverse events (>10%) are dry eye (49%), halo vision (26%), glare (20%), corneal striae (16%), punctate keratitis (16%), photopsia (14%), foreign body sensation in eyes (12%), corneal opacity (11%) and vision blurred (11%).

6.2 Complications

The incidence (first occurrence) of postoperative complications is summarized in Table 3 below. The most commonly occurring postoperative complication at 1 month or later was Dry Eye requiring chronic artificial tears or punctual plugs. Other (AE) events listed below are reflected in the overall Adverse Event table, Table 2 above. Other (Surg) refers to two corneal flap refloats and one retreatment.

Table 3: Complications for All Treated Patients

Complication	Intraop (N=74)	Day 1 (N=74)	Wk 1 (N=74)	Mo 1 (N=74)	Mo 3 (N=70)	Mo 6 (N=73)	Mo 9 (N=64)	Mo 12 (N=63)	Mo 18 (N=15)	Mo 24 (N=6)	Overall (N=74)
Any Complications	1 (1%)	9 (12%)	20 (27%)	19 (26%)	15 (21%)	11 (15%)	4 (6%)	7 (11%)	2 (13%)	2 (33%)	39 (53%)
Diffuse Lamellar Keratitis	0	1 (1%)	0	0	0	0	0	0	0	0	1 (1%)
Dry Eye Requiring Chronic Artificial Tears or Punctal Plugs	0	0	0	4 (5%)	4 (6%)	3 (4%)	2 (3%)	2 (3%)	0	0	8 (11%)
Foreign Body Sensation	0	0	0	3 (4%)	0	0	0	0	0	0	3 (4%)
Ghosts or Double Images	0	0	3 (4%)	0	0	0	0	0	0	0	3 (4%)
Loss of 2 lines BCVA	0	0	0	0	1 (1%)	0	0	0	0	0	1 (1%)
Misaligned Flap	0	1 (1%)	0	0	0	0	0	0	0	0	1 (1%)
Miscreated Flap	1 (1%)	0	0	0	0	0	0	0	0	0	1 (1%)
Other (AE)	0	4 (5%)	17 (23%)	12 (16%)	11 (16%)	8 (11%)	2 (3%)	5 (8%)	2 (13%)	2 (33%)	32 (43%)
Other (Surg)	0	3 (4%)	0	0	0	0	0	0	0	0	3 (4%)
Pain	0	0	0	1 (1%)	0	0	1 (2%)	1 (2%)	1 (7%)	0	3 (4%)

6.3 Subjective Visual Complaints

Subjective visual complaints were obtained from each subject using a 10-point questionnaire to record symptoms. Visual complaints were recorded for each eye, and severity was classified as being either: *"none," "mild," "moderate," "marked,"* or *"severe."* The "*unknown*" listed in the table means the subject did not provide a response to that question. The results of the subjective questionnaire at baseline and at the 1- through 12-month examinations are summarized by symptom in Table 4 below.

Table 4: Patient Symptoms Recorded via Self-Administered Symptom Questionnaire for All Treated Eyes

Question	Response	Screening (N=135)	Mo 1 (N=135)	Mo 3 (N=127)	Mo 6 (N=133)	Mo 9 (N=117)	Mo 12 (N=113)
Light Sensitivity	None	93 (69%)	88 (65%)	95 (75%)	105 (79%)	94 (80%)	81 (72%)
	Mild	20 (15%)	28 (21%)	24 (19%)	21 (16%)	17 (15%)	23 (20%)
	Moderate	7 (5%)	18 (13%)	4 (3%)	7 (5%)	5 (4%)	5 (4%)
	Marked	4 (3%)	0	2 (2%)	0	1 (1%)	0
	Severe	2 (1%)	1 (1%)	0	0	0	0
	Unknown	9 (7%)	0	2 (2%)	0	0	4 (4%)
Difficulty Driving at Night	None	63 (47%)	111 (82%)	110 (87%)	117 (88%)	103 (88%)	93 (82%)
	Mild	15 (11%)	20 (15%)	13 (10%)	15 (11%)	14 (12%)	14 (12%)
	Moderate	18 (13%)	2 (1%)	2 (2%)	1 (1%)	0	2 (2%)
	Marked	21 (16%)	2 (1%)	0	0	0	0
	Severe	9 (7%)	0	0	0	0	0
	Unknown	9 (7%)	0	2 (2%)	0	0	4 (4%)
Reading Difficulty	None	112 (83%)	113 (84%)	98 (77%)	110 (83%)	102 (87%)	91 (81%)
	Mild	9 (7%)	16 (12%)	18 (14%)	15 (11%)	9 (8%)	13 (12%)
	Moderate	5 (4%)	3 (2%)	6 (5%)	6 (5%)	3 (3%)	4 (4%)
	Marked	0	1 (1%)	2 (2%)	2 (2%)	3 (3%)	1 (1%)
	Severe	0	2 (1%)	1 (1%)	0	0	0
	Unknown	9 (7%)	0	2 (2%)	0	0	4 (4%)
Double Vision	None	124 (92%)	124 (92%)	120 (94%)	130 (98%)	114 (97%)	108 (96%)
	Mild	2 (1%)	8 (6%)	3 (2%)	2 (2%)	3 (3%)	1 (1%)
	Moderate	0	3 (2%)	2 (2%)	0	0	0
	Marked	0	0	0	1 (1%)	0	0
	Severe	0	0	0	0	0	0
	Unknown	9 (7%)	0	2 (2%)	0	0	4 (4%)
Fluctuation in Vision	None	106 (79%)	93 (69%)	98 (77%)	99 (74%)	94 (80%)	91 (81%)
	Mild	14 (10%)	37 (27%)	22 (17%)	31 (23%)	22 (19%)	16 (14%)
	Moderate	6 (4%)	5 (4%)	5 (4%)	2 (2%)	0	2 (2%)
	Marked	0	0	0	1 (1%)	0	0
	Unknown	9 (7%)	0	2 (2%)	0	1 (1%)	4 (4%)

Table 4: Patient Symptoms Recorded via Self-Administered Symptom Questionnaire for All Treated Eyes							
Question	Response	Screening (N=135)	Mo 1 (N=135)	Mo 3 (N=127)	Mo 6 (N=133)	Mo 9 (N=117)	Mo 12 (N=113)
Glare	None	108 (80%)	95 (70%)	94 (74%)	111 (83%)	98 (84%)	94 (83%)
	Mild	13 (10%)	34 (25%)	24 (19%)	16 (12%)	13 (11%)	15 (13%)
	Moderate	2 (1%)	6 (4%)	7 (6%)	6 (5%)	6 (5%)	0
	Marked	3 (2%)	0	0	0	0	0
	Unknown	9 (7%)	0	2 (2%)	0	0	4 (4%)
Halos	None	111 (82%)	96 (71%)	88 (69%)	105(79%)	94 (80%)	89 (79%)
	Mild	12 (9%)	33 (24%)	32 (25%)	28 (21%)	19 (16%)	20 (18%)
	Moderate	3 (2%)	6 (4%)	3 (2%)	0	2 (2%)	0
	Marked	0	0	2 (2%)	0	2 (2%)	0
	Unknown	9 (7%)	0	2 (2%)	0	0	4 (4%)
Starbursts	None	112 (83%)	98 (73%)	95 (75%)	106(80%)	101(86%)	84 (74%)
	Mild	11 (8%)	27 (20%)	24 (19%)	27 (20%)	12 (10%)	23 (20%)
	Moderate	2 (1%)	8 (6%)	4 (3%)	0	4 (3%)	2 (2%)
	Marked	1 (1%)	2 (1%)	2 (2%)	0	0	0
	Unknown	9 (7%)	0	2 (2%)	0	0	4 (4%)
Dryness	None	94 (70%)	56 (41%)	48 (38%)	68 (51%)	62 (53%)	57 (50%)
	Mild	29 (21%)	57 (42%)	45 (35%)	44 (33%)	40 (34%)	43 (38%)
	Moderate	3 (2%)	14 (10%)	28 (22%)	20 (15%)	14 (12%)	7 (6%)
	Marked	0	2 (1%)	2 (2%)	1 (1%)	1 (1%)	2 (2%)
	Severe	0	6 (4%)	2 (2%)	0	0	0
	Unknown	9 (7%)	0	2 (2%)	0	0	4 (4%)
Pain	None	119 (88%)	119 (88%)	117 (92%)	127 (95%)	113 (97%)	106 (94%)
	Mild	6 (4%)	12 (9%)	8 (6%)	5 (4%)	4 (3%)	3 (3%)
	Moderate	0	4 (3%)	0	1 (1%)	0	0
	Unknown	10 (7%)	0	2 (2%)	0	0	4 (4%)
Foreign Body Sensation	None	111 (82%)	95 (70%)	105 (83%)	116 (87%)	103 (88%)	95 (84%)
	Mild	15 (11%)	34 (25%)	16 (13%)	15 (11%)	14 (12%)	14 (12%)
	Moderate	0	6 (4%)	2 (2%)	1 (1%)	0	0
	Severe	0	0	0	1 (1%)	0	0
	Unknown	9 (7%)	0	4 (3%)	0	0	4 (4%)
Other[2]	None	35 (26%)	37 (27%)	30 (24%)	37 (28%)	29 (25%)	35 (31%)
	Mild	0	2 (1%)	2 (2%)	0	0	0
	Moderate	2 (1%)	0	0	0	2 (2%)	0
	Marked	2 (1%)	0	1 (1%)	0	0	1 (1%)
	Unknown	96 (71%)	96 (71%)	94 (74%)	96 (72%)	86 (74%)	77 (68%)

[2] Other refers to headaches, difficulty focusing, mild pain, and difficulty reading music.

Visual symptoms after topography-assisted LASIK were generally mild in severity. Eye dryness was the most commonly reported patient complaint that occurred in the early 1 or 3 month postoperative period, with 4% of the eyes (6/135) reporting severe dry eye at 1 month and 2% (2/127) reporting severe dry eye at 3 months. This is not an atypical finding after LASIK surgery.

Changes in the degree of severity of patient symptoms reported via the self-administered questionnaire at 3 and 6-months after topography-assisted LASIK are summarized below in Tables 5 and 6 respectively. Clinically significant changes were defined as a change of ±10% or more in the proportion of eyes reporting symptoms that were moderate to severe postoperatively compared to baseline. The 21.6% improvement in difficulty with night driving was statistically ($p<0.05$) and clinically significant.

Table 5: Change in Degree of Severity of Patient Symptoms at 3 Months After Topography-Assisted LASIK Compared to Before LASIK for All Treated Eyes

Question	Preop Marked-Severe n (%)	Month 3 Marked-Severe n (%)	Percent Difference	p-value[1]
Difficulty Driving at Night	25 (21.6%)	0	-21.6%	<.001
Double Vision	0	0	0.0%	*
Dryness	0	4 (3.4%)	3.4%	0.125
Fluctuation in Vision	0	0	0.0%	*
Foreign Body Sensation	0	0	0.0%	*
Glare	3 (2.6%)	0	-2.6%	0.250
Halos	0	0	0.0%	*
Light Sensitivity	6 (5.2%)	2 (1.7%)	-3.4%	0.219
Other	0	1 (3.0%)	3.0%	1.000
Pain	0	0	0.0%	*
Reading Difficulty	0	3 (2.6%)	2.6%	0.250
Starbursts	1 (0.9%)	0	-0.9%	1.000

[1] McNemar's test. * indicates that the p-value cannot be calculated.

Eye dryness is a condition known to occur after LASIK surgery of any type that typically improves over time, as evidenced by the declining proportion of eyes reporting severe dry eye in which 4% of the eyes (6/135) at 1 month, 2% (2/127) at 3-months, and in none of the eyes (0%) at 6, 9 and 12-months postoperatively, as shown in Table 4. Patients are instructed to use postoperative lubricants on an as needed basis and emphasize the importance of continuing to use ocular lubricants postoperatively.

Table 6: Change in Degree of Severity of Patient Symptoms at 6 Months After Topography-Assisted LASIK Compared to Before LASIK for All Treated Eyes				
Question	Preop Marked-Severe n (%)	Month 6 Marked-Severe n (%)	Percent Difference	p-value[1]
Difficulty Driving at Night	28 (22.6%)	0	-22.6%	<.001
Double Vision	0	1 (0.8%)	0.8%	1.000
Dryness	0	1 (0.8%)	0.8%	1.000
Fluctuation in Vision	0	1 (0.8%)	0.8%	1.000
Foreign Body Sensation	0	1 (0.8%)	0.8%	1.000
Glare	3 (2.4%)	0	-2.4%	0.250
Halos	0	0	0.0%	*
Light Sensitivity	6 (4.8%)	0	-4.8%	0.031
Other	0	0	0.0%	*
Pain	0	0	0.0%	*
Reading Difficulty	0	2 (1.6%)	1.6%	0.500
Starbursts	1 (0.8%)	0	-0.8%	1.000
[1] McNemar's test. * indicates that the p-value cannot be calculated.				

