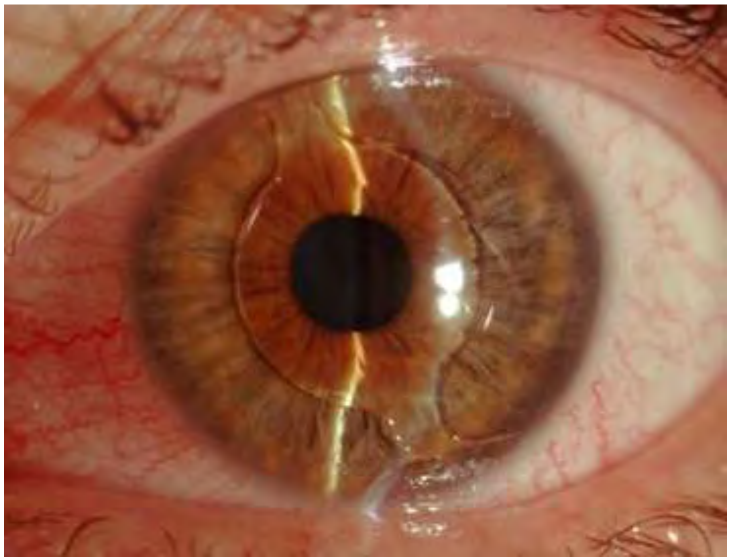
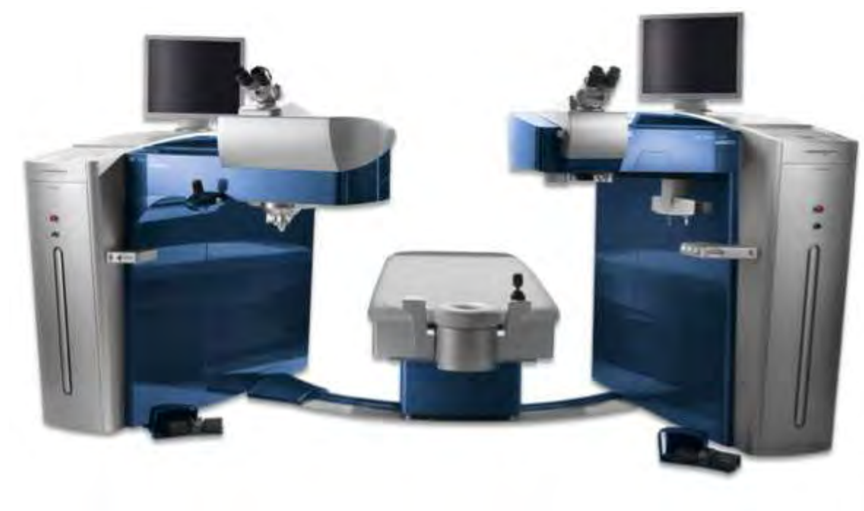
Cachet or LASIK for high myopia?





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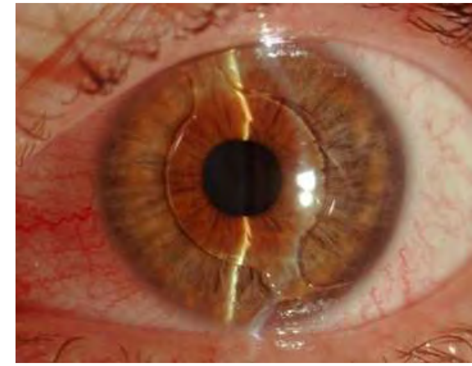
Introduction:

- Phakic IOL implantation is a valid option in the correction of high myopia and myopia in cases with thin or irregular cornea.
- We have worked with several anterior chamber and posterior chamber phakc IOLs with all advantages and potential disadvantages.

Disadvantages of PC phakic IOLs

•risk for papillary block,
• the need for a peripheral iridectomy,
•cataract formation due to lens injury during the procedure
• glaucoma due to angle obstruction
•Dislocation in the posterior pole
•Pigment dispersion


Cache



- The hydrophobic acrylic material used in the cache phakic IOL has been extensively used in routine cataract surgery implantation with excellent results and biocompatibility. We decided to evaluate the safety, efficacy and clinical parameters of the Cache, phakic IOL (Alcon, Fort Worth, TX) in the visual rehabilitation of high myopia (HM).

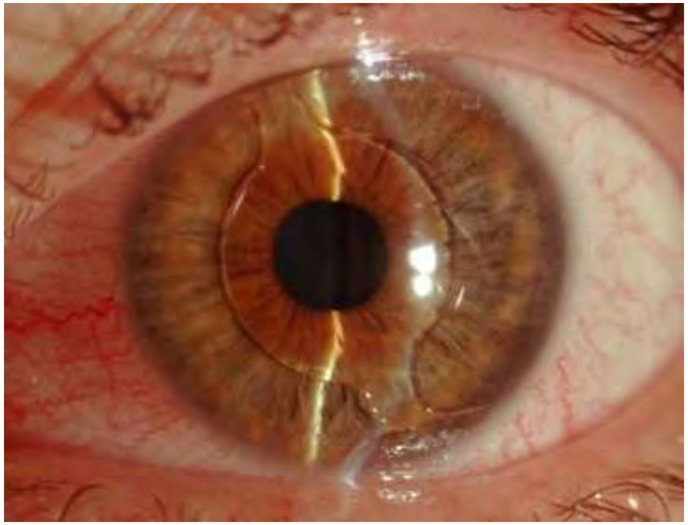
Methods

We studied 15 eyes of 15 consecutive patients at least 6 months for improvement of BSCVA, were evaluated pre- and 6 months post- operatively for: age, UCVA, BSCVA, refraction, cylinder (C), topographic cylinder change (TCc), endothelium (ECC and possible complications.

Results:

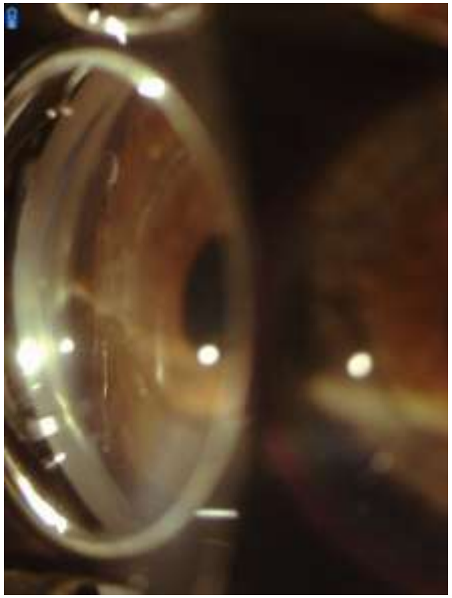
- The mean age was 27 years and mean values pre- and post-op were respectively: UCVA: from 20/400 to 20/32,
- BSCVA: from 20/40 to 20/28, (mag effect)
- Spherical equivalent reduction from 10.2 to 1.5 diopters,
- Cylinder: from -2.75D to -1.75 D, Topographic Cylinder change: -0.35D, Endothelial cell count CC: 2650, 2550.
- No complications were encountered in his small group.

1 day post-op: 20/20



Conclusions:

Haptics viewed by gonio



- This phakic IOL appears to be safe and effective in high myopia in stabilized KCN eyes.
- Significant advantages include:
- a simple implantation technique,
- the very small incision needed (2.2-2.5mm),
- no need for peripheral iridectomy,
- little anterior chamber angle changes from the haptics.

D1036

Clinical Evaluation of Phakic Intraocular Lens Implantation for High Myopia

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Department of Ophthalmology

PURPOSE

- To evaluate the safety, efficacy, and clinical parameters of the Acrysof Cachet phakic intraocular lens (Alcon, Fort Worth, TX) in the visual rehabilitation of high myopia.

INTRODUCTION

- Phakic intraocular lens (IOL) implantation is one option in the correction of high myopia and myopia in cases with thin or irregular corneas.
- Some issues with anterior chamber and posterior chamber phakic IOLs include risk of pupillary block, need for a peripheral iridectomy, cataract formation, corneal decompensation, and glaucoma due to angle obstruction.
- The Acrysof Cachet phakic IOL offers several advantages including a hydrophobic acrylic material which is routinely used in cataract surgery with excellent results and biocompatibility.
- Our goal was to evaluate the post-surgical results and safety profile of the Cachet phakic IOL.

METHODS

- Prospective nonrandomized clinical trial
- Twenty-five eyes of eighteen consecutive patients were evaluated pre- and six months postoperatively
- Clinical parameters and outcome measures included age, uncorrected visual acuity (UCVA), best spectacle-corrected visual acuity (BSCVA), manifest refraction, cylinder, topographic cylinder change, and endothelial cell count

RESULTS

- The mean age was 27 years and mean pre- and postoperative values were:

- UCVA: 20/400 to 20/25
- BSCVA: 20/25 to 20/18
- Spherical equivalent reduction from 10.2D to 0.5D
- Cylinder: -1.75D to -1.25D
- Topographic cylinder change: -0.35D
- Endothelial cell count: 2650 to 2550

- No complications were encountered.

CONCLUSION

- The Acrysof Cachet phakic IOL appears to be safe and effective in high myopia.
- Significant advantages include a simple implantation technique, small corneal incision (2.7mm), no need for peripheral iridectomy, and minimal anterior chamber changes from the haptics.