The change in severity of each subjective complaint was also tabulated based on the numerical value assigned to each rating: none (1), mild (2), moderate (3), marked (4), or severe (5). If the numerical post response (after LASIK) is equal to the numerical baseline response (before LASIK), then the post response was considered to be the same (baseline = postoperative = same). If the post response is numerically less than the baseline response, then the post response was considered to be better (baseline > post = better). Likewise, if the post response is numerically greater than the pre response, then the post response was considered to be worse (baseline < post = worse). As shown in Table 7 below, dryness was rated as being worse in nearly half of the eyes at 3 and 6 months after the LASIK surgery.

Table 7: Subjective Complaints at 3 and 6 Months After Topography-Assisted LASIK Compared to Before LASIK for All Treated Eyes					
Visit	Question	N	Better n (%)	Same n (%)	Worse n (%)
Postop Month 3	Light Sensitivity	116	27 (23.3%)	68 (58.6%)	21 (18.1%)
	Difficulty Driving at Night	116	54 (46.6%)	54 (46.6%)	8 (6.9%)
	Reading Difficulty	116	8 (6.9%)	85 (73.3%)	23 (19.8%)
	Double Vision	116	2 (1.7%)	109 (94.0%)	5 (4.3%)
	Fluctuation in Vision	116	8 (6.9%)	93 (80.2%)	15 (12.9%)
	Glare	116	12 (10.3%)	81 (69.8%)	23 (19.8%)
	Halos	116	9 (7.8%)	83 (71.6%)	24 (20.7%)
	Starbursts	116	2 (1.7%)	96 (82.8%)	18 (15.5%)
	Dryness	116	6 (5.2%)	52 (44.8%)	58 (50.0%)
	Pain	115	4 (3.5%)	103 (89.6%)	8 (7.0%)
	Foreign Body Sensation	116	8 (6.9%)	96 (82.8%)	12 (10.3%)
	Other	33	0	30 (90.9%)	3 (9.1%)
Postop Month 6	Light Sensitivity	124	25 (20.2%)	83 (66.9%)	16 (12.9%)
	Difficulty Driving at Night	124	59 (47.6%)	58 (46.8%)	7 (5.6%)
	Reading Difficulty	124	8 (6.5%)	95 (76.6%)	21 (16.9%)
	Double Vision	124	2 (1.6%)	119 (96.0%)	3 (2.4%)
	Fluctuation in Vision	124	12 (9.7%)	92 (74.2%)	20 (16.1%)
	Glare	124	12 (9.7%)	98 (79.0%)	14 (11.3%)
	Halos	124	11 (8.9%)	94 (75.8%)	19 (15.3%)
	Starbursts	124	6 (4.8%)	104 (83.9%)	14 (11.3%)
	Dryness	124	13 (10.5%)	57 (46.0%)	54 (43.5%)
	Pain	123	5 (4.1%)	113 (91.9%)	5 (4.1%)
	Foreign Body Sensation	124	9 (7.3%)	104 (83.9%)	11 (8.9%)
	Other	35	0	35 (100%)	0

The Refractive Status and Vision Profile (RSVP) is a validated questionnaire instrument that measures self-reported vision-related health status (symptoms, functioning, expectations, concern) in persons with refractive error. The RSVP questionnaire was administered at baseline and at each postoperative visit, beginning with Month 1, to evaluate patient satisfaction, use of corrective lenses (spectacles or contact lenses), and the patient's quality of vision and quality of life. The subscales that were evaluated are:

- Concern: worry, concern or frustration about vision; afraid to do activities because of vision.
- Expectations: patients' anticipated postoperative tolerance of less-than-perfect vision.
- Physical/social functioning: watching TV or movies, seeing alarm clock, caring for or playing with children, performing one's job, playing sports or recreational activities

- Driving: driving at night, during rain
- Symptoms: eyes are irritated, pain, light sensitivity
- Optical problems; change in vision during day, depth perception, seeing in dim light
- Glare: seeing or driving under glare conditions
- Problems with corrective lenses: wearing glasses or contact lenses is bothersome, cannot wear lenses; lenses get fogged up, wet or lost

The changes in the scores for each subscale that is evaluated in the questionnaire are summarized in Table 8 below. [NOTE: The number of respondents for each subscale varies based on whether the subscale question applies to that patient. For example, if the subscale question asks the patient about the use of glasses and the patient does not wear glasses, then that question is not answered by the patient. A negative number difference from baseline indicates an improvement in the subscale.]

The results of the RSVP show an improvement in all subscales (except "Expectations") evaluated at each of the postoperative visits and in the total composite score that is computed for each visit. Published literature indicates that a difference of 6 points or more on the composite score is a clinically significant change[3]. The difference in composite score from baseline to each postoperative visit showed a clinically significant improvement in the RSVP profile, with a mean improvement at each postoperative visit that ranged from 6 to 14 points. Furthermore, at the 3 Month visit (timepoint of refractive stability), all subscales (except "Expectations") and total score changes from baseline were statistically significant.

The effect size was calculated as a measure of the sensitivity of the RSVP in detecting clinically meaningful changes following the LASIK surgery responsiveness). According to Schein et al., validation of the RSVP,[4] if the effect size is between 0.2 and 0.5, the change is considered clinically small. The change is a medium clinically meaningful change if the effect size is between 0.5 and 0.8 and the change is a large clinically meaningful change if the effect size is ≥ 0.8. Based on the effect sizes in the table, the change in the total RSVP score exhibited a large clinically meaningful effect.

[3] Schein OD, Vitale S, Cassard SD. Steinberg EP. Patient Outcomes of Refractive Surgery: The Refractive Status and Vision Profile. *J Cataract Refract Surg*. 2001 May;27(5):665-73.

Table 8: Change in Refractive Status Vision Profile (RSVP) Scores for All Treated Patients							
Subscale	Statistic	Preop	Mo 1	Mo 3	Mo 6	Mo 9	Mo 12
Concern							
	n	70	73	70	72	64	62
	mean (SD)	45.4 (20.6)	23.7 (12.8)	19.2 (12.7)	17.5 (12.6)	18.7 (13.8)	17.3 (15.4)
	median	41.7	25.0	16.7	16.7	16.7	16.7
	min,max	8.3 , 91.7	0.0 , 50.0	0.0 , 41.7	0.0 , 41.7	0.0 , 50.0	0.0 , 45.8
Concern change from preop							
	n		69	66	68	60	59
	mean (SD)		-21.5 (20.2)	-26.4 (20.9)	-27.7 (19.0)	-25.0 (19.4)	-28.2 (18.1)
	median		-16.7	-25.0	-25.0	-22.9	-25.0
	min,max		-75.0 , 16.7	-91.7 , 8.3	-83.3 , 16.7	-75.0 , 12.5	-62.5 , 12.5
	p-value[1]		<.001	<.001	<.001	<.001	<.001
	effect size[2]		-1.044	-1.280	-1.344	-1.213	-1.367
Expectations							
	n	70	54	51	53	48	48
	mean (SD)	52.9 (25.2)	55.3 (25.0)	61.0 (27.3)	63.7 (27.3)	60.4 (27.9)	60.2 (29.9)
	median	62.5	50.0	75.0	75.0	68.8	75.0
	min,max	0.0 , 87.5	0.0 , 100.0	0.0 , 100.0	0.0 , 100.0	0.0 , 100.0	0.0 , 100.0
Expectations change from preop							
	n		51	48	50	45	46
	mean (SD)		-0.7 (23.5)	1.8 (29.7)	5.0 (28.1)	3.6 (27.4)	2.2 (27.9)
	median		0.0	0.0	0.0	0.0	0.0
	min,max		-75.0 , 25.0	-75.0 , 62.5	-75.0 , 50.0	-50.0 , 50.0	-75.0 , 75.0
	p-value[1]		0.824	0.673	0.215	0.381	0.600
	effect size[2]		-0.029	0.072	0.198	0.143	0.086
Physical/Social Functioning							
	n	70	71	66	70	61	58
	mean (SD)	19.1 (15.5)	6.5 (10.0)	5.5 (14.3)	3.3 (7.3)	3.1 (6.4)	2.3 (4.3)
	median	15.9	2.5	0.0	0.0	0.0	0.0
	min,max	0.0 , 75.0	0.0 , 54.5	0.0 , 100.0	0.0 , 50.0	0.0 , 29.5	0.0 , 22.5

Table 8: Change in Refractive Status Vision Profile (RSVP) Scores for All Treated Patients							
Subscale	Statistic	Preop	Mo 1	Mo 3	Mo 6	Mo 9	Mo 12
Physical/Social Functioning change from preop							
	n		68	63	66	59	55
	mean (SD)		-12.9 (18.7)	-13.9 (20.7)	-15.7 (16.3)	-14.9 (16.7)	-17.2 (16.8)
	median		-11.5	-13.6	-13.6	-13.6	-13.6
	min,max		-75.0 , 54.5	-72.7 , 84.4	-75.0 , 20.0	-75.0 , 15.0	-72.7 , 6.6
	p-value[1]		<.001	<.001	<.001	<.001	<.001
	effect size[2]		-0.830	-0.898	-1.008	-0.960	-1.110
Driving							
	n	67	69	65	69	61	58
	mean (SD)	20.3 (19.4)	11.9 (17.3)	8.0 (12.4)	7.7 (12.5)	7.4 (10.0)	9.1 (13.9)
	median	16.7	8.3	0.0	0.0	0.0	0.0
	min,max	0.0 , 75.0	0.0 , 75.0	0.0 , 50.0	0.0 , 50.0	0.0 , 33.3	0.0 , 50.0
Driving change from preop							
	n		65	59	62	56	52
	mean (SD)		-8.4 (24.4)	-11.6 (20.4)	-13.6 (22.1)	-12.1 (22.0)	-11.2 (25.4)
	median		-8.3	-8.3	-8.3	-8.3	-4.2
	min,max		-75.0 , 54.2	-75.0 , 25.0	-75.0 , 41.7	-75.0 , 25.0	-75.0 , 50.0
	p-value[1]		0.007	<.001	<.001	<.001	0.002
	effect size[2]		-0.434	-0.598	-0.701	-0.622	-0.579
Symptoms							
	n	68	71	66	70	61	58
	mean (SD)	12.6 (14.6)	11.8 (10.6)	8.3 (7.9)	8.5 (8.7)	6.5 (6.9)	5.7 (9.3)
	median	10.0	10.0	7.5	5.0	5.0	0.0
	min,max	0.0 , 62.5	0.0 , 45.0	0.0 , 35.0	0.0 , 35.0	0.0 , 30.0	0.0 , 55.0
Symptoms change from preop							
	n		66	61	64	57	53
	mean (SD)		-1.1 (17.6)	-5.1 (16.3)	-4.4 (15.7)	-5.5 (15.6)	-6.9 (17.1)
	median		0.0	0.0	0.0	0.0	0.0