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Disclosure: none

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ARVO 2012

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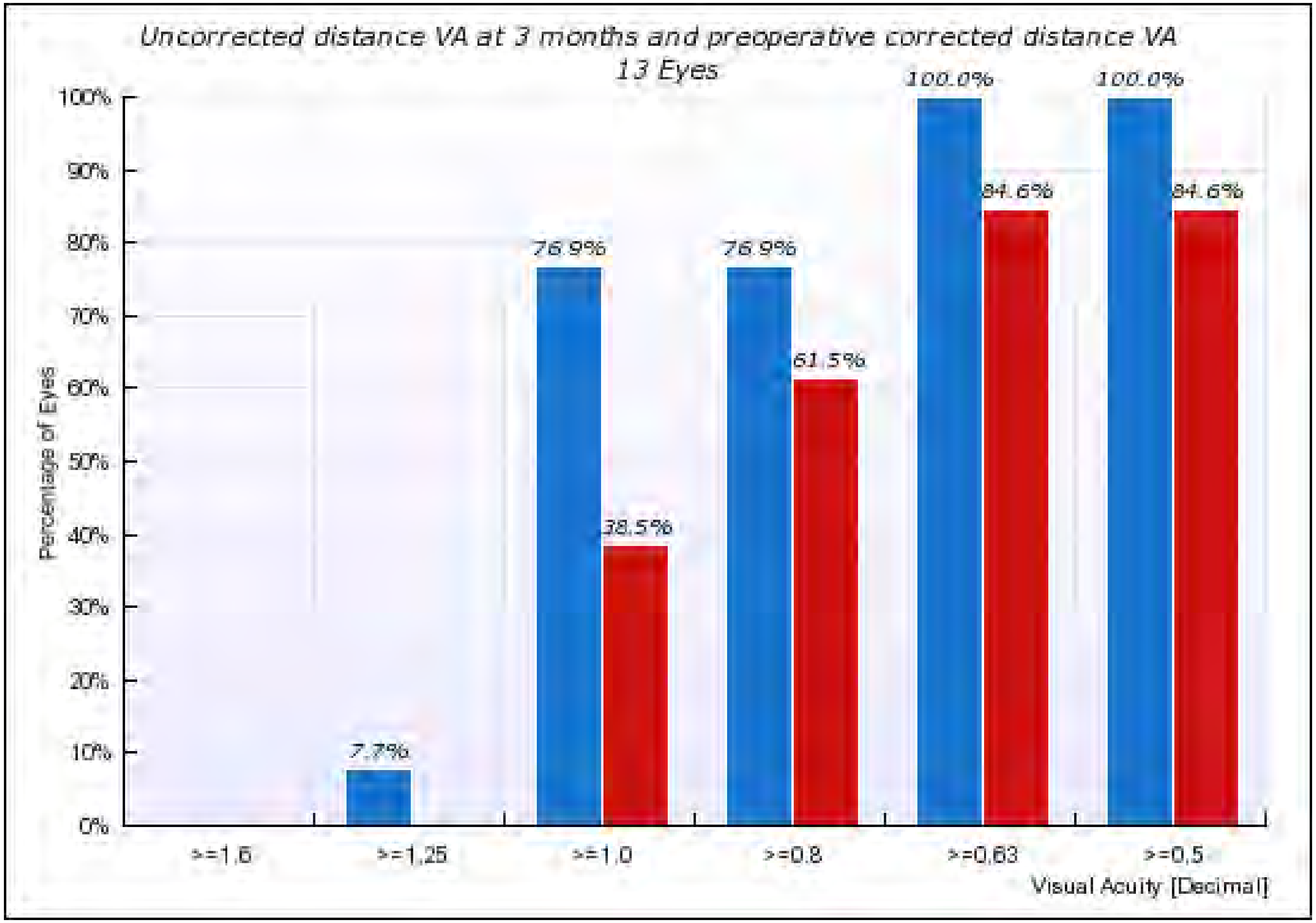
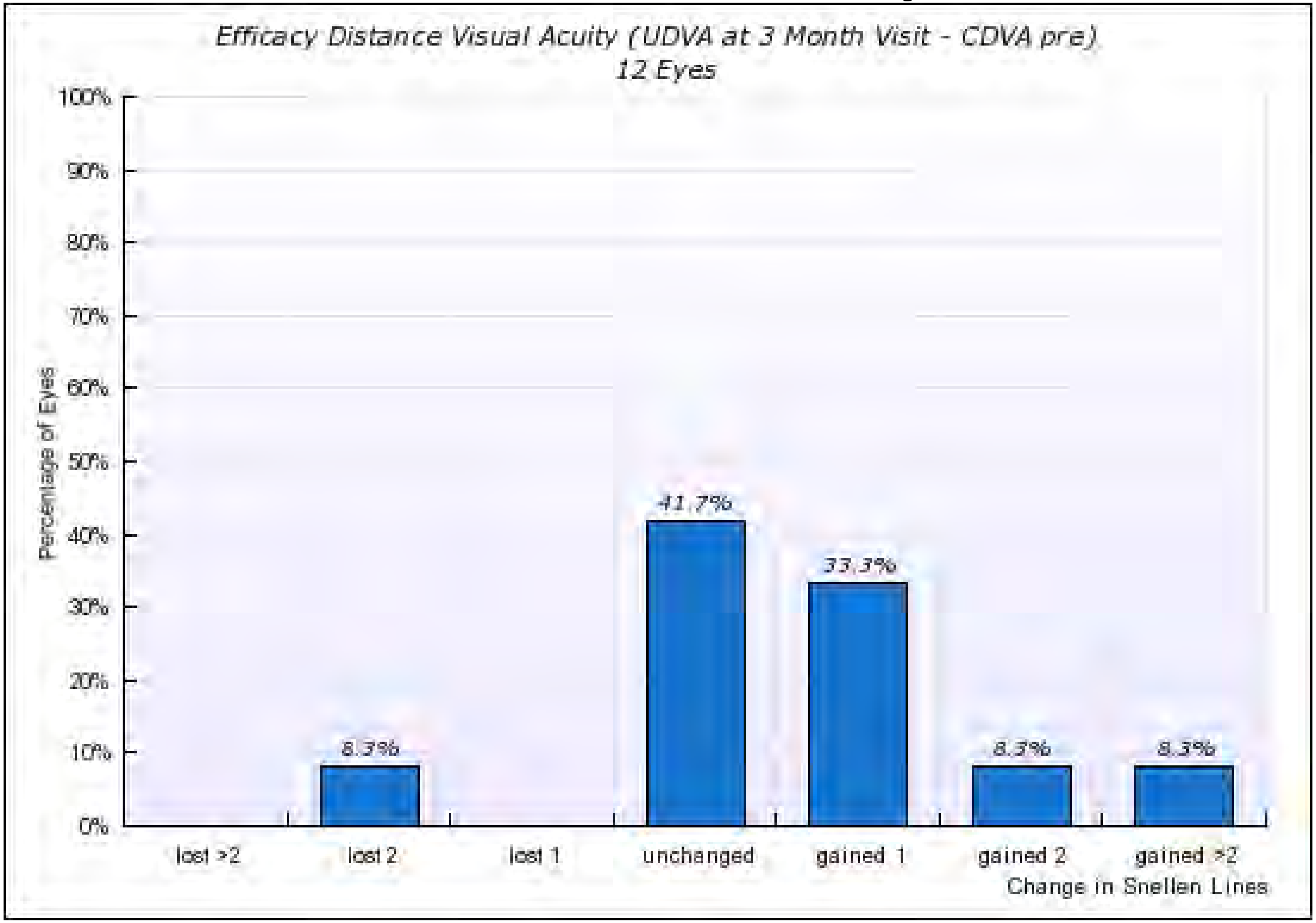
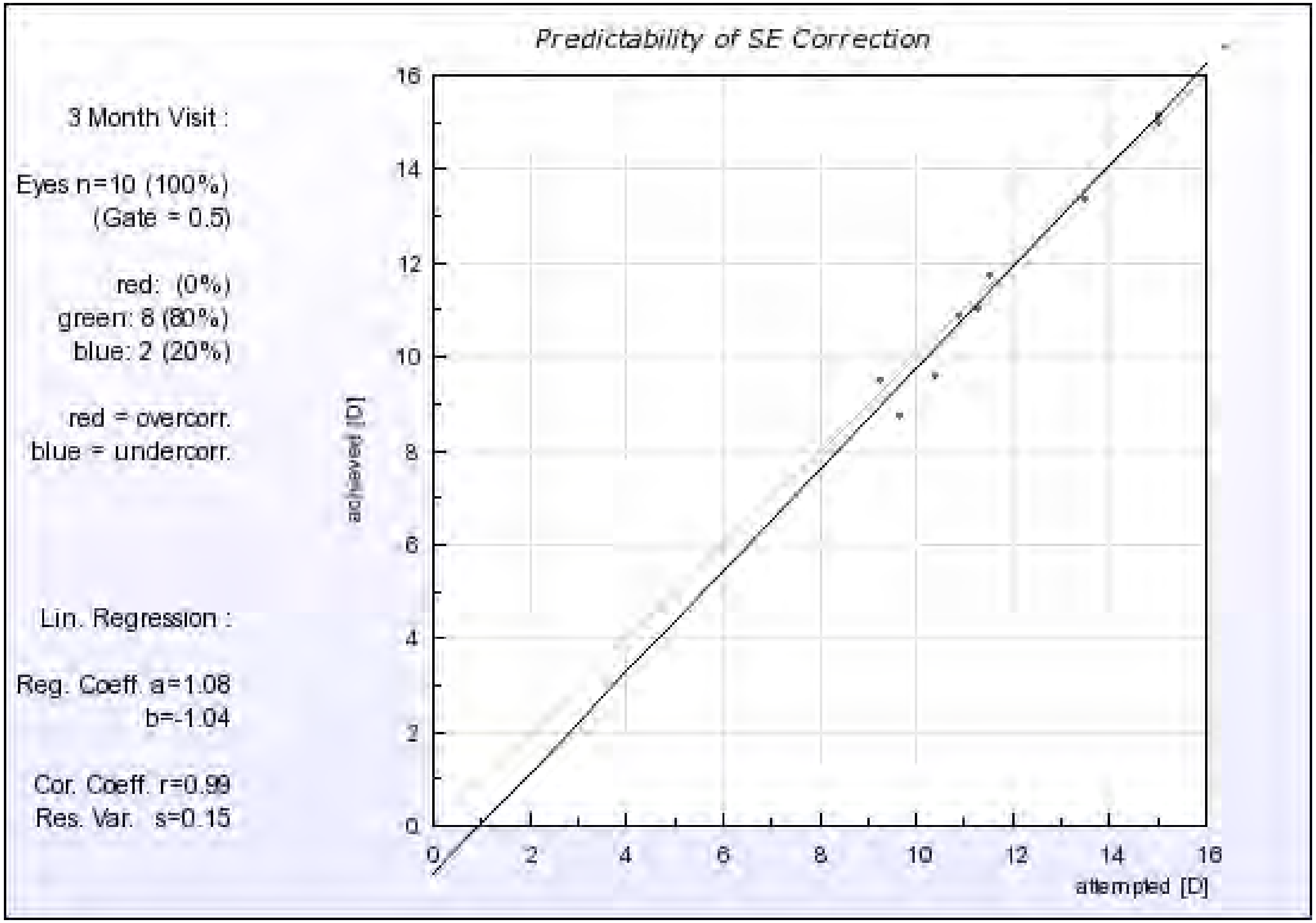
Cachet UDVA, CDVA