Table 8: Change in Refractive Status Vision Profile (RSVP) Scores for All Treated Patients							
Subscale	Statistic	Preop	Mo 1	Mo 3	Mo 6	Mo 9	Mo 12
	min,max		-57.5 , 40.0	-62.5 , 35.0	-57.5 , 35.0	-57.5 , 30.0	-62.5 , 25.0
	p-value[1]		0.626	0.018	0.028	0.010	0.005
	effect size[2]		-0.072	-0.347	-0.301	-0.374	-0.469
Optical Problems							
	n	69	71	66	70	61	58
	mean (SD)	9.6 (11.4)	4.6 (7.4)	3.6 (5.9)	3.1 (6.4)	3.3 (5.8)	3.0 (5.4)
	median	5.0	0.0	0.0	0.0	0.0	0.0
	min,max	0.0 , 45.0	0.0 , 30.0	0.0 , 30.0	0.0 , 25.0	0.0 , 25.0	0.0 , 20.0
Optical Problems change from preop							
	n		67	62	65	58	54
	mean (SD)		-4.9 (12.8)	-6.6 (13.1)	-6.1 (12.8)	-4.8 (11.7)	-6.8 (12.9)
	median		0.0	0.0	-5.0	0.0	-5.0
	min,max		-40.0 , 30.0	-45.0 , 20.0	-45.0 , 25.0	-35.0 , 20.0	-40.0 , 20.0
	p-value[1]		0.003	<.001	<.001	0.003	<.001
	effect size[2]		-0.426	-0.579	-0.529	-0.418	-0.597
Glare							
	n	68	70	66	70	61	58
	mean (SD)	14.0 (13.5)	13.5 (12.3)	8.8 (9.9)	8.3 (11.1)	7.5 (11.3)	6.8 (10.2)
	median	16.7	8.3	8.3	4.2	0.0	0.0
	min,max	0.0 , 50.0	0.0 , 50.0	0.0 , 33.3	0.0 , 50.0	0.0 , 50.0	0.0 , 58.3
Glare change from preop							
	n		65	61	64	57	53
	mean (SD)		-0.4 (16.7)	-5.2 (18.1)	-5.7 (18.7)	-4.6 (17.6)	-6.4 (15.8)
	median		0.0	0.0	0.0	0.0	0.0
	min,max		-41.7 , 33.3	-50.0 , 33.3	-50.0 , 33.3	-41.7 , 41.7	-50.0 , 25.0
	p-value[1]		0.854	0.029	0.017	0.053	0.004
	effect size[2]		-0.028	-0.384	-0.424	-0.341	-0.477
Problems with Corrective Lenses							
	n	71	11	5	7	4	5

Table 8: Change in Refractive Status Vision Profile (RSVP) Scores for All Treated Patients							
Subscale	Statistic	Preop	Mo 1	Mo 3	Mo 6	Mo 9	Mo 12
	mean (SD)	37.6 (22.6)	13.8 (10.6)	12.5 (12.5)	11.9 (19.2)	12.5 (14.4)	17.5 (16.8)
	median	33.3	12.5	12.5	0.0	12.5	25.0
	min,max	0.0 , 92.9	0.0 , 25.0	0.0 , 25.0	0.0 , 50.0	0.0 , 25.0	0.0 , 37.5
Problems with Corrective Lenses change from preop							
	n		11	5	7	4	5
	mean (SD)		-16.2 (20.6)	-26.7 (9.6)	-23.0 (9.3)	-33.3 (31.2)	-19.2 (25.3)
	median		-25.0	-25.0	-17.9	-29.2	-25.0
	min,max		-37.5 , 18.8	-37.5 , -12.5	-37.5 , -12.5	-75.0 , 0.0	-50.0 , 12.5
	p-value[1]		0.026	0.003	<.001	0.122	0.165
	effect size[2]		-0.717	-1.180	-1.016	-1.475	-0.848
Total							
	n	71	73	70	72	64	62
	mean (SD)	24.1 (10.4)	12.9 (7.6)	11.4 (8.0)	10.0 (7.3)	9.9 (7.6)	9.8 (7.7)
	median	21.9	10.6	9.2	8.0	8.3	7.6
	min,max	8.8 , 49.3	3.0 , 31.4	0.0 , 37.5	0.7 , 33.3	0.0 , 46.9	0.0 , 42.9
Total change from preop							
	n		70	67	69	61	60
	mean (SD)		-11.2 (12.8)	-13.6 (13.0)	-14.1 (12.0)	-13.3 (11.9)	-14.1 (12.2)
	median		-9.9	-12.6	-11.6	-13.0	-13.0
	min,max		-41.0 , 19.6	-46.4 , 25.3	-42.6 , 20.9	-41.0 , 13.5	-42.5 , 13.4
	p-value[1]		<.001	<.001	<.001	<.001	<.001
	effect size[2]		-1.076	-1.303	-1.352	-1.271	-1.351

[1] Paired t-test
[2] Mean of change from preop divided by standard deviation of preop

Patient satisfaction with their uncorrected vision at 3 and 6-months after the topography-assisted LASIK procedure, compared to their vision satisfaction before the procedure, is summarized in Table 9 below. Of the 63 patients who answered this question before their LASIK surgery, 93.7% (59/63) of the patients were either dissatisfied or very dissatisfied with their preoperative uncorrected vision and one patient (1/51; 1.6%) was satisfied with his uncorrected vision. At 3-months after the topography-assisted LASIK treatment, patient satisfaction improved significantly with 93.7% (59/63) of the study participants reporting they were either satisfied or very satisfied with their postoperative uncorrected vision; 3.2% (2/63) were neither satisfied nor dissatisfied; and, 3.2% (2/63) were dissatisfied or very dissatisfied. At 6 months, patient satisfaction with their uncorrected vision was with 92.1% (58/63) of those completing the questionnaire reporting that they were either satisfied or very satisfied with their uncorrected vision after the topography-assisted LASIK procedure compared to 4.8% (3/63) of the respondents who were either dissatisfied or very dissatisfied with their uncorrected vision before the LASIK treatment was performed.

Table 9: Patient Satisfaction with Uncorrected Vision at 3 and 6 Months after LASIK Compared to Before LASIK

Satisfaction	Baseline (N=63)	3 Months (N=63)	6 Months (N=63)
Very dissatisfied	35 (55.6%)	2 (3.2%)	3 (4.8%)
Dissatisfied	24 (38.1%)	0	0
Neither satisfied or dissatisfied	3 (4.8%)	2 (3.2%)	2 (3.2%)
Satisfied	1 (1.6%)	20 (31.7%)	19 (30.2%)
Very satisfied	0	39 (61.9%)	39 (61.9%)

RSVP Question: During the past month, how satisfied have you been with your current vision WITHOUT glasses or contacts
Patients who received surgery with answers at baseline, 3 and 6 months were included in the summary

7.0 CLINICAL RESULTS FOR TOPOGRAPHY-ASSISTED LASIK MYOPIC ASTIGMATISM CLINICAL STUDY

7.1 Study Design

Analyses of safety and effectiveness results were performed on data obtained at 1, 3, 6, 9 and 12-months after LASIK surgery. Ophthalmic effectiveness evaluations included slit lamp examination of the eye, corneal topography, cycloplegic refraction, manifest refraction, and measurements of corrected and uncorrected visual acuity. Safety monitoring throughout the study included observations at appropriate times for complications, adverse events, and clinically significant findings on ophthalmic examination. Primary effectiveness evaluations were based on measurements of postoperative manifest refraction and uncorrected visual acuity. Primary safety analyses included changes in best spectacle corrected visual acuity (BSCVA), and tabulations of adverse events, complications, other postoperative observations, and patient ratings of subjective complaints.

7.2 The Nidek EC-5000 Excimer Laser System is indicated for topography-assisted Laser-Assisted In-Situ Keratomileusis (LASIK) treatment using the Final Fit™ custom ablation treatment planning software:

- for the reduction or elimination of myopic refractive errors from >-0.75 to -5.0 D of sphere with astigmatic refractive errors from >-0.5 to -2.0 D at the spectacle plane with manifest refraction spherical equivalent (MRSE) of >-1.0 D to -6.0 D;
- in patients 21 years of age or older; and,
- in patients with documented stability of manifest refraction over the prior year, demonstrated by a change in manifest refraction spherical equivalent (MRSE) not greater than ±0.5 D.

The surgical treatment parameters for the treated eye were based on the manifest refraction from the screening visit (non-contact lens wearers only) or, for contact lens wearers, the last contact lens stability confirmation visit and the manifest refraction obtained preoperatively on the operative day.

7.2.1 Steps in Performing the Final Fit™ Treatment Plan for Protocol CATz-1

For the CATz-1 study, the OATz and CATz modes of the Final Fit™ software (v.1.11) were used to plan the treatment. Treatment planning was performed using the following general procedures:

1. Obtain a minimum of three corneal topographies at the screening visit or preoperatively on the day of surgery using the OPD-Scan (software v.1.02).
2. Transfer the topographies via a flash disk to the Final Fit™ computer for review using OPD-Scan software (v.1.02).
3. Evaluate each of the topographies using the following criteria:
    a. Difference between the OPD-Scan refraction spherical equivalent (SE) and the manifest refraction spherical equivalent is ≤0.75 D SE; and, difference between

OPD-Scan refraction axis and manifest axis is ≤15 degrees if the OPD-Scan cylinder value is -0.5 D or higher; or,

b. If the spherical equivalent difference between the OPD-Scan refraction and the manifest refraction is >0.75 D, the difference between the OPD-Scan SE and the cycloplegic SE is ≤ 0.75 D and the OPD-Scan and cycloplegic axes are within 15 degrees of each other;
c. 5 mm pupil diameter data are displayed in OPD-Scan display for refraction;
d. OPD-Scan displays at least 5 rings without artifacts;
e. Mesopic pupil size < 8 mm in diameter;
f. Residual bed thickness > 250 microns postoperatively (calculated in Final Fit™); and,
g. Irregularity maximum (Irr Max) ≤ 10 microns (calculated in Final Fit™)

4. Open Final Fit™ and select the topographies for the eye to be treated that meet the above criteria.
5. Enter the following patient-specific treatment parameters:
   a. Manifest refraction sphere, cylinder, axis; and,
   b. Central pachymetry.
6. Check that the following default parameters are displayed:
   a. Vertex distance = 12;
   b. Nomogram = S095 - C111 – S30;
   c. Optical zone = 5.0 mm;
   d. Treatment zone = 8.5 mm;
   e. Profile number = 5;
   f. Treatment Rate = 80% treatment;
   g. Irr OZ/TZ = 6.0/8.5 mm

7.3 Patient Population

A total of 135 eyes in 74 subjects were treated at three centers in the United States and one international center. All eyes evaluated at each postoperative examination were included in the safety and effectiveness analyses.

Table 10 below presents the demographic information for the cohort of subjects enrolled in the study.

Table 10: Subject Population Demographic Characteristics for All Treated Patients

		Site 1 (N=18)	Site 2 (N=21)	Site 3 (N=16)	Site 4 (N=19)	Total (N=74)	p-value[1]
Gender							0.759
	Male	9 (50%)	8 (38%)	8 (50%)	7 (37%)	32 (43%)	
	Female	9 (50%)	13 (62%)	8 (50%)	12 (63%)	42 (57%)	
Age							<.001
	n	18	21	16	19	74	
	mean (SD)	36.9 (7.1)	39.5 (7.9)	34.9 (9.5)	28.7 (5.6)	35.1 (8.5)	
	median	35.5	39.0	33.5	28.0	34.0	
	min,max	23.0 , 50.0	23.0 , 55.0	23.0 , 64.0	21.0 , 41.0	21.0 , 64.0	
Race							<.001
	Caucasian	18 (100%)	12 (57%)	12 (75%)	0 (0%)	42 (57%)	
	Black	0 (0%)	0 (0%)	3 (19%)	0 (0%)	3 (4%)	
	Asian	0 (0%)	3 (14%)	1 (6%)	0 (0%)	4 (5%)	
	Hispanic	0 (0%)	5 (24%)	0 (0%)	19 (100%)	24 (32%)	
	Other	0 (0%)	1 (5%)	0 (0%)	0 (0%)	1 (1%)	

[1] Chi-square test for categorical variables and t-test for continuous variables

The cohort had a mean age of 35.1 years. The youngest and oldest subjects treated were 21 years and 64 years of age, respectively. Age, race, and gender were characteristic of the patient populations treated at each investigative site.

Accountability by eye for the 135-treated eye cohort is summarized in Table 11 below for the entire cohort of treated eyes.

Table 11: Accountability by Eye for All Treated Eyes							
Status	Day 1	Week 1	Month 1	Month 3	Month 6	Month 9	Month 12
Enrolled [Treated] (N)	135	135	135	135	135	135	135
Available for Analysis	135 (100%)	135 (100%)	135 (100%)	127 (94%)	133 (99%)	117 (87%)	113 (84%)
Discontinued	0	0	0	0	0	0	2 (1%)
Active (Not Eligible for Interval)	0	0	0	0	0	0	0
Lost to Follow-up	0	0	0	0	0	2 (1%)	16 (12%)
Missed Visit (Accounted for)	0	0	0	8 (6%)	2 (1%)	16 (12%)	4 (3%)
Accountability	100%	100%	100%	94%	99%	87%	85%

Two eyes were discontinued from the study at the 12-month visit. One bilaterally treated subject moved geographically distant from the investigative site.

7.4 Data Analysis and Results

7.4.1 Baseline Characteristics

The preoperative refractive errors for the entire cohort of treated eyes are summarized in Table 12 (stratified by baseline sphere and cylinder) and Table 13 (stratified by baseline MRSE) below.

Table 12: Bin Distribution Stratified by Preop Manifest Refractive Sphere and Cylinder

	Cylinder					
Sphere	-0.50 to -0.75 D	-0.76 to -1.00 D	-1.01 to -2.00 D	-2.01 to -3.00 D	-3.01 to -4.00 D	Total
-1.00 to -2.00 D	21 (16%)	8 (6%)	10 (7%)	1 (1%)	1 (1%)	41
-2.01 to -3.00 D	16 (12%)	3 (2%)	4 (3%)	3 (2%)	0	26
-3.01 to -4.00 D	18 (13%)	5 (4%)	12 (9%)	2 (1%)	1 (1%)	38
-4.01 to -5.00 D	13 (10%)	2 (1%)	2 (1%)	1 (1%)	0	18
-5.01 to -6.00 D	4 (3%)	3 (2%)	5 (4%)	0	0	12
Total	72	21	33	7	2	135

Table 13: Bin Distribution Stratified by Preop Manifest Refractive MRSE and Cylinder

	Cylinder					
MRSE	-0.50 to -0.75 D	-0.76 to -1.00 D	-1.01 to -2.00 D	-2.01 to -3.00 D	-3.01 to -4.00 D	Total
-1.01 to -2.00 D	19 (14%)	7 (5%)	6 (4%)	0	0	32
-2.01 to -3.00 D	13 (10%)	3 (2%)	4 (3%)	0	1 (1%)	21
-3.01 to -4.00 D	17 (13%)	4 (3%)	5 (4%)	1 (1%)	0	27
-4.01 to -5.00 D	15 (11%)	3 (2%)	12 (9%)	4 (3%)	0	34
-5.01 to -6.00 D	6 (4%)	3 (2%)	4 (3%)	2 (1%)	1 (1%)	16
> -6.00 D	2 (1%)	1 (1%)	2 (1%)	0	0	5
Total	72	21	33	7	2	135

7.4.2 Uncorrected Visual Acuity (UCVA)

All eyes treated in the study were targeted for emmetropia. Uncorrected visual acuity was measured in the CATz study using an ETDRS visual acuity chart. Uncorrected visual acuity across time is summarized below in Table 14 for the entire cohort. At the 3 Month postoperative visit, eyes treated for myopic astigmatism with CATz topography-assisted LASIK had the following uncorrected visual acuity outcomes: 86.6% (110/127 eyes) achieved an UCVA of 20/20 or better, and 48.8% (62/127) had an UCVA of 20/16 or better. One eye had an UCVA that was worse than 20/32 (126/127; 99.2% 20/32 or better) at 3 months after the topography-assisted LASIK procedure.

Table 14: UCVA Before and After Topography-Assisted LASIK for All Eyes Treated

	Statistic	Preop	Month 1	Month 3	Month 6	Month 9	Month 12
20/12.5 or better	n/N	0/135	8/135	10/127	10/133	22/117	17/111
	%	0.0%	5.9%	7.9%	7.5%	18.8%	15.3%
	CI[1]	(0.0, 2.7)%	(2.6, 11.3)%	(3.8, 14.0)%	(3.7, 13.4)%	(12.2, 27.1)%	(9.2, 23.4)%
20/16 or better	n/N	0/135	45/135	62/127	65/133	57/117	57/111
	%	0.0%	33.3%	48.8%	48.9%	48.7%	51.4%
	CI[1]	(0.0, 2.7)%	(25.5, 42.0)%	(39.9, 57.8)%	(40.1, 57.7)%	(39.4, 58.1)%	(41.7, 61.0)%
20/20 or better	n/N	1/135	108/135	110/127	118/133	108/117	95/111
	%	0.7%	80.0%	86.6%	88.7%	92.3%	85.6%
	CI[1]	(0.0, 4.1)%	(72.3, 86.4)%	(79.4, 92.0)%	(82.1, 93.5)%	(85.9, 96.4)%	(77.6, 91.5)%
20/25 or better	n/N	1/135	130/135	123/127	127/133	113/117	106/111
	%	0.7%	96.3%	96.9%	95.5%	96.6%	95.5%
	CI[1]	(0.0, 4.1)%	(91.6, 98.8)%	(92.1, 99.1)%	(90.4, 98.3)%	(91.5, 99.1)%	(89.8, 98.5)%
20/32 or better	n/N	3/135	132/135	126/127	133/133	117/117	111/111
	%	2.2%	97.8%	99.2%	100.0%	100.0%	100.0%
	CI[1]	(0.5, 6.4)%	(93.6, 99.5)%	(95.7, 100.0)%	(97.3, 100.0)%	(96.9, 100.0)%	(96.7, 100.0)%
20/40 or better	n/N	7/135	135/135	127/127	133/133	117/117	111/111
	%	5.2%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(2.1, 10.4)%	(97.3, 100.0)%	(97.1, 100.0)%	(97.3, 100.0)%	(96.9, 100.0)%	(96.7, 100.0)%
20/80 or better	n/N	22/135	135/135	127/127	133/133	117/117	111/111
	%	16.3%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(10.5, 23.6)%	(97.3, 100.0)%	(97.1, 100.0)%	(97.3, 100.0)%	(96.9, 100.0)%	(96.7, 100.0)%
20/200 or better	n/N	135/135	135/135	127/127	133/133	117/117	111/111
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(97.3, 100.0)%	(97.3, 100.0)%	(97.1, 100.0)%	(97.3, 100.0)%	(96.9, 100.0)%	(96.7, 100.0)%

[1] Exact 95% confidence interval

Eyes treated in the study also demonstrated an improvement in functional vision after the topography-assisted LASIK procedure. As shown in Table 15 below, 95.3% (121/127) of the eyes achieved an uncorrected visual acuity (UCVA) postoperatively that was no worse than 1 line (5 letters) below the baseline best spectacle-corrected visual acuity (BSCVA) at Month 3; whereas, 4.7% (6/127) of the eyes had an UCVA that was two or more lines worse than the baseline BSCVA. More than three-quarters of the eyes (101/127; 79.5%) have uncorrected vision after the topography-assisted LASIK procedure that is as good as, or better than, their best spectacle corrected vision before LASIK.

Table 15: Postop UCVA Compared to Preop BSCVA for All Treated Eyes

	Statistic	Week 1	Month 1	Month 3	Month 6	Month 9	Month 12
> 2 lines better	n/N	0/133	1/135	1/127	1/133	2/117	6/111
	%	0.0%	0.7%	0.8%	0.8%	1.7%	5.4%
	CI[1]	(0.0, 2.7)%	(0.0, 4.1)%	(0.0, 4.3)%	(0.0, 4.1)%	(0.2, 6.0)%	(2.0, 11.4)%
2 lines better	n/N	8/133	6/135	15/127	15/133	19/117	14/111
	%	6.0%	4.4%	11.8%	11.3%	16.2%	12.6%
	CI[1]	(2.6, 11.5)%	(1.6, 9.4)%	(6.8, 18.7)%	(6.5, 17.9)%	(10.1, 24.2)%	(7.1, 20.3)%
1 line better	n/N	33/133	41/135	47/127	46/133	37/117	31/111
	%	24.8%	30.4%	37.0%	34.6%	31.6%	27.9%
	CI[1]	(17.7, 33.0)%	(22.8, 38.9)%	(28.6, 46.0)%	(26.6, 43.3)%	(23.3, 40.9)%	(19.8, 37.2)%
Equal	n/N	56/133	53/135	38/127	49/133	40/117	39/111
	%	42.1%	39.3%	29.9%	36.8%	34.2%	35.1%
	CI[1]	(33.6, 51.0)%	(31.0, 48.0)%	(22.1, 38.7)%	(28.6, 45.6)%	(25.7, 43.5)%	(26.3, 44.8)%
1 line worse	n/N	22/133	29/135	20/127	17/133	16/117	17/111
	%	16.5%	21.5%	15.7%	12.8%	13.7%	15.3%
	CI[1]	(10.7, 24.0)%	(14.9, 29.4)%	(9.9, 23.3)%	(7.6, 19.7)%	(8.0, 21.3)%	(9.2, 23.4)%
2 lines worse	n/N	10/133	3/135	5/127	4/133	2/117	2/111
	%	7.5%	2.2%	3.9%	3.0%	1.7%	1.8%
	CI[1]	(3.7, 13.4)%	(0.5, 6.4)%	(1.3, 8.9)%	(0.8, 7.5)%	(0.2, 6.0)%	(0.2, 6.4)%
> 2 lines worse	n/N	4/133	2/135	1/127	1/133	1/117	2/111
	%	3.0%	1.5%	0.8%	0.8%	0.9%	1.8%
	CI[1]	(0.8, 7.5)%	(0.2, 5.2)%	(0.0, 4.3)%	(0.0, 4.1)%	(0.0, 4.7)%	(0.2, 6.4)%

[1] Exact 95% confidence interval

7.4.3 Accuracy of MRSE over Time

The number of eyes that are within ±0.5 D, ±1.0 D, and ±2.0 D of attempted versus achieved manifest refraction spherical equivalent (MRSE) and the proportion of eyes that were overcorrected or undercorrected at each of the postoperative examinations are summarized in Table 16 for all eyes treated.

Table 16: Refractive Predictability Before and After Topography-Assisted LASIK in All Eyes Treated

	Statistic	Preop	Month 1	Month 3	Month 6	Month 9	Month 12
+/- 0.50 D	n/N	0/135	126/135	118/127	113/124	108/117	94/109
	%	0.0%	93.3%	92.9%	91.1%	92.3%	86.2%
	CI[1]	(0.0, 2.7)%	(87.7, 96.9)%	(87.0, 96.7)%	(84.7, 95.5)%	(85.9, 96.4)%	(78.3, 92.1)%
+/- 1.00 D	n/N	0/135	135/135	127/127	123/124	116/117	109/109
	%	0.0%	100.0%	100.0%	99.2%	99.1%	100.0%
	CI[1]	(0.0, 2.7)%	(97.3, 100.0)%	(97.1, 100.0)%	(95.6, 100.0)%	(95.3, 100.0)%	(96.7, 100.0)%
+/- 2.00 D	n/N	32/135	135/135	127/127	124/124	117/117	109/109
	%	23.7%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(16.8, 31.8)%	(97.3, 100.0)%	(97.1, 100.0)%	(97.1, 100.0)%	(96.9, 100.0)%	(96.7, 100.0)%
Overcorrected > 1 D	n/N	0/135	0/135	0/127	0/124	0/117	0/109
	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 2.7)%	(0.0, 2.7)%	(0.0, 2.9)%	(0.0, 2.9)%	(0.0, 3.1)%	(0.0, 3.3)%
Overcorrected > 2 D	n/N	0/135	0/135	0/127	0/124	0/117	0/109
	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 2.7)%	(0.0, 2.7)%	(0.0, 2.9)%	(0.0, 2.9)%	(0.0, 3.1)%	(0.0, 3.3)%
Undercorrected < -1 D	n/N	135/135	0/135	0/127	1/124	1/117	0/109
	%	100.0%	0.0%	0.0%	0.8%	0.9%	0.0%
	CI[1]	(97.3, 100.0)%	(0.0, 2.7)%	(0.0, 2.9)%	(0.0, 4.4)%	(0.0, 4.7)%	(0.0, 3.3)%
Undercorrected < -2 D	n/N	103/135	0/135	0/127	0/124	0/117	0/109
	%	76.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	CI[1]	(68.2, 83.2)%	(0.0, 2.7)%	(0.0, 2.9)%	(0.0, 2.9)%	(0.0, 3.1)%	(0.0, 3.3)%

[1] Exact 95% confidence interval

Overall, 92.9% (118/127) of the eyes in this study achieved refractive outcomes within 0.5 D of attempted versus achieved MRSE and 100% of the eyes (127/127) within 1.0 D of attempted versus achieved MRSE at 3-months after the topography-assisted LASIK procedure. These refractive outcomes correlate well with the uncorrected visual acuities reported by the subjects.

7.4.4 Stability of Refractive Outcome

Refractive stability was evaluated in the eyes that completed one or more pairs of successive postoperative visits. The mean changes (paired differences) in MRSE (±S.D. and 95% C.I.) between pairs of successive refractions for eyes with all consecutive visits from Month 1 through Month 6 are reported in Table 17 for all eyes treated. Refractive stability, as defined in the CATz-1 protocol, is achieved at 3-months and confirmed at 6-months postoperatively for this cohort of eyes treated with topography-assisted LASIK.