Cachet efficacy



Cachet predictability



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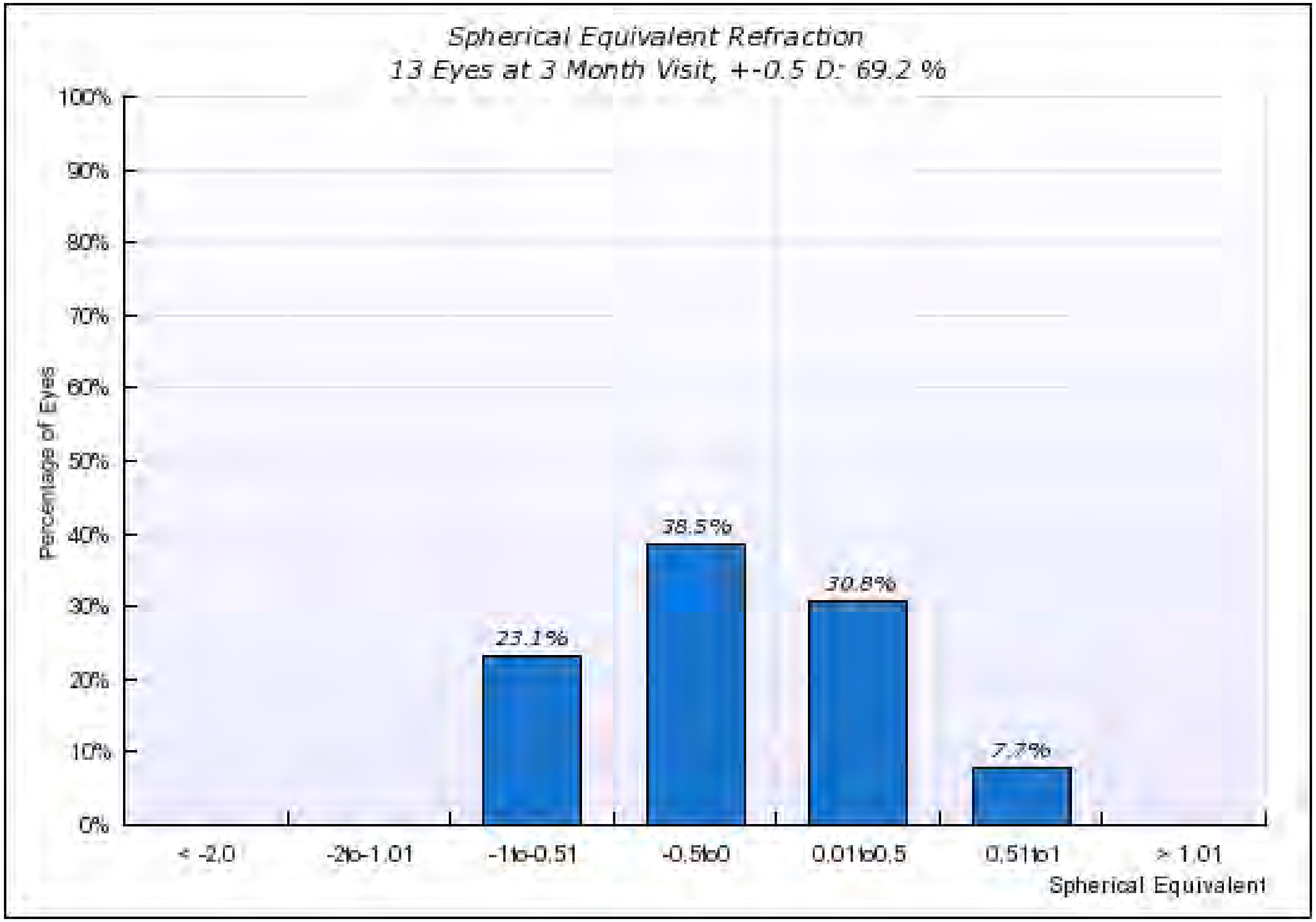
Cachet Spherical Equivalent



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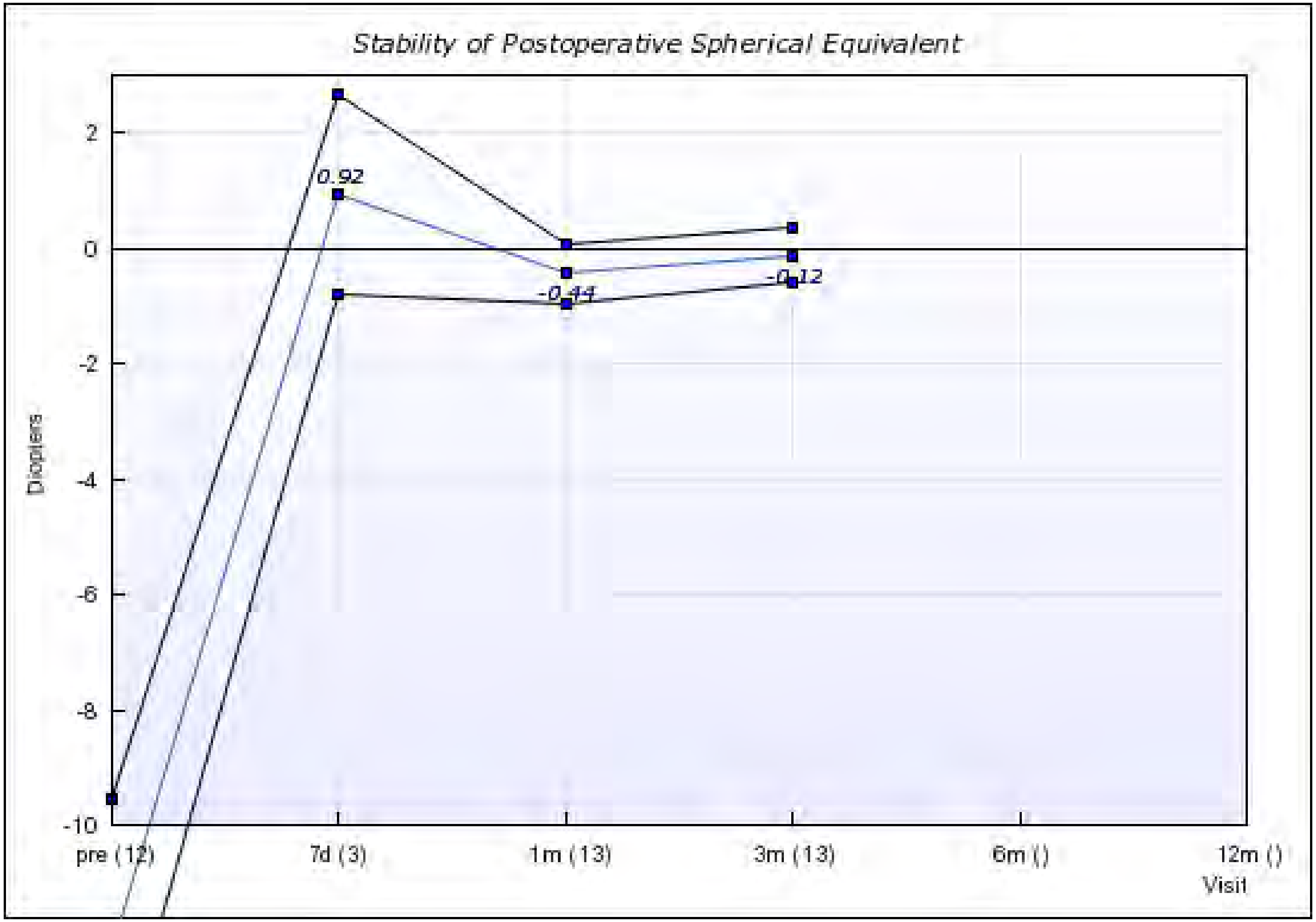
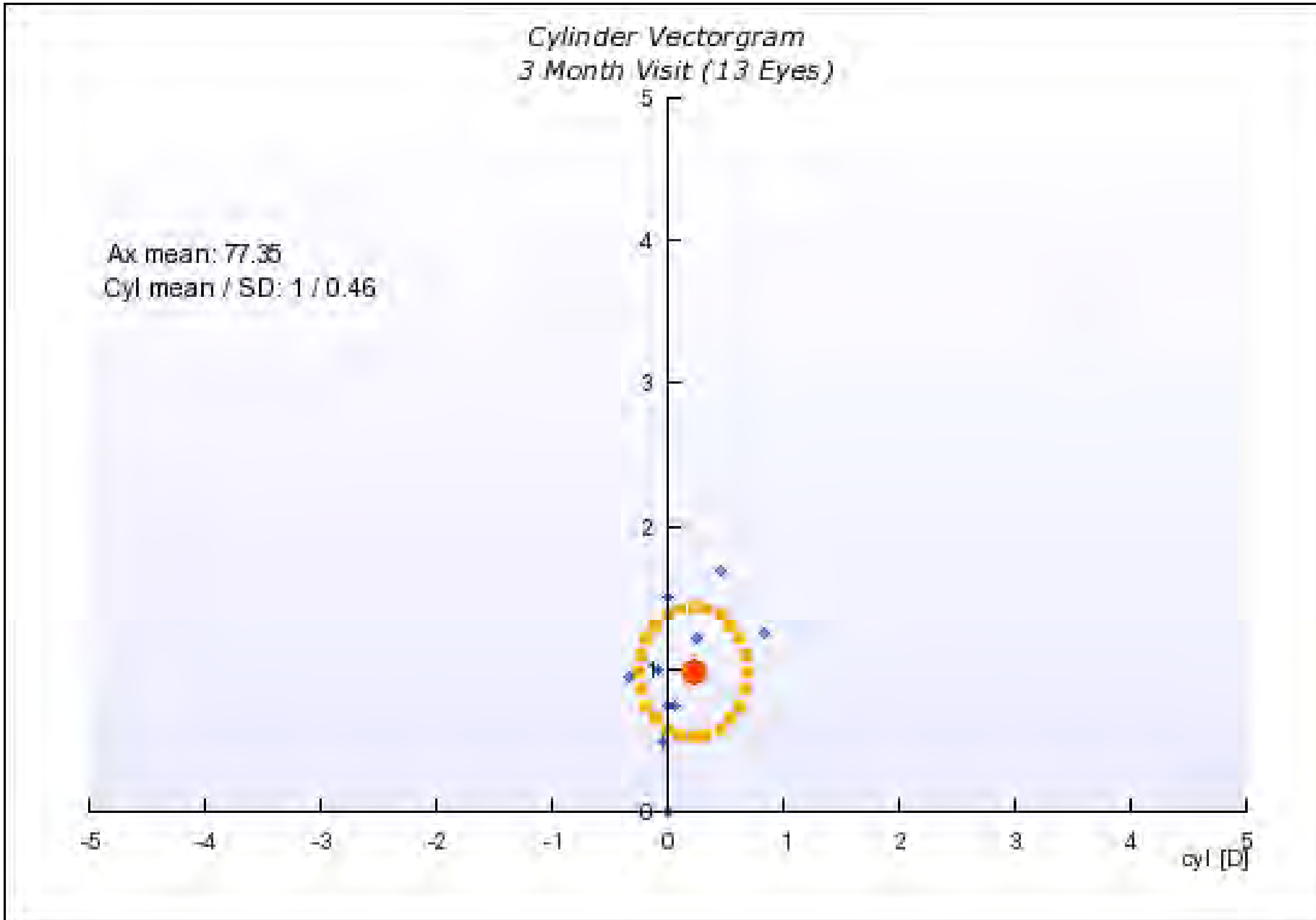
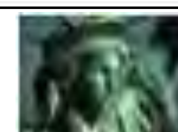
Cachet cylinder stability