Table 17: Refractive Stability for All Treated Eyes that Have Paired Differences at All of Specified Visit Intervals From Week 1 to Month 6

Measure	Statistic	Week 1 to Month 1	Month 1 to Month 3	Month 3 to Month 6
Absolute Change of MRSE <= 1D	n/N	112/114	114/114	114/114
	%	98.2%	100.0%	100.0%
	CI[1]	(93.8, 99.8)%	(96.8, 100.0)%	(96.8, 100.0)%
Absolute Change of MRSE <= 0.5D	n/N	100/114	107/114	109/114
	%	87.7%	93.9%	95.6%
	CI[1]	(80.3, 93.1)%	(87.8, 97.5)%	(90.1, 98.6)%
Change of MRSE in diopters	Mean	-0.051	-0.023	-0.025
	Std	0.365	0.270	0.245
	CI[2]	(-0.118, 0.017)	(-0.073, 0.027)	(-0.071, 0.020)
Change of MRSE per year	Mean	-0.876	-0.138	-0.102
	Std	6.331	1.623	0.981
	CI[2]	(-2.050, 0.299)	(-0.439, 0.163)	(-0.284, 0.080)
Change of MRSE per month	Mean	-0.067	-0.011	-0.008
	Std	0.487	0.135	0.082
	CI[2]	(-0.158, 0.023)	(-0.037, 0.014)	(-0.024, 0.007)

[1] Exact 95% confidence interval
[2] 95% confidence interval based on t-distribution

The stability of the mean MRSE plotted over time (Figure 7.4.4-1) illustrates the refractive stability for the cohort.

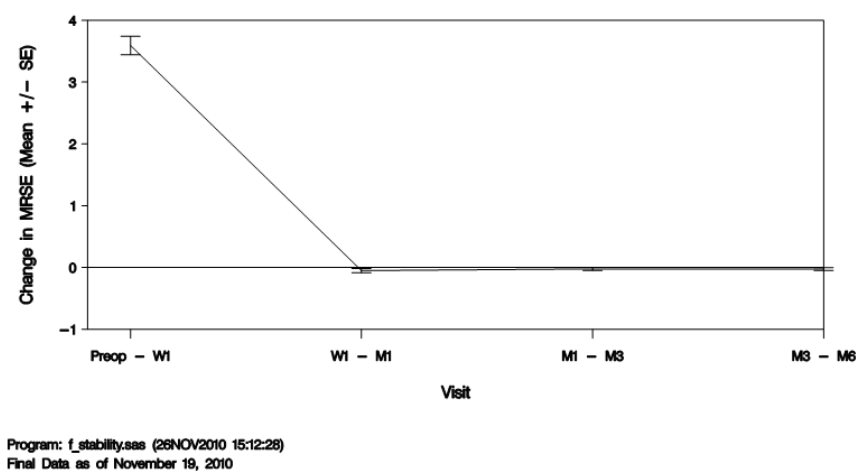

Figure 7.4.4-1: Change in Mean MRSE over Time

7.4.5 Effectiveness of Astigmatism Correction

Vector analysis was performed on the cohort of eyes treated for myopic astigmatism. All vector analysis is based on the vector components in the spectacle plane.

Cylinder stability calculated as the magnitude of cylinder vector differences is summarized in Table 18 below for each postoperative visit interval from Month 1 through Month 6.

Table 18: Stability of Vector Cylinder Magnitude After Topography-Assisted LASIK for All Treated Eyes that Have Paired Differences at All of Specified Visit Intervals from Week 1 to Month 6

Measure	Statistic	Week 1 to Month 1	Month 1 to Month 3	Month 3 to Month 6
Absolute Change of Cylinder <= 1D	n/N	122/123	123/123	123/123
	%	99.2%	100.0%	100.0%
	CI[1]	(95.6, 100.0)%	(97.0, 100.0)%	(97.0, 100.0)%
Absolute Change of Cylinder <= 0.5D	n/N	107/123	114/123	116/123
	%	87.0%	92.7%	94.3%
	CI[1]	(79.7, 92.4)%	(86.6, 96.6)%	(88.6, 97.7)%
Change of Cylinder in diopters	Mean	0.238	0.193	0.186
	Std	0.226	0.190	0.167
	CI[2]	(0.198, 0.279)	(0.159, 0.227)	(0.156, 0.216)
Change of Cylinder per year	Mean	4.133	1.158	0.744
	Std	3.915	1.142	0.669
	CI[2]	(3.435, 4.832)	(0.954, 1.362)	(0.624, 0.863)
Change of Cylinder per month	Mean	0.318	0.096	0.062
	Std	0.301	0.095	0.056
	CI[2]	(0.264, 0.372)	(0.080, 0.113)	(0.052, 0.072)

[1] Exact 95% confidence interval
[2] 95% confidence interval based on t-distribution

The stability of absolute (non-vector) cylinder is summarized in Table 19 below.

Table 19: Stability of Absolute (Non-Vector) Cylinder After Topography-Assisted LASIK for All Treated Eyes that Have Paired Differences at All of Specified Visit Intervals From Week 1 to Month 6				
Measure	Statistic	Week 1 to Month 1	Month 1 to Month 3	Month 3 to Month 6
Absolute Change of Cylinder <= 1D	n/N	123/123	123/123	123/123
	%	100.0%	100.0%	100.0%
	CI[1]	(97.0, 100.0)%	(97.0, 100.0)%	(97.0, 100.0)%
Absolute Change of Cylinder <= 0.5D	n/N	120/123	122/123	123/123
	%	97.6%	99.2%	100.0%
	CI[1]	(93.0, 99.5)%	(95.6, 100.0)%	(97.0, 100.0)%
Change of Cylinder in diopters	Mean	-0.018	-0.006	-0.006
	Std	0.272	0.213	0.223
	CI[2]	(-0.067, 0.030)	(-0.044, 0.032)	(-0.046, 0.034)
Change of Cylinder per year	Mean	-0.317	-0.037	-0.024
	Std	4.713	1.281	0.891
	CI[2]	(-1.158, 0.524)	(-0.265, 0.192)	(-0.183, 0.135)
Change of Cylinder per month	Mean	-0.024	-0.003	-0.002
	Std	0.363	0.107	0.074
	CI[2]	(-0.089, 0.040)	(-0.022, 0.016)	(-0.015, 0.011)
[1] Exact 95% confidence interval [2] 95% confidence interval based on t-distribution				

The descriptive statistics for the accuracy of the achieved cylinder outcome compared to the desired outcome, stratified by the degree of preoperative vector cylinder, are summarized in Table 20 below.

Table 20: Treatment Accuracy for Sphere and Cylinder Magnitude After Topography-Assisted LASIK Compared to Before LASIK							
	Preop	Week 1	Month 1	Month 3	Month 6	Month 9	Month 12
Sphere	N = 135	N = 133	N = 135	N = 127	N = 133	N = 117	N = 111
Mean (SD)	-3.06 (1.40)	0.11 (0.38)	0.08 (0.31)	0.06 (0.31)	0.05 (0.32)	0.03 (0.33)	0.02 (0.37)
Attempted (SD)	-3.06 (1.40)	-3.08 (1.39)	-3.06 (1.40)	-3.04 (1.43)	-3.05 (1.41)	-3.04 (1.40)	-3.22 (1.41)
Achieved (SD)		-3.19 (1.52)	-3.13 (1.44)	-3.10 (1.48)	-3.10 (1.46)	-3.07 (1.45)	-3.24 (1.45)
% Achieved		103	103	103	102	102	101
Within +/- 0.5D, n (%)		115 (86%)	127 (94%)	121 (95%)	124 (93%)	109 (93%)	100 (90%)
Within +/- 1.0D, n (%)		131 (98%)	134 (99%)	126 (99%)	133 (100%)	117 (100%)	111 (100%)
Cylinder	N = 135	N = 133	N = 135	N = 127	N = 133	N = 117	N = 111
Mean (SD)	-1.03 (0.64)	-0.21 (0.27)	-0.23 (0.25)	-0.24 (0.24)	-0.24 (0.27)	-0.22 (0.24)	-0.19 (0.24)
Attempted (SD)	-1.03 (0.64)	-1.02 (0.64)	-1.03 (0.64)	-1.04 (0.64)	-1.03 (0.64)	-0.97 (0.56)	-1.01 (0.59)
Achieved (SD)		-0.81 (0.66)	-0.80 (0.66)	-0.80 (0.64)	-0.79 (0.66)	-0.74 (0.62)	-0.82 (0.63)
% Achieved		76	73	72	71	71	77
Within +/- 0.5D, n (%)		123 (92%)	125 (93%)	117 (92%)	121 (91%)	111 (95%)	103 (93%)
Within +/- 1.0D, n (%)		133 (100%)	135 (100%)	127 (100%)	133 (100%)	117 (100%)	111 (100%)

A summary of the intended refractive correction (IRC), surgically induced refractive correction (SIRC), correction ratio (CR), and error ratio (ER) at 3-months postoperatively (timepoint of stability) is provided in Table 21 below.

Table 21: Refractive Correction Parameters at 3 Months Stratified by Preop Cylinder for All Treated Eyes

Preop Cylinder	N	|IRC| Mean (SD)	|SIRC| Mean (SD)	|EV| Mean (SD)	CR Mean (SD)	ER Mean (SD)
All	127	0.95 (0.57)	0.89 (0.54)	0.24 (0.24)	0.95 (0.28)	0.31 (0.35)
0 to -0.5 D	40	0.46 (0.02)	0.45 (0.19)	0.22 (0.21)	0.96 (0.41)	0.48 (0.47)
-0.5 D to -1.0 D	46	0.80 (0.12)	0.76 (0.19)	0.20 (0.22)	0.95 (0.21)	0.25 (0.29)
> -1.0 D to -2.0 D	34	1.38 (0.24)	1.30 (0.32)	0.29 (0.25)	0.94 (0.16)	0.22 (0.20)
> -2.0 D to -3.0 D	5	2.48 (0.31)	2.09 (0.49)	0.44 (0.44)	0.84 (0.15)	0.19 (0.18)
> -3.0 D to -4.0 D	2	3.17 (0.13)	2.81 (0.38)	0.37 (0.53)	0.89 (0.16)	0.11 (0.16)

At 3-months postoperatively, the surgically induced refractive correction (SIRC) of 0.89 for the myopic astigmatism cohort closely approximates the intended refractive correction (IRC) of 0.95 for all eyes treated. This is confirmed by the correction ratio (CR) of 0.95 for all treated eyes in the cohort.

7.4.6 Best Spectacle Corrected Visual Acuity (BSCVA)

Best spectacle corrected visual acuity was measured in the CATz-1 study using an ETDRS visual acuity chart. The changes in lines of best spectacle corrected visual acuity from screening to each postoperative visit are summarized in Table 22 for the entire cohort. In the tables, a decrease in lines of BSCVA represents a loss of BSCVA, whereas an increase in lines of BSCVA represents a gain or improvement in BSCVA.

Table 22: Changes in Lines of BCVA From Preop to Postop for All Treated Eyes

	Statistic	Week 1	Month 1	Month 3	Month 6	Month 9	Month 12
Decrease > 2 lines	n/N	0/131	0/133	0/123	0/127	0/109	0/103
	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 2.8)%	(0.0, 2.7)%	(0.0, 3.0)%	(0.0, 2.9)%	(0.0, 3.3)%	(0.0, 3.5)%
Decrease 2 lines	n/N	0/131	0/133	2/123	0/127	0/109	0/103
	%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 2.8)%	(0.0, 2.7)%	(0.2, 5.8)%	(0.0, 2.9)%	(0.0, 3.3)%	(0.0, 3.5)%
Decrease 1 line	n/N	13/131	12/133	8/123	4/127	7/109	9/103
	%	9.9%	9.0%	6.5%	3.1%	6.4%	8.7%
	CI[1]	(5.4, 16.4)%	(4.7, 15.2)%	(2.8, 12.4)%	(0.9, 7.9)%	(2.6, 12.8)%	(4.1, 15.9)%
No change	n/N	57/131	57/133	43/123	65/127	45/109	38/103
	%	43.5%	42.9%	35.0%	51.2%	41.3%	36.9%
	CI[1]	(34.9, 52.4)%	(34.3, 51.7)%	(26.6, 44.1)%	(42.2, 60.1)%	(31.9, 51.1)%	(27.6, 47.0)%
Increase 1 line	n/N	50/131	49/133	44/123	38/127	33/109	34/103
	%	38.2%	36.8%	35.8%	29.9%	30.3%	33.0%
	CI[1]	(29.8, 47.1)%	(28.6, 45.6)%	(27.3, 44.9)%	(22.1, 38.7)%	(21.8, 39.8)%	(24.1, 43.0)%
Increase 2 lines	n/N	10/131	14/133	22/123	16/127	21/109	15/103
	%	7.6%	10.5%	17.9%	12.6%	19.3%	14.6%
	CI[1]	(3.7, 13.6)%	(5.9, 17.0)%	(11.6, 25.8)%	(7.4, 19.7)%	(12.3, 27.9)%	(8.4, 22.9)%
Increase > 2 lines	n/N	1/131	1/133	4/123	4/127	3/109	7/103
	%	0.8%	0.8%	3.3%	3.1%	2.8%	6.8%
	CI[1]	(0.0, 4.2)%	(0.0, 4.1)%	(0.9, 8.1)%	(0.9, 7.9)%	(0.6, 7.8)%	(2.8, 13.5)%

[1] Exact 95% confidence interval

Summary of Key Safety and Effectiveness Variables

7.4.7 Key Effectiveness Variables

The effectiveness analyses were based on 127 eyes that were available for analysis at 3-months postoperatively. A summary of key effectiveness variables is provided below in Table 23 for all eyes treated in the cohort. It is expected that at least 50% of the eyes will achieve a postoperative uncorrected visual acuity (UCVA) of 20/20 or better. In the cohort of eyes treated in this study, 86.6% (110/127) of all eyes treated had an UCVA of 20/20 or better at 3-months postoperatively, which is the time point of refractive stability. Additionally, 92.9% (118/127) of the eyes achieved refractive outcomes within ±0.5 D of attempted MRSE and 100% (127/127) of the eyes were within ±1.0 D of attempted MRSE at 3-months after the topography-assisted LASIK procedure.

Table 23: Key Effectiveness Outcomes After Topopgraphy-Assisted LASIK for All Eyes Treated

	Statistic	Week 1	Month 1	Month 3	Month 6	Month 9	Month 12
Effectiveness Variables							
MRSE +/- 0.50 D	n/N	117/133	126/135	118/127	113/124	108/117	94/109
	%	88.0%	93.3%	92.9%	91.1%	92.3%	86.2%
	CI[1]	(81.2, 93.0)%	(87.7, 96.9)%	(87.0, 96.7)%	(84.7, 95.5)%	(85.9, 96.4)%	(78.3, 92.1)%
MRSE +/- 1.00 D	n/N	132/133	135/135	127/127	123/124	116/117	109/109
	%	99.2%	100.0%	100.0%	99.2%	99.1%	100.0%
	CI[1]	(95.9, 100.0)%	(97.3, 100.0)%	(97.1, 100.0)%	(95.6, 100.0)%	(95.3, 100.0)%	(96.7, 100.0)%
MRSE +/- 2.00 D	n/N	133/133	135/135	127/127	124/124	117/117	109/109
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(97.3, 100.0)%	(97.3, 100.0)%	(97.1, 100.0)%	(97.1, 100.0)%	(96.9, 100.0)%	(96.7, 100.0)%
UCVA 20/20 or better	n/N	104/133	108/135	110/127	118/133	108/117	95/111
	%	78.2%	80.0%	86.6%	88.7%	92.3%	85.6%
	CI[1]	(70.2, 84.9)%	(72.3, 86.4)%	(79.4, 92.0)%	(82.1, 93.5)%	(85.9, 96.4)%	(77.6, 91.5)%
UCVA 20/40 or better	n/N	133/133	135/135	127/127	133/133	117/117	111/111
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(97.3, 100.0)%	(97.3, 100.0)%	(97.1, 100.0)%	(97.3, 100.0)%	(96.9, 100.0)%	(96.7, 100.0)%

[1] Exact 95% confidence interval

Summaries of key effectiveness parameters at 3-months postoperatively are stratified below by preoperative manifest refraction spherical equivalent (MRSE), preoperative manifest sphere, and preoperative manifest cylinder in Tables 24 through 26, respectively.

Table 24: Primary Effectiveness Variables at Month 3 for All Treated Eyes by Preoperative MRSE

	Statistic	-1.01 to -2.00 D	-2.01 to -3.00 D	-3.01 to -4.00 D	-4.01 to -5.00 D	-5.01 to -6.00 D	> -6.00 D	Total
Effectiveness Variables								
MRSE +/- 0.50 D	n/N	31/32	19/19	22/24	30/31	13/16	3/5	118/127
	%	96.9%	100.0%	91.7%	96.8%	81.3%	60.0%	92.9%
	CI[1]	(83.8, 99.9)%	(82.4, 100.0)%	(73.0, 99.0)%	(83.3, 99.9)%	(54.4, 96.0)%	(14.7, 94.7)%	(87.0, 96.7)%
MRSE +/- 1.00 D	n/N	32/32	19/19	24/24	31/31	16/16	5/5	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(89.1, 100.0)%	(82.4, 100.0)%	(85.8, 100.0)%	(88.8, 100.0)%	(79.4, 100.0)%	(47.8, 100.0)%	(97.1, 100.0)%
MRSE +/- 2.00 D	n/N	32/32	19/19	24/24	31/31	16/16	5/5	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(89.1, 100.0)%	(82.4, 100.0)%	(85.8, 100.0)%	(88.8, 100.0)%	(79.4, 100.0)%	(47.8, 100.0)%	(97.1, 100.0)%
UCVA 20/20 or better	n/N	30/32	18/19	20/24	28/31	10/16	4/5	110/127
	%	93.8%	94.7%	83.3%	90.3%	62.5%	80.0%	86.6%
	CI[1]	(79.2, 99.2)%	(74.0, 99.9)%	(62.6, 95.3)%	(74.2, 98.0)%	(35.4, 84.8)%	(28.4, 99.5)%	(79.4, 92.0)%
UCVA 20/40 or better	n/N	32/32	19/19	24/24	31/31	16/16	5/5	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(89.1, 100.0)%	(82.4, 100.0)%	(85.8, 100.0)%	(88.8, 100.0)%	(79.4, 100.0)%	(47.8, 100.0)%	(97.1, 100.0)%

[1] Exact 95% confidence interval

Table 25: Key Effectiveness Outcomes Stratified by Baseline Sphere at 3 Months After Topography-Assisted LASIK								
	Statistic	-0.00 to -1.00 D	-1.01 to -2.00 D	-2.01 to -3.00 D	-3.01 to -4.00 D	-4.01 to -5.00 D	-5.01 to -6.00 D	Total
Effectiveness Variables								
MRSE +/- 0.50 D	n/N	10/10	29/31	22/22	34/35	14/17	9/12	118/127
	%	100.0%	93.5%	100.0%	97.1%	82.4%	75.0%	92.9%
	CI[1]	(69.2, 100.0)%	(78.6, 99.2)%	(84.6, 100.0)%	(85.1, 99.9)%	(56.6, 96.2)%	(42.8, 94.5)%	(87.0, 96.7)%
MRSE +/- 1.00 D	n/N	10/10	31/31	22/22	35/35	17/17	12/12	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(69.2, 100.0)%	(88.8, 100.0)%	(84.6, 100.0)%	(90.0, 100.0)%	(80.5, 100.0)%	(73.5, 100.0)%	(97.1, 100.0)%
MRSE +/- 2.00 D	n/N	10/10	31/31	22/22	35/35	17/17	12/12	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(69.2, 100.0)%	(88.8, 100.0)%	(84.6, 100.0)%	(90.0, 100.0)%	(80.5, 100.0)%	(73.5, 100.0)%	(97.1, 100.0)%
UCVA 20/20 or better	n/N	9/10	29/31	19/22	31/35	16/17	6/12	110/127
	%	90.0%	93.5%	86.4%	88.6%	94.1%	50.0%	86.6%
	CI[1]	(55.5, 99.7)%	(78.6, 99.2)%	(65.1, 97.1)%	(73.3, 96.8)%	(71.3, 99.9)%	(21.1, 78.9)%	(79.4, 92.0)%
UCVA 20/40 or better	n/N	10/10	31/31	22/22	35/35	17/17	12/12	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(69.2, 100.0)%	(88.8, 100.0)%	(84.6, 100.0)%	(90.0, 100.0)%	(80.5, 100.0)%	(73.5, 100.0)%	(97.1, 100.0)%
[1] Exact 95% confidence interval								

Table 26: Key Effectiveness Outcomes Stratified by Baseline Cylinder at 3 Months After Topography-Assisted LASIK							
	Statistic	-0.50 to -0.75 D	-0.76 to -1.00 D	-1.01 to -2.00 D	-2.01 to -3.00 D	-3.01 to -4.00 D	Total
Effectiveness Variables							
MRSE +/- 0.50 D	n/N	60/65	20/21	31/33	5/6	2/2	118/127
	%	92.3%	95.2%	93.9%	83.3%	100.0%	92.9%
	CI[1]	(83.0, 97.5)%	(76.2, 99.9)%	(79.8, 99.3)%	(35.9, 99.6)%	(15.8, 100.0)%	(87.0, 96.7)%
MRSE +/- 1.00 D	n/N	65/65	21/21	33/33	6/6	2/2	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(94.5, 100.0)%	(83.9, 100.0)%	(89.4, 100.0)%	(54.1, 100.0)%	(15.8, 100.0)%	(97.1, 100.0)%
MRSE +/- 2.00 D	n/N	65/65	21/21	33/33	6/6	2/2	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(94.5, 100.0)%	(83.9, 100.0)%	(89.4, 100.0)%	(54.1, 100.0)%	(15.8, 100.0)%	(97.1, 100.0)%
UCVA 20/20 or better	n/N	61/65	18/21	25/33	4/6	2/2	110/127
	%	93.8%	85.7%	75.8%	66.7%	100.0%	86.6%
	CI[1]	(85.0, 98.3)%	(63.7, 97.0)%	(57.7, 88.9)%	(22.3, 95.7)%	(15.8, 100.0)%	(79.4, 92.0)%
UCVA 20/40 or better	n/N	65/65	21/21	33/33	6/6	2/2	127/127
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	CI[1]	(94.5, 100.0)%	(83.9, 100.0)%	(89.4, 100.0)%	(54.1, 100.0)%	(15.8, 100.0)%	(97.1, 100.0)%
[1] Exact 95% confidence interval							

8.0 ZERNIKE ANALYSIS

The CATz (Customized Aspheric Treatment Zone) mode of the Final Fit software is a topography-assisted treatment and not a wavefront-assisted treatment. The treatment is calculated to first reduce the refractive error (spherocylindrical correction) based on the manifest refraction using OATz Profile #5 and then treats a portion of the residual corneal irregularities based on the raw topographic data.

Zernike polynomial data were obtained in all eyes using the Nidek OPD-Scan topographer/aberrometer. The OPDScan calculates the whole eye aberrometry Zernike coefficients according to the methods described in ANSI Z80.28.[5] Although the CATz treatment is not a wavefront-assisted treatment, an analysis of the Zernike coefficients was performed to evaluate the effect of the topography-assisted LASIK treatment on whole eye aberrations. The analysis is based on a consistent cohort of eyes that had an OPDScan with 5 mm pupil diameter data at all timepoints evaluated.

The magnitudes of the RMS aberrations are summarized in Table 27. The topography-assisted LASIK procedure results in a decrease in defocus and astigmatism which parallels the primary goal of the procedure. Spherical aberrations increase in magnitude from 0.05µm to 0.08 µm at 3 months postoperatively, the timepoint of refractive stability.

Table 27: RMS Aberration Magnitudes Before and After Topography-Assisted LASIK Mean (µm) ±SD for All Treated Eyes 6-Month Consistent Cohort

		Pre-op		Month 1		Month 3		Month 6	
Aberration	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD
RMS Defocus	101	2.799	1.234	0.344	0.318	0.370	0.300	0.389	0.303
RMS Astigmatism	101	0.493	0.292	0.300	0.378	0.292	0.270	0.275	0.190
RMS >2nd Order	101	0.243	0.101	0.354	0.447	0.373	0.371	0.324	0.225
RMS Coma	101	0.102	0.058	0.125	0.097	0.135	0.085	0.129	0.086
RMS Trefoil	101	0.167	0.093	0.199	0.110	0.219	0.138	0.197	0.121
RMS Spherical Aberration	101	0.051	0.036	0.078	0.056	0.080	0.052	0.070	0.051
RMS Secondary Astigmatism	101	0.037	0.024	0.051	0.055	0.053	0.054	0.053	0.047
RMS Tetrafoil	101	0.053	0.046	0.096	0.216	0.107	0.252	0.086	0.141
RMS >4th Order	101	0.073	0.055	0.142	0.396	0.148	0.270	0.117	0.159

[5] ANSI Standard Z80.28:-2010: Methods for Reporting Optical Aberrations of Eyes

The signed aberration amplitudes are presented in Table 28. The mean defocus amplitude and signed astigmatism horizontal amplitude is reduced at all timepoints compared to baseline. Spherical aberrations show an increase that is no greater than that observed with conventional LASIK treatments.