Cachet vector





Potential limitations

- AC depth
- Calculation of white to white-potential misfit
- Addressing high astigmatism-toric?
- The lens centers in the AC, not the pupil
- Long term Endothelial cell studies necessary
- Potential risk for retina complications needs to be assessed by larger studies

ARVO 2012

Phakic foldable intraocular lens implantation for the visual rehabilitation of residual significant anisometropia following the stabilization of keratoconus with the Athens Protocol

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Purpose

To evaluate the safety and efficacy of phakic intraocular lens implantation for the visual rehabilitation of residual significant anisometropia following the stabilization of keratoconus with the Athens Protocol.

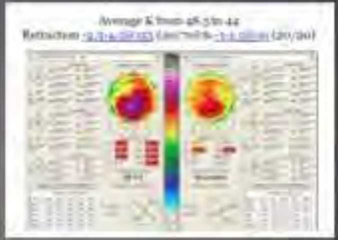
Methods

Consecutive eyes with keratoconus treated with the Athens Protocol (photorefractive keratectomy with collagen cross-linking) with residual significant anisometropia (greater than 6 diopters) and with contact lens intolerance were implanted with phakic intraocular lenses (AcrySof® Cachet® Phakic Lens) for visual rehabilitation over a period of 2 years. The preoperative versus postoperative uncorrected visual acuity (UCVA), best spectacle-corrected visual acuity (BSCVA), refractive error, keratometry (K), corneal topography (T), pachymetry (P), and endothelial cell count (ECC) were compared. Signs of progression of corneal ectasia were assessed using sequential corneal topography and tomography. Any change in keratometry greater than one diopter was considered to be progression of ectasia.

Insertion of AcrySof® Cachet® Phakic Intraocular Lens

Results

12 cases of keratoconus that were previously treated with the Athens Protocol were included. The mean follow-up was 0.9 years (range 3 months to-1.5 years). UCVA changed from 0.2 to 0.7. BSCVA improved from 0.6 to 0.8. Mean refractive spherical equivalent decreased from -8.25D to +0.5D. ECC stayed relatively stable (2750 versus 2800) as did corneal P, T and K. None of the eyes developed signs of ectasia progression.



Conclusions

Phakic intraocular lens implantation for the improvement of residual significant anisometropia following the stabilization of keratoconus with the Athens Protocol is a safe and effective adjunctive treatment. This form of refractive surgery does not appear to cause progression of corneal ectasia in this high-risk group of individuals.

References

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Krueger RR, Kanellopoulos AJ. J Refract Surg. 2010 Oct;26(10):S827-32
2.) Management of corneal ectasia after LASIK with combined, same-day, topography-guided partial transepithelial PRK and collagen cross-linking: the athens protocol. Kanellopoulos AJ, Binder PS. J Refract Surg. 2011 May;27(5):323-31.
3.) AcrySof Cachet Phakic Intraocular Lens in Myopic Patients: Visual Performance, Wavefront Error, and Lens Position. Mastropasqua L, Toto L, Vecchiarino L, Doronzo E, Mastropasqua R, Di Nicola M. J Refract Surg. 2012 Apr;28(4):267-74.

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Table 7
Best Spectacle Corrected Visual Acuity (BSCVA), Snellen

Eyes with preoperative Best Spectacle Corrected Visual Acuity (BSCVA) better than or equal to 20/20												
	20/20 or better		20/25		20/32		20/40		worse than 20/40		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
6 months	230	100.0	0	0.0	0	0.0	0	0.0	0	0.0	230	100.0
1 year	223	98.2	4	1.8	0	0.0	0	0.0	0	0.0	227	100.0
2 years	212	98.1	2	0.9	2	0.9	0	0.0	0	0.0	216	100.0
3 years	214	98.2	4	1.8	0	0.0	0	0.0	0	0.0	218	100.0
4 years	187	97.4	4	2.1	1	0.5	0	0.0	0	0.0	192	100.0
5 years	90	95.7	3	3.2	1	1.1	0	0.0	0	0.0	94	100.0

Table 8 presents the change in BSCVA from the preoperative visit for all study subjects who have reached the corresponding postoperative visit. It is important to note that three (3) subjects had ≥ 2 line decreases. One subject had a 2 line decrease at the 3 year postoperative visit (BSCVA loss of 0.24 logMAR) that was related to a nuclear cataract and unrelated to the IOL; one subject had a > 2 line decrease (BSCVA loss of 0.32 logMAR) at the 4 year postoperative visit that was related to a nuclear cataract and unrelated to the IOL; and one subject had a 2 line decrease at the 5 year postoperative visit (BSCVA loss of 0.22 logMAR) that was related to fatigue and unrelated to the IOL (BSCVA measured - 0.1 logMAR at a later visit).

Table 8
Change in BSCVA from the Preoperative Visit

	> 2 Line Decrease		2 Line Decrease		1 Line Decrease		No Change		1 Line Increase		2 Line Increase		> 2 Line Increase		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
6 months	0	0.0	0	0.0	1	0.3	146	41.4	139	39.2	54	15.2	15	4.2	355	100.0
1 year	0	0.0	0	0.0	3	0.9	147	42.0	122	34.9	60	17.1	18	5.1	350	100.0
2 years	0	0.0	0	0.0	3	0.9	130	39.0	120	36.0	60	18.0	20	6.0	333	100.0
3 years	0	0.0	1	0.3	4	1.2	131	39.0	131	39.0	52	15.5	17	5.1	336	100.0
4 years	1	0.3	0	0.0	5	1.7	111	37.5	122	41.2	43	14.5	14	4.7	296	100.0
5 years	0	0.0	1	0.6	5	3.1	66	41.3	61	38.1	20	12.5	7	4.4	160	100.0

1 line = 0.1 logMAR unit

Predictability of Refraction

The refraction was predictable at multiple time points as shown in Table 9.