TABLE 28: Signed Aberration Amplitudes Before and After Topography-Assisted LASIK Mean (μm) ±S.D.

		Pre-op		Month 1		Month 3		Month 6	
Aberration	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Signed Defocus	101	2.799	1.234	0.204	0.422	0.237	0.414	0.283	0.405
Signed Astigmatism Horizontal	101	-0.135	0.485	0.008	0.439	-0.013	0.340	-0.015	0.265
Signed Astigmatism Vertical	101	-0.006	0.278	-0.070	0.189	-0.043	0.267	-0.068	0.195
Signed Coma Horizontal	101	-0.009	0.092	-0.036	0.127	-0.043	0.123	-0.030	0.119
Signed Coma Vertical	101	-0.005	0.072	-0.018	0.087	-0.015	0.092	-0.014	0.095
Signed Spherical Aberration	101	0.014	0.061	0.049	0.083	0.045	0.084	0.052	0.069

A paired analysis was performed for each eye in the consistent cohort to determine the change in aberration magnitudes and the percentage change in magnitudes at each postoperative visit compared to baseline. Descriptive statistics for these two parameters are presented in Table 29 below. As expected, the changes in defocus and astigmatism were significant ($p<0.05$). The increases in spherical aberration and coma were also significant ($p<0.05$). Significant percentage changes should be interpreted cautiously for those Zernike coefficients, such as trefoil, that have very small values in which small incremental changes in value will result in a seemingly large percentage change.

Table 29: Change in RMS Aberration From Preop for All Treated Eyes 6-Month Consistent Cohort											
			Month 1			Month 3			Month 6		
Aberration		N	Mean	SD	p-value	Mean	SD	p-value	Mean	SD	p-value
RMS Defocus	Change	101	-2.455	1.180	<.001	-2.429	1.201	<.001	-2.409	1.178	<.001
	% Change	101	-84.6	22.9	<.001	-81.4	34.4	<.001	-79.3	42.6	<.001
RMS Astigmatism	Change	101	-0.194	0.462	<.001	-0.201	0.343	<.001	-0.218	0.317	<.001
	% Change	101	-20.0	131.4	0.130	-28.0	70.8	<.001	-27.0	73.3	<.001
RMS >2nd Order	Change	101	0.111	0.459	0.017	0.130	0.383	<.001	0.081	0.236	<.001
	% Change	101	74.7	355.6	0.037	75.3	233.2	0.002	49.7	112.3	<.001
RMS Coma	Change	101	0.024	0.093	0.012	0.034	0.096	<.001	0.028	0.089	0.002
	% Change	101	64.8	163.8	<.001	89.2	189.0	<.001	72.4	179.6	<.001
RMS Trefoil	Change	101	0.033	0.141	0.022	0.052	0.160	0.002	0.030	0.148	0.045
	% Change	101	76.2	193.2	<.001	90.7	218.3	<.001	70.9	175.8	<.001
RMS Spherical Aberration	Change	101	0.027	0.057	<.001	0.029	0.052	<.001	0.020	0.053	<.001
	% Change	100	169.1	394.2	<.001	159.7	347.4	<.001	127.7	313.1	<.001
RMS Secondary Astigmatism	Change	101	0.014	0.057	0.015	0.015	0.054	0.005	0.016	0.047	<.001
	% Change	101	101.9	281.0	<.001	102.2	272.5	<.001	105.8	240.9	<.001
RMS Tetrafoil	Change	101	0.043	0.221	0.052	0.055	0.254	0.032	0.033	0.139	0.018
	% Change	101	178.7	526.3	<.001	178.6	472.5	<.001	108.4	222.5	<.001
RMS >4th Order	Change	101	0.069	0.402	0.089	0.075	0.273	0.007	0.043	0.164	0.009
	% Change	101	138.1	685.6	0.046	125.3	358.4	<.001	84.7	262.6	0.002

The changes in signed-value of the aberrations were evaluated at each postoperative visit compared to baseline and are presented in Table 30 below. The topography-assisted LASIK treatment resulted in an expected significant ($p<0.05$) change in defocus and horizontal astigmatism.

Table 30: Change in Signed Aberration From Preop for All Treated Eyes 6-Month Consistent Cohort											
			Month 1			Month 3			Month 6		
Aberration		N	Mean	SD	p-value	Mean	SD	p-value	Mean	SD	p-value
Signed Defocus	µm Change	101	-2.595	1.203	<.001	-2.561	1.176	<.001	-2.516	1.139	<.001
	% Change	101	-92.4	26.5	<.001	-89.3	37.7	<.001	-86.3	45.4	<.001
Signed Astigmatism Horizontal	µm Change	101	0.144	0.540	0.009	0.122	0.459	0.009	0.120	0.424	0.005
	% Change	101	-34.8	685.4	0.611	-61.0	189.9	0.002	-99.0	186.0	<.001
Signed Astigmatism Vertical	µm Change	101	-0.064	0.278	0.023	-0.037	0.325	0.251	-0.062	0.264	0.020
	% Change	101	-87.1	528.4	0.101	-101.6	1095.0	0.353	-183.8	895.9	0.042
Signed Coma Horizontal	µm Change	101	-0.026	0.122	0.033	-0.034	0.121	0.006	-0.021	0.105	0.046
	% Change	101	-22.1	698.7	0.751	-9.1	685.4	0.894	-142.6	812.2	0.081
Signed Coma Vertical	µm Change	101	-0.013	0.086	0.119	-0.010	0.088	0.257	-0.009	0.085	0.294
	% Change	100	-13.2	485.0	0.785	27.3	1010.3	0.788	95.1	888.4	0.287
Signed Spherical Aberration	µm Change	101	0.035	0.068	<.001	0.031	0.070	<.001	0.038	0.062	<.001
	% Change	100	-44.6	474.8	0.350	-19.2	426.9	0.654	-19.5	379.3	0.608

The percentage of eyes with reduced, overcorrected, or increased aberrations is presented in Table 31 below. The changes in aberrations are defined as follows:

- ***Reduced:*** Aberrations reduced in magnitude by an order that is greater than or equal to the repeated-measures standard deviation and of the same sign (orientation), or reversed in sign (orientation) with magnitude less than or equal to the repeated-measures standard deviation;
- ***Overcorrected:*** Aberrations with reversed sign (orientation) and magnitude that is greater than the repeated measures standard deviation; or,
- ***Increased:*** Aberrations increased in magnitude by an order that is greater than or equal to the repeated-measures standard deviation and of the same sign (orientation).

At 3 and 6-months, each aberration evaluated is either reduced or unchanged in at least two-thirds of eyes that underwent the topography-assisted LASIK procedure.

Table 31: Percentage of Eyes with Reduced, Overcorrected, or Increased Aberrations After Topography-Assisted LASIK Compared to Before LASIK					
Aberration	Visit	No Change	Reduced	Overcorrected	Increased
Signed Astigmatism Horizontal	1 Months	69 (68.3%)	29 (28.7%)	0	3 (3.0%)
	3 Months	72 (71.3%)	27 (26.7%)	1 (1.0%)	1 (1.0%)
	6 Months	67 (66.3%)	30 (29.7%)	2 (2.0%)	2 (2.0%)
Signed Astigmatism Vertical	1 Months	71 (70.3%)	22 (21.8%)	5 (5.0%)	3 (3.0%)
	3 Months	69 (68.3%)	23 (22.8%)	3 (3.0%)	6 (5.9%)
	6 Months	74 (73.3%)	21 (20.8%)	4 (4.0%)	2 (2.0%)
Signed Coma Horizontal	1 Months	84 (83.2%)	6 (5.9%)	1 (1.0%)	10 (9.9%)
	3 Months	80 (79.2%)	5 (5.0%)	5 (5.0%)	11 (10.9%)
	6 Months	85 (84.2%)	5 (5.0%)	1 (1.0%)	10 (9.9%)
Signed Coma Vertical	1 Months	84 (83.2%)	6 (5.9%)	2 (2.0%)	9 (8.9%)
	3 Months	83 (82.2%)	7 (6.9%)	2 (2.0%)	9 (8.9%)
	6 Months	77 (76.2%)	7 (6.9%)	3 (3.0%)	14 (13.9%)
Signed Spherical Aberration	1 Months	74 (73.3%)	3 (3.0%)	8 (7.9%)	16 (15.8%)
	3 Months	77 (76.2%)	3 (3.0%)	7 (6.9%)	14 (13.9%)
	6 Months	73 (72.3%)	8 (7.9%)	7 (6.9%)	13 (12.9%)
Signed Secondary Astigmatism Horizontal	1 Months	90 (89.1%)	2 (2.0%)	5 (5.0%)	4 (4.0%)
	3 Months	87 (86.1%)	4 (4.0%)	3 (3.0%)	7 (6.9%)
	6 Months	86 (85.1%)	4 (4.0%)	6 (5.9%)	5 (5.0%)
Signed Secondary Astigmatism Vertical	1 Months	92 (91.1%)	2 (2.0%)	4 (4.0%)	3 (3.0%)
	3 Months	88 (87.1%)	1 (1.0%)	6 (5.9%)	6 (5.9%)
	6 Months	93 (92.1%)	2 (2.0%)	4 (4.0%)	2 (2.0%)

Table 32 below presents the percentage of eyes that had changes in aberrations that were increased and overcorrected, defined as aberrations with a reversed sign (orientation) and magnitude that is greater than the preoperative magnitude plus the repeated-measures standard deviation. The proportion of eyes that have increased and overcorrected aberrations is low for astigmatism (horizontal, vertical, secondary horizontal, secondary vertical), with 12% or fewer of the eyes that showed an increase and/or overcorrection.

Table 32: Percentage of Eyes With Increased or Overcorrected Aberrations (OPD) 6-Month Consistent Cohort

Aberration	Visit	No Change or Reduced	Increased or Overcorrected
Signed Astigmatism Horizontal	1 Months	98 (97.0%)	3 (3.0%)
	3 Months	99 (98.0%)	2 (2.0%)
	6 Months	97 (96.0%)	4 (4.0%)
Signed Astigmatism Vertical	1 Months	93 (92.1%)	8 (7.9%)
	3 Months	92 (91.1%)	9 (8.9%)
	6 Months	95 (94.1%)	6 (5.9%)
Signed Coma Horizontal	1 Months	90 (89.1%)	11 (10.9%)
	3 Months	85 (84.2%)	16 (15.8%)
	6 Months	90 (89.1%)	11 (10.9%)
Signed Coma Vertical	1 Months	90 (89.1%)	11 (10.9%)
	3 Months	90 (89.1%)	11 (10.9%)
	6 Months	84 (83.2%)	17 (16.8%)
Signed Spherical Aberration	1 Months	77 (76.2%)	24 (23.8%)
	3 Months	80 (79.2%)	21 (20.8%)
	6 Months	81 (80.2%)	20 (19.8%)
Signed Secondary Astigmatism Horizontal	1 Months	92 (91.1%)	9 (8.9%)
	3 Months	91 (90.1%)	10 (9.9%)
	6 Months	90 (89.1%)	11 (10.9%)
Signed Secondary Astigmatism Vertical	1 Months	94 (93.1%)	7 (6.9%)
	3 Months	89 (88.1%)	12 (11.9%)
	6 Months	95 (94.1%)	6 (5.9%)

A paired difference analysis was performed to evaluate the stability of the aberrations across time. Differences were calculated as the postoperative value minus the preoperative value; hence, positive numbers indicate an increase and negative numbers indicate a decrease in the value of the parameter. Clinical experience has shown that tear film, artifact and other factors can introduce variability into the acquired topographer/aberrometer, which is not device specific. Table 33 below presents the mean paired aberration differences between postoperative periods.