Table 9
Spherical Equivalence Accuracy to Preoperative Target

	6 months	1 year	2 year	3 year	4 year	5 year
N	355	349	332	337	295	160
0.0 to ± 0.5 D	79.2%	77.1%	74.7%	76.3%	69.2%	71.3%
0.0 to ± 1.0 D	95.2%	95.4%	94.0%	93.2%	89.5%	88.8%

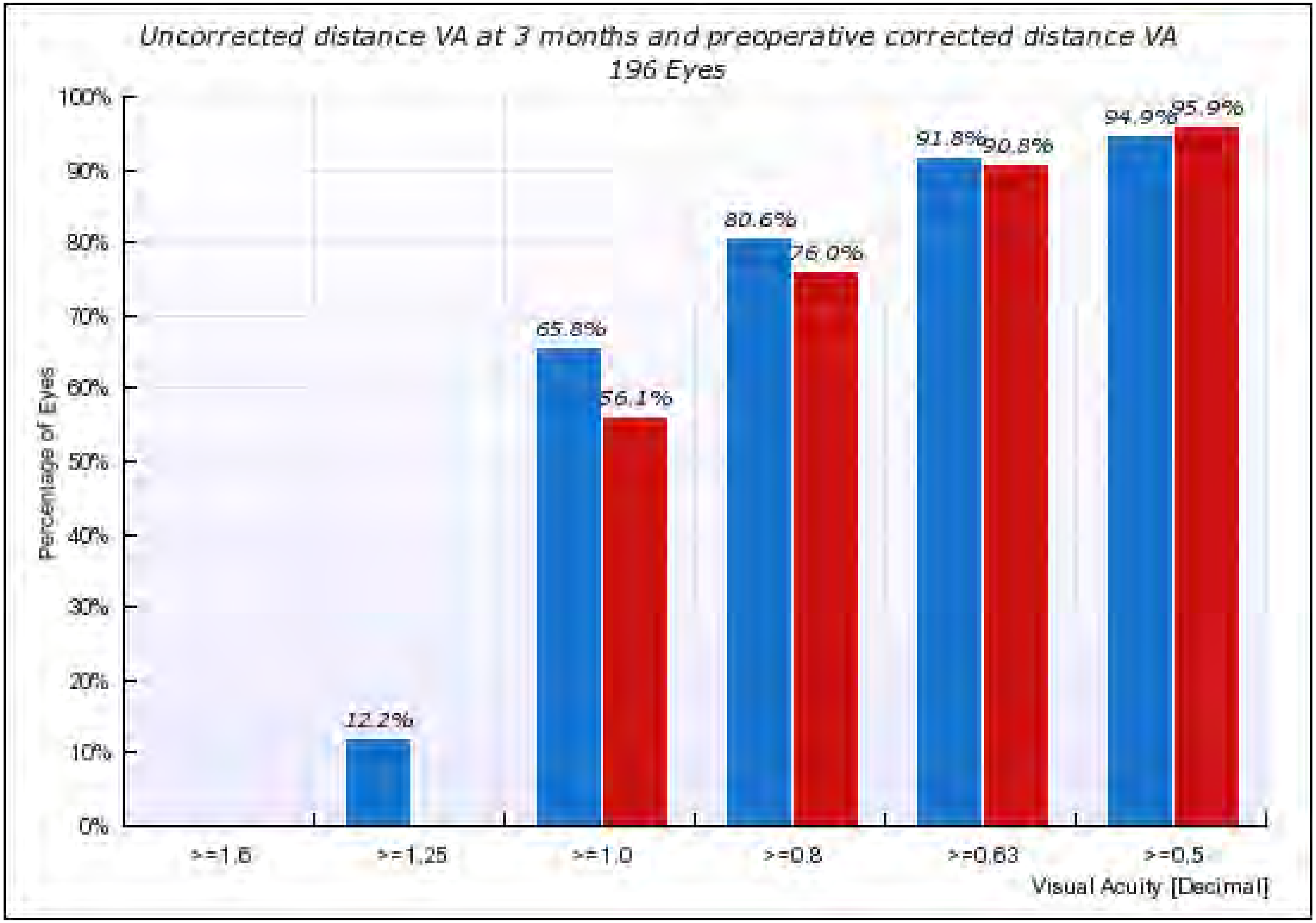
Stability of Refraction

The refraction was stable across time as shown in Table 10.

Table 10
Spherical Equivalence Stability (Change Between Visits)

	N	±0.5 D	±1.0 D	±2.0 D	>2.0 D
6 months to 1 year	345	96.8%	99.4%	100.0%	0.0%
1 year to 2 years	329	96.7%	100.0%	100.0%	0.0%
2 years to 3 years	323	95.0%	99.1%	100.0%	0.0%
3 year to 4 years	291	94.8%	99.3%	100.0%	0.0%
4 years to 5 years	152	91.4%	100.0%	100.0%	0.0%

High myopic LASIK 400 eyeQ



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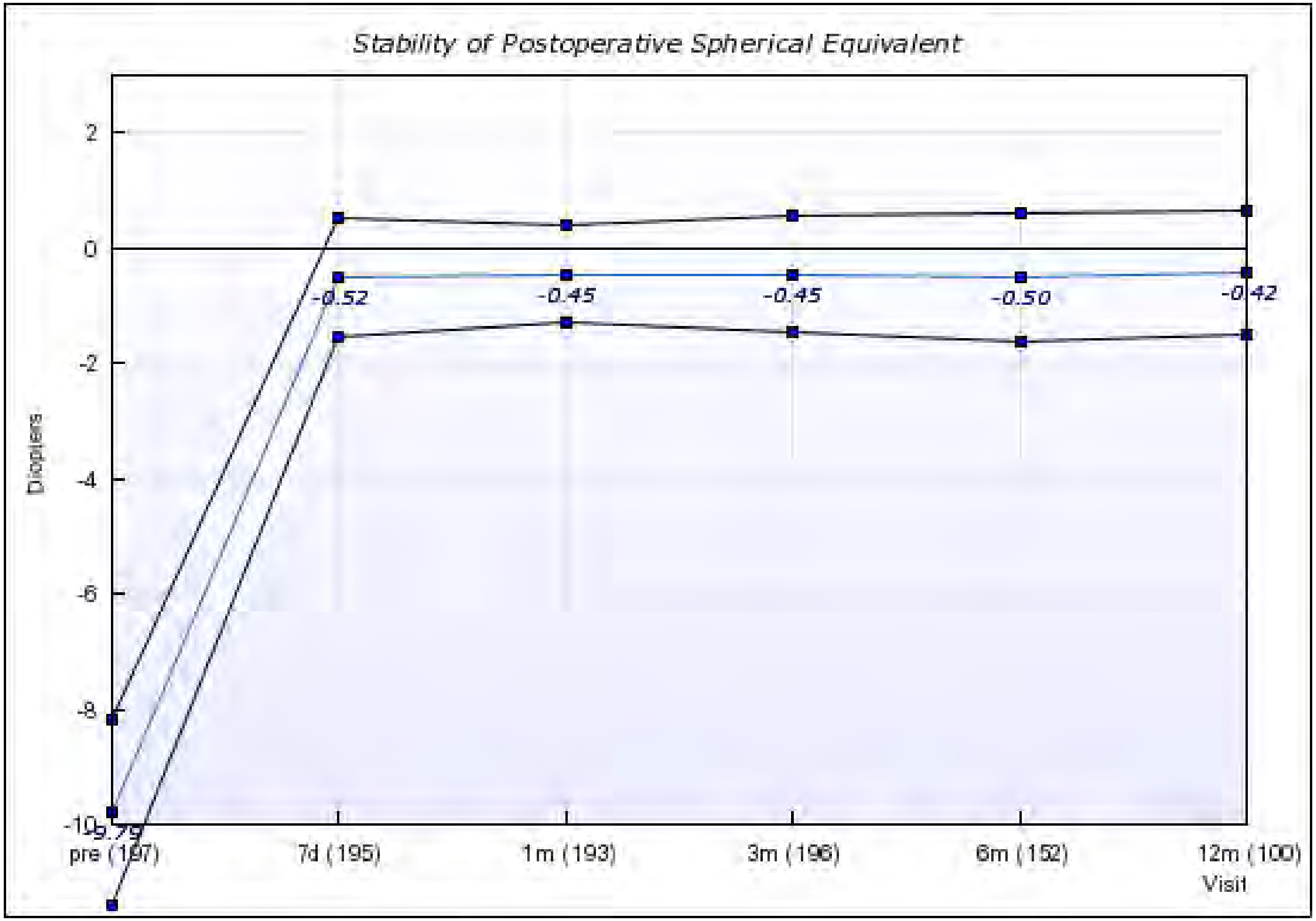
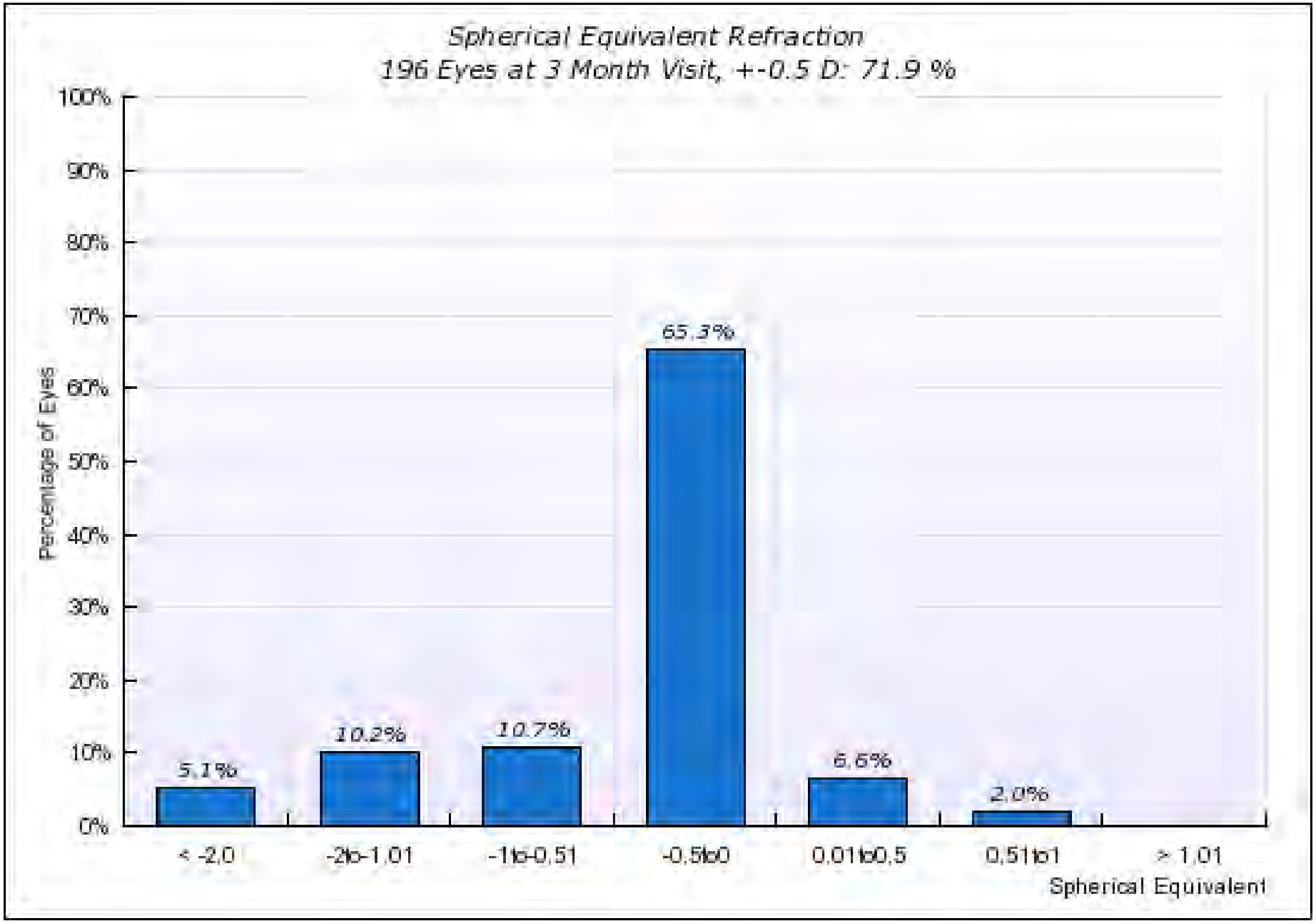
eyeQ over -8D