Table 33: Mean Paired RMS Aberration Difference Between Postop Visits 6-Month Consistent Cohort

Aberration	Statistic	Preop to Month 1	Month 1 to Month 3	Month 3 to Month 6
RMS Defocus	Mean	-2.455	0.026	0.019
	Std	1.180	0.292	0.231
	CI[1]	(-2.688, -2.222)	(-0.031, 0.084)	(-0.026, 0.065)
RMS Astigmatism	Mean	-0.194	-0.007	-0.017
	Std	0.462	0.417	0.249
	CI[1]	(-0.285, -0.102)	(-0.089, 0.075)	(-0.066, 0.032)
RMS >2nd Order	Mean	0.111	0.019	-0.049
	Std	0.459	0.573	0.391
	CI[1]	(0.020, 0.202)	(-0.094, 0.132)	(-0.126, 0.028)
RMS Coma	Mean	0.024	0.010	-0.006
	Std	0.093	0.090	0.084
	CI[1]	(0.005, 0.042)	(-0.008, 0.028)	(-0.023, 0.011)
RMS Trefoil	Mean	0.033	0.019	-0.022
	Std	0.141	0.155	0.173
	CI[1]	(0.005, 0.060)	(-0.011, 0.050)	(-0.056, 0.012)
RMS Spherical Aberration	Mean	0.027	0.002	-0.009
	Std	0.057	0.055	0.051
	CI[1]	(0.016, 0.039)	(-0.009, 0.013)	(-0.019, 0.001)
RMS Secondary Astigmatism	Mean	0.014	0.001	0.001
	Std	0.057	0.063	0.052
	CI[1]	(0.003, 0.025)	(-0.011, 0.014)	(-0.010, 0.011)
RMS Tetrafoil	Mean	0.043	0.012	-0.022
	Std	0.221	0.333	0.274
	CI[1]	(-0.000, 0.087)	(-0.054, 0.077)	(-0.076, 0.033)
RMS >4th Order	Mean	0.069	0.006	-0.031
	Std	0.402	0.475	0.277
	CI[1]	(-0.011, 0.148)	(-0.088, 0.100)	(-0.086, 0.023)

[1] 95% confidence interval based on t-distribution

The mean paired signed aberration difference between postop visits analysis was performed to evaluate the stability of the aberrations across time are presented in Table 34 below for defocus, astigmatism (horizontal, vertical), coma (horizontal, vertical) and spherical aberration.

Table 34: Mean Paired Signed Aberration Difference Between Postop Visits 6-Month Consistent Cohort

Aberration	Statistic	Preop to Month 1	Month 1 to Month 3	Month 3 to Month 6
Signed Defocus	Mean	-2.595	0.034	0.045
	Std	1.203	0.325	0.287
	CI[1]	(-2.832, -2.357)	(-0.031, 0.098)	(-0.011, 0.102)
Signed Astigmatism Horizontal	Mean	0.144	-0.021	-0.002
	Std	0.540	0.455	0.316
	CI[1]	(0.037, 0.250)	(-0.111, 0.069)	(-0.064, 0.060)
Signed Astigmatism Vertical	Mean	-0.064	0.027	-0.025
	Std	0.278	0.258	0.272
	CI[1]	(-0.119, -0.009)	(-0.024, 0.078)	(-0.079, 0.029)
Signed Coma Horizontal	Mean	-0.026	-0.007	0.013
	Std	0.122	0.106	0.092
	CI[1]	(-0.050, -0.002)	(-0.028, 0.014)	(-0.006, 0.031)
Signed Coma Vertical	Mean	-0.013	0.003	0.001
	Std	0.086	0.063	0.074
	CI[1]	(-0.030, 0.004)	(-0.009, 0.016)	(-0.013, 0.016)
Signed Spherical Aberration	Mean	0.035	-0.003	0.007
	Std	0.068	0.078	0.064
	CI[1]	(0.021, 0.048)	(-0.019, 0.012)	(-0.006, 0.020)

[1] 95% confidence interval based on t-distribution

9.0 CONTRAST SENSITIVITY

Contrast sensitivity was evaluated preoperatively and at 6 months after the topography-assisted LASIK procedure with and without glare under mesopic (3 cd/m^2) and photopic (85 cd/m^2) chart luminance conditions. Testing was performed using the StereoOptical Optec® 6500 Vision Tester and the Functional Acuity Contrast Test (FACT™) Chart with sine-wave grating chart, which tests at five spatial frequencies (1.5, 3, 6, 12, and 18 cycles/degree) and nine levels of contrast, that increase in contrast in equal 0.15 log units from Column 1 through Column 9 for each spatial frequency. The Optec® 6500 is calibrated by the manufacturer to provide photopic and mesopic test conditions and has a built-in glare source that is preset to deliver 10 lux glare luminance under photopic test conditions and 1 lux glare luminance under mesopic conditions.

To perform the test, the subject reports the orientation of the grating (right, up, or left). The test is scored by assigning the corresponding percentage contrast value for the target to the last correct grating (target) seen for each spatial frequency according to the following chart in Table 34:

Table 34: Contrast Percentage for FACT™ Chart Contrast Sensitivity Test Targets

ROW	Cycles per Degree	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
A	(1.5)	7	9	13	18	25	36	50	71	100
B	(3)	10	15	20	29	40	57	80	114	160
C	(6)	12	16	23	33	45	64	90	128	180
D	(12)	8	11	15	22	30	43	60	85	120
E	(18)	4	6	8	12	17	23	33	46	65

The change in contrast sensitivity is then determined by converting the contrast percentage to logarithmic values ($\log_{10}$) and calculating the difference between the contrast percentage at baseline and 6 months after the topography-assisted LASIK for each spatial frequency.
For the CATz-1 study, each treated eye was tested at each of the five spatial frequencies using the manufacturer's preset glare under the following test conditions:

- Photopic (85 cd/m^2) without glare
- Photopic (85 cd/m^2) with glare (10 lux)
- Mesopic (3 cd/m^2) without glare
- Mesopic (3 cd/m^2) with glare (1 lux)

The changes in logarithmic contrast sensitivity, based on the last correct grating seen for each spatial frequency are presented below for the photopic and mesopic test conditions. As shown in Table 38 below, there is a gain in photopic mean contrast sensitivity, both with and

without glare, at all spatial frequencies tested. The improvements in photopic contrast with glare were statistically significant at all spatial frequencies except the lowest frequency tested (1.5 cpd) and in photopic contrast with glare at 6.0 cpd.

Table 35: Changes in Photopic Contrast Sensitivity in Log10 for All Treated Eyes Tested Monocularly With Data at Pre-op and Post-op Month 6

			Pre-op		Month 6		Change			
Spatial Frequency (cycles/degree)	Glare	N	Mean	SD	Mean	SD	Mean	SD	95% CI	p-value
1.5	Yes	69	1.688	0.166	1.685	0.184	-0.003	0.205	(-0.052 , 0.047)	0.918
	No	104	1.586	0.174	1.582	0.196	-0.004	0.191	(-0.041 , 0.033)	0.841
3	Yes	69	1.860	0.157	1.899	0.197	0.040	0.193	(-0.007 , 0.086)	0.092
	No	104	1.834	0.181	1.841	0.205	0.006	0.225	(-0.038 , 0.050)	0.775
6	Yes	69	1.883	0.329	1.985	0.300	0.102	0.411	(0.003 , 0.201)	0.043
	No	104	1.876	0.281	1.864	0.424	-0.012	0.439	(-0.097 , 0.074)	0.787
12	Yes	69	1.539	0.463	1.664	0.301	0.126	0.473	(0.012 , 0.239)	0.031
	No	104	1.564	0.354	1.546	0.386	-0.018	0.443	(-0.104 , 0.068)	0.677
18	Yes	69	1.110	0.525	1.244	0.361	0.134	0.524	(0.008 , 0.260)	0.037
	No	104	1.146	0.433	1.184	0.381	0.038	0.457	(-0.051 , 0.127)	0.401

Eyes treated with the topography-assisted LASIK procedure also showed a gain in mesopic mean contrast sensitivity with and without glare at all but the highest spatial frequencies of 12 cpd with and without glare and 18 cpd without glare at 6-months after the treatment as shown in Table 36 below.

Table 36: Changes in Mesopic Contrast Sensitivity in Log10 for All Treated Eyes Tested Monocularly With Data at Pre-op and Post-op Month 6

			Pre-op		Month 6		Change			
Spatial Frequency (cycles/degree)	Glare	N	Mean	SD	Mean	SD	Mean	SD	95% CI	p-value
1.5	Yes	69	1.552	0.208	1.632	0.148	0.080	0.250	(0.020 , 0.140)	0.010
	No	104	1.627	0.184	1.628	0.203	0.001	0.198	(-0.037 , 0.040)	0.945
3	Yes	69	1.686	0.229	1.739	0.296	0.054	0.314	(-0.022 , 0.129)	0.161
	No	104	1.748	0.219	1.759	0.262	0.011	0.260	(-0.040 , 0.061)	0.671
6	Yes	69	1.580	0.474	1.666	0.427	0.086	0.571	(-0.051 , 0.224)	0.213
	No	104	1.662	0.415	1.710	0.332	0.048	0.422	(-0.034 , 0.130)	0.245
12	Yes	69	1.053	0.577	1.144	0.494	0.091	0.556	(-0.042 , 0.225)	0.178
	No	104	1.162	0.485	1.150	0.460	-0.012	0.507	(-0.111 , 0.086)	0.803
18	Yes	69	0.604	0.501	0.558	0.515	-0.045	0.554	(-0.178 , 0.088)	0.500
	No	104	0.686	0.481	0.597	0.493	-0.089	0.485	(-0.183 , 0.005)	0.064

10.0 KEY SAFETY VARIABLES

The safety analyses were based on 127 eyes that were available for analysis at 3-months postoperatively. A summary of key safety variables is provided below in Table 37 for all eyes treated in the cohort.

Table 37: Key Safety Variables for All Eyes Treated After Topography-Assisted LASIK

	Statistic	Week 1	Month 1	Month 3	Month 6	Month 9	Month 12
Safety Variables							
Loss of 2 or more lines (>=10 letters) in BSCVA	n/N	0/131	0/133	2/123	0/127	0/109	0/103
	%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 2.8)%	(0.0, 2.7)%	(0.2, 5.8)%	(0.0, 2.9)%	(0.0, 3.3)%	(0.0, 3.5)%
BSCVA worse than 20/40	n/N	0/131	0/133	0/123	0/127	0/109	0/103
	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 2.8)%	(0.0, 2.7)%	(0.0, 3.0)%	(0.0, 2.9)%	(0.0, 3.3)%	(0.0, 3.5)%
BSCVA worse than 20/25 if 20/20 or better preop	n/N	0/104	0/106	2/97	0/100	0/87	0/81
	%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%
	CI[1]	(0.0, 3.5)%	(0.0, 3.4)%	(0.3, 7.3)%	(0.0, 3.6)%	(0.0, 4.2)%	(0.0, 4.5)%

[1] Exact 95% confidence interval

One subject had a transient 2-line loss of BSCVA in both eyes at the 3-month postoperative visit only, due to eye dryness and eye tiredness. As shown in Table 37 above, none of the other eyes in the study had a loss of two or more lines of BSCVA at any visit nor did any other eyes have a BSCVA of 20/25 or worse if 20/20 or better preoperatively at any other postoperative visit.

11.0 RETREATMENTS

There was one retreatment performed on one study eye during the CATz clinical study. Approval was granted from CDRH and the IRB prior to this retreatment being performed. UCVA prior to the retreatment was 20/25 in the eye to be retreated. UCVA at 1-month post-retreatment was 20/20. At 5-months post-retreatment, UCVA in the retreated eye remained at 20/20 with a manifest refraction of +0.25 sphere with a BSCVA of 20/20. At this visit, the study subject was given an add of +1.5 for near vision correction providing J1 near vision acuity. Due to limited retreatment experience, there is insufficient data to

determine the safety or effectiveness of performing LASIK retreatments on eyes that were originally treated for spherical myopia or myopic astigmatism with the CATz treatment.

12.0 CONFORMANCE TO STANDARDS

The Nidek EC-5000 Excimer Laser System complies with EN 60601-1-2:2001 for electromagnetic compatibility.

13.0 HOW SUPPLIED

The Nidek EC-5000 is available in two models: CXII and CXIII. The base unit Nidek EC-5000 Excimer Laser System includes the laser generator, excimer laser, beam delivery, optical system for observation of the patient and the procedure, gas system, and computer system control. The System requires periodic maintenance and care, particularly for the gas system. Refer to the Operator's Manual for care instructions and precautions.

Options include a CCD color camera, TV camera adapter, color monitor, computer desk, foot controller (X,Y,Z adjustment), 200 Hz eye tracker, laser goggles, calibration unit and plates, cylinder stand (large, small), and buffer tube: 5m (for outside cylinder).

14.0 OPERATOR'S MANUAL

The Operator's Manual (Document Part Number: **26200-P912B (01.'11)**) is supplied separately.