Stability of Postoperative Spherical Equivalent
Diopters
2
0
-2
-4
-6
-8
-10
-9.79
-0.52
-0.45
-0.45
-0.50
-0.42
pre (197)
7d (195)
1m (193)
3m (196)
6m (152)
12m (100)
Visit

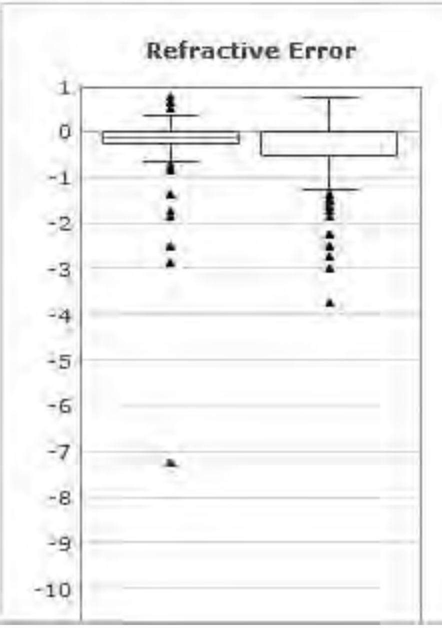
LASIK with 400Hz eyeQ for over -8D



RE: Refractive Suite Vs 400 EyeQ

Results

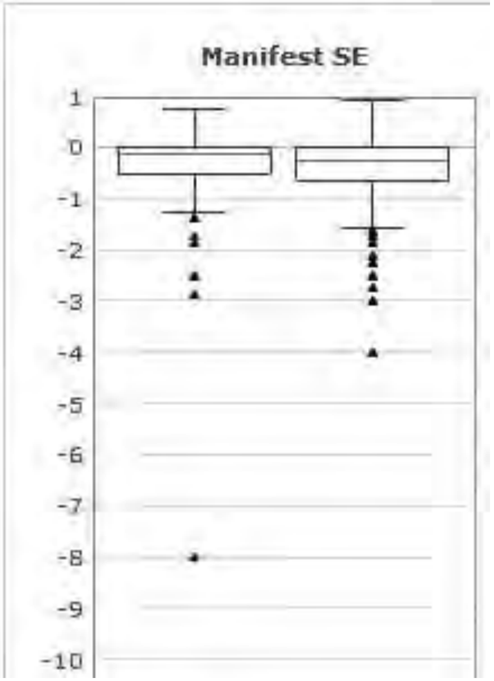
	Group 1	Group 2	P (2-tailed U-Test)
n (eyes)	51	196	
Demographics			
Age mean (n)	29.8 (51)	31.6 (196)	0.3042
Preop UDVA mean (n)	-2.12 (51)	-2.05 (196)	0.4188
Preop CDVA mean (n)	-0.1 (51)	-0.09 (196)	0.9754
Refractive Error			
Mean ± SD	-0.49 ± 1.23	-0.36 ± 1.04	0.5846
Median	-0.13	0	
Max	0.75	1.38	
Q3	0	0	
IQR	0.25	0.5	
Q1	-0.25	-0.5	
Min	-7.25	-11	



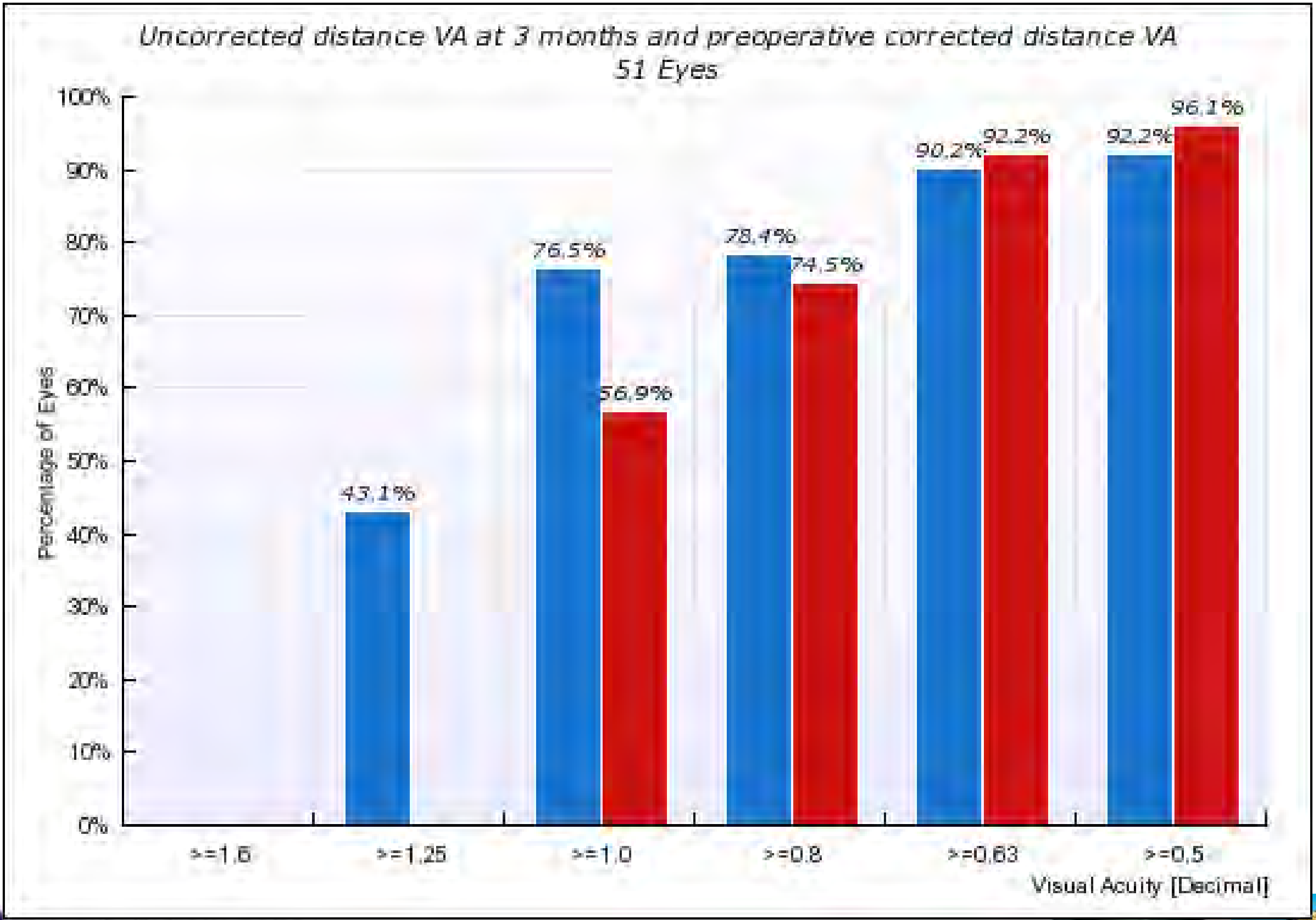
Manifest SE Ref. Suite Vs 400HzEyeQ

Results

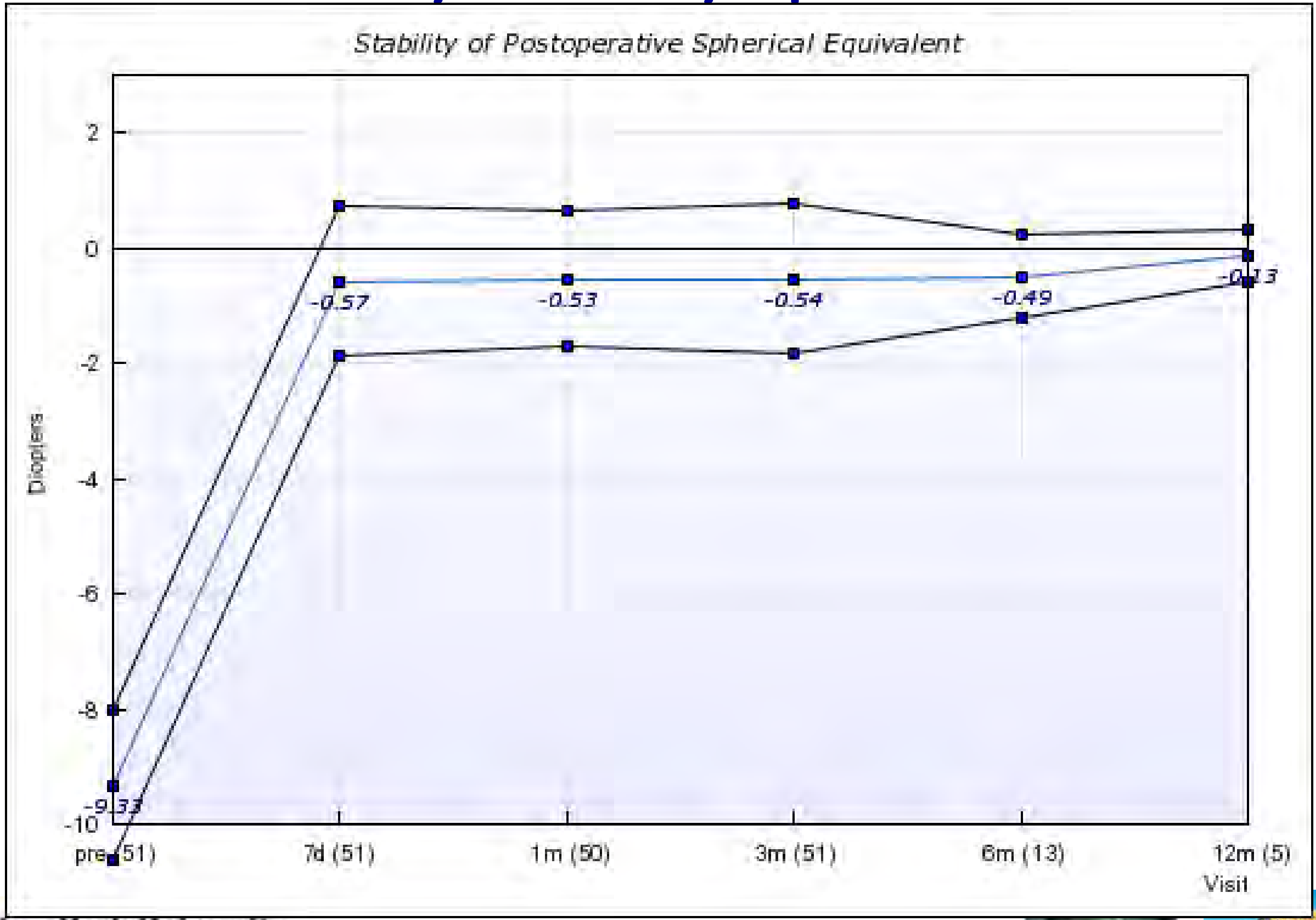
	Group 1	Group 2	P (2-tailed U-Test)
n (eyes)	51	196	
Demographics			
Age mean (n)	29.8 (51)	31.6 (196)	0.3042
Preop UDVA mean (n)	-2.12 (51)	-2.05 (196)	0.4188
Preop CDVA mean (n)	-0.1 (51)	-0.09 (196)	0.9754
Manifest SE			
Mean ± SD	-0.54 ± 1.29	-0.45 ± 1.02	0.6433
Median	-0.13	-0.25	
Max	0.5	0.88	
Q3	0	0	
IQR	0.5	0.63	
Q1	-0.5	-0.63	
Min	-8	-11	



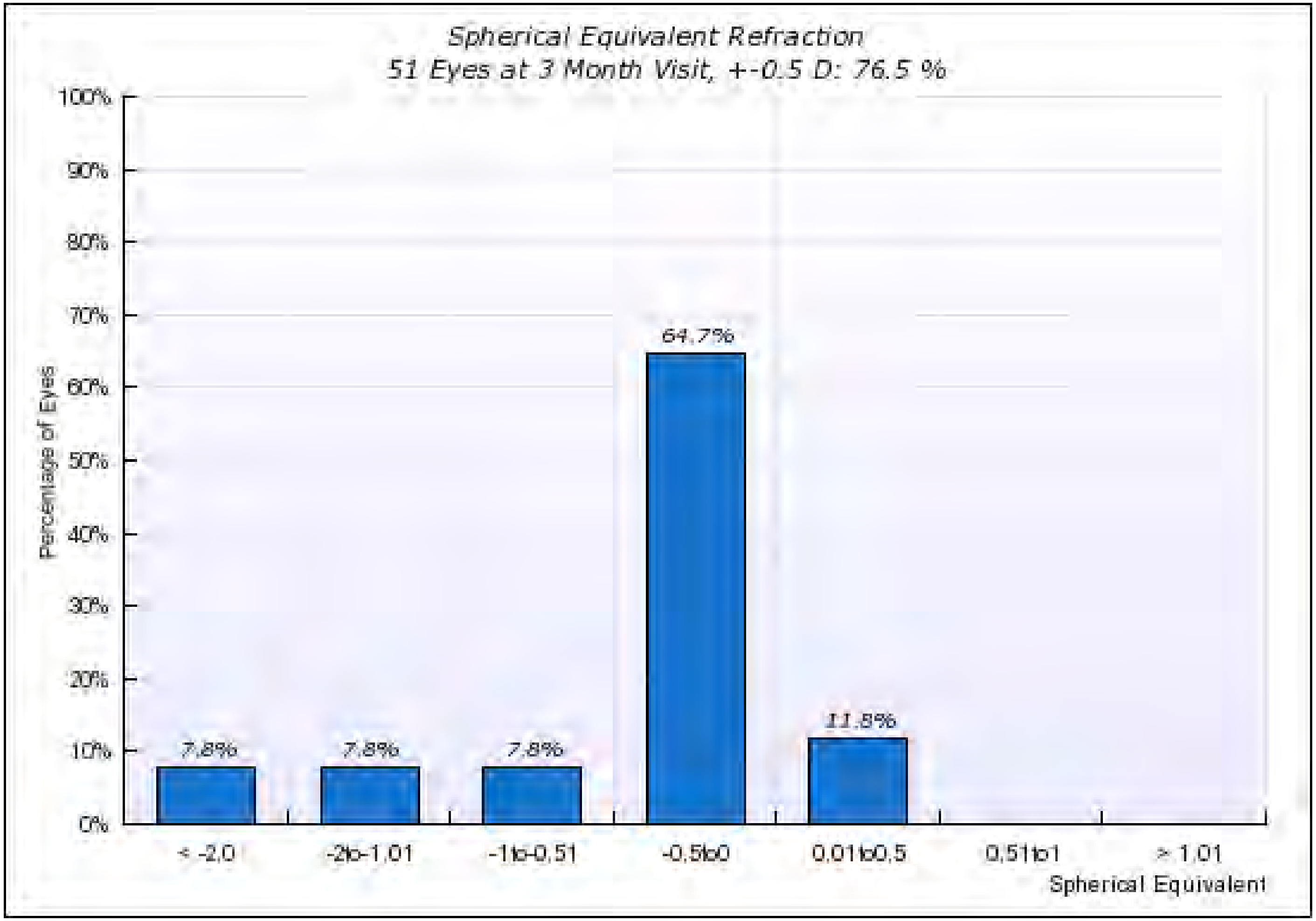
Refractive Suite over -8D



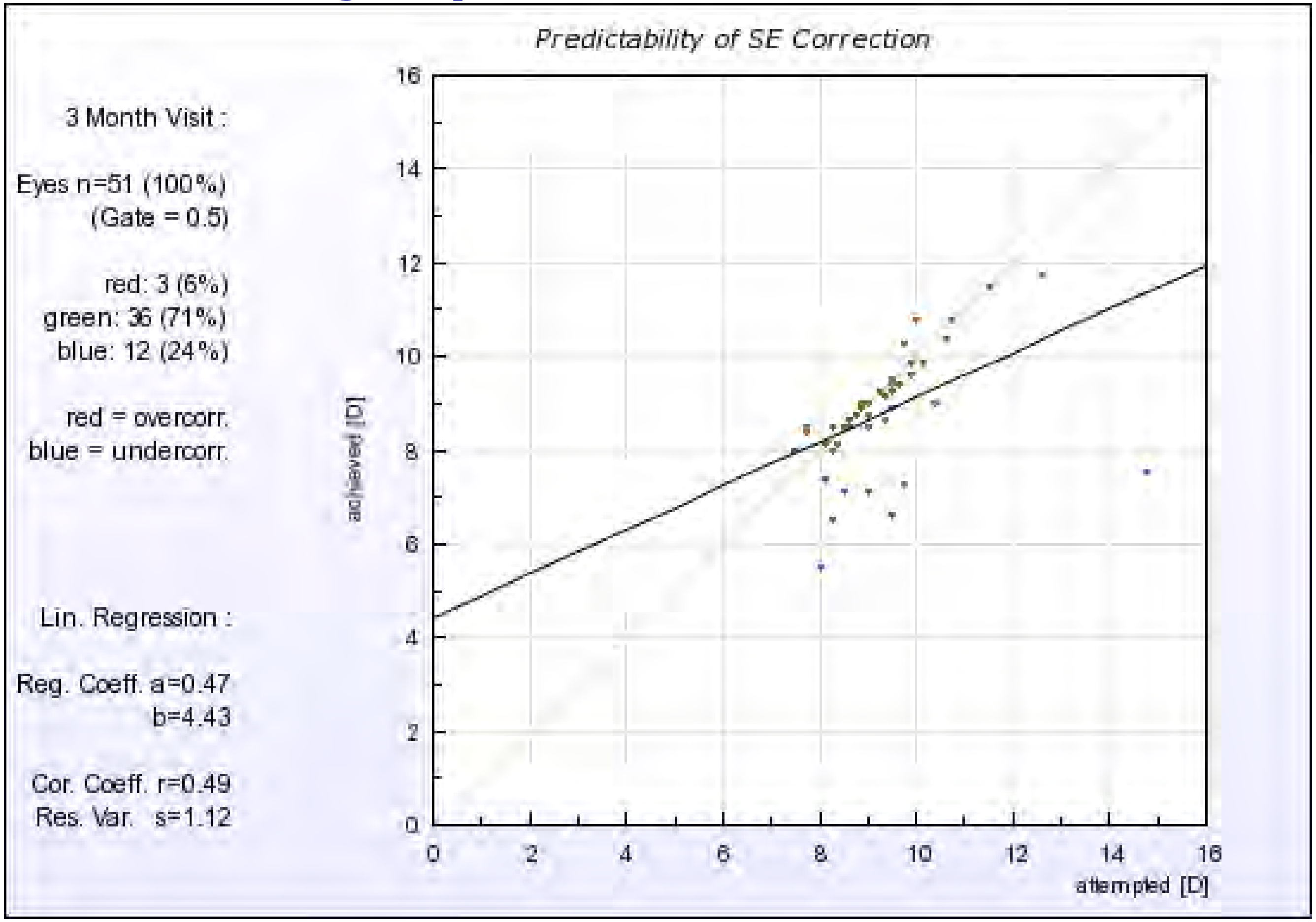
Refractive Suite:
K stability for myopia over-8D



Refractive Suite: SE for myopia over -8D



Predictability Refractive Suite for myopia over -8D



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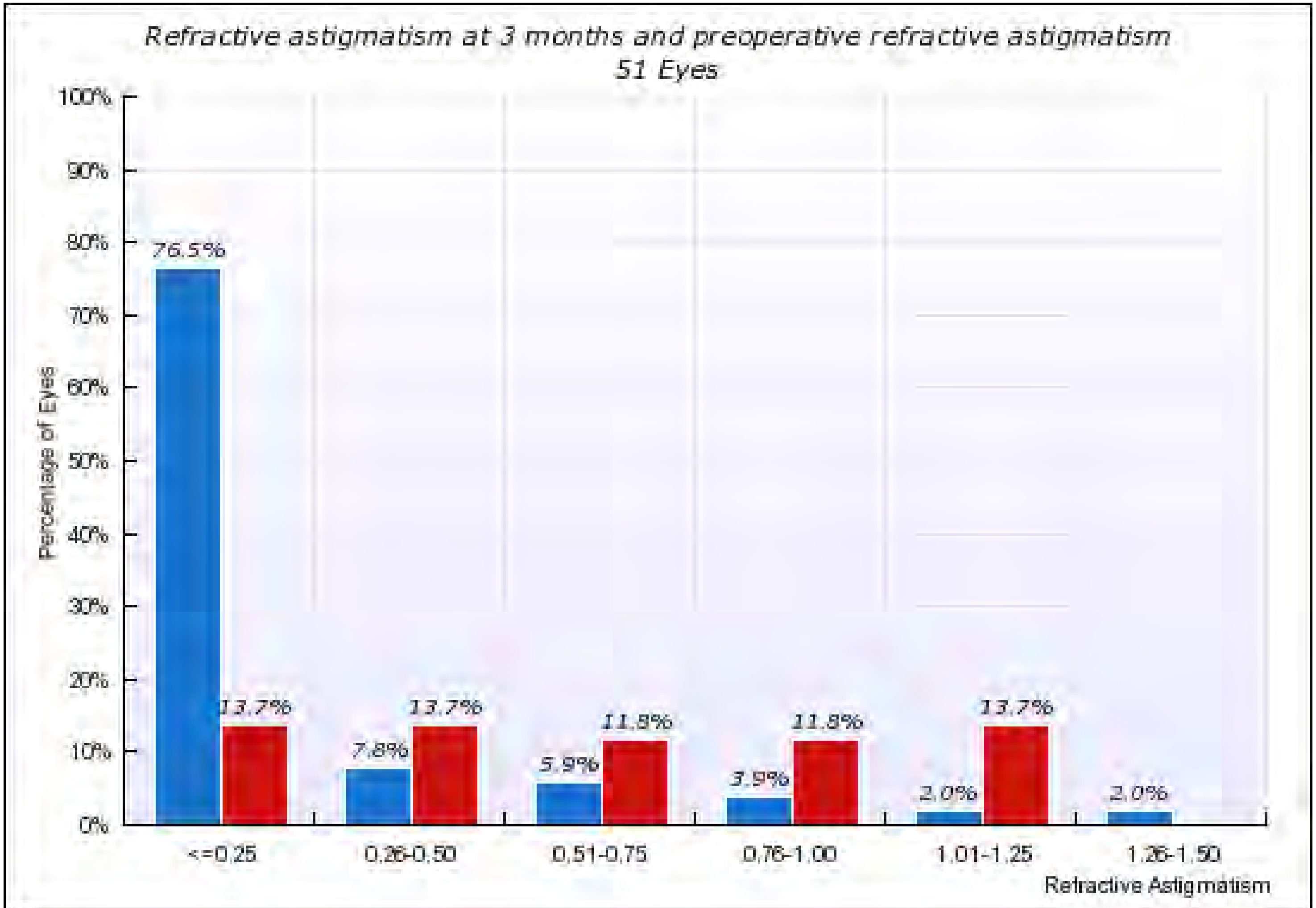
Cyl RefSuite over -8D



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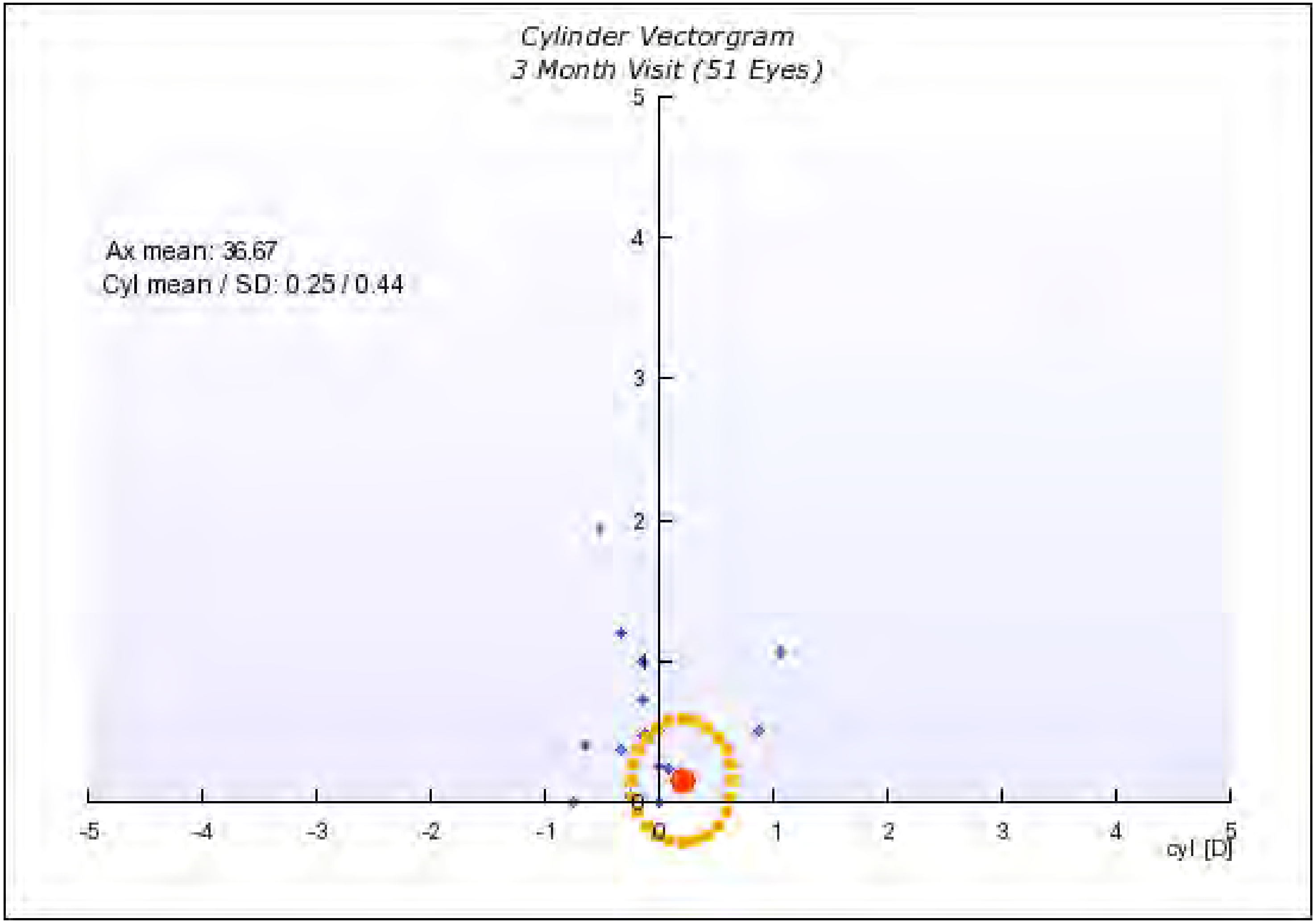
Vector cyl Ref Suite over -8D



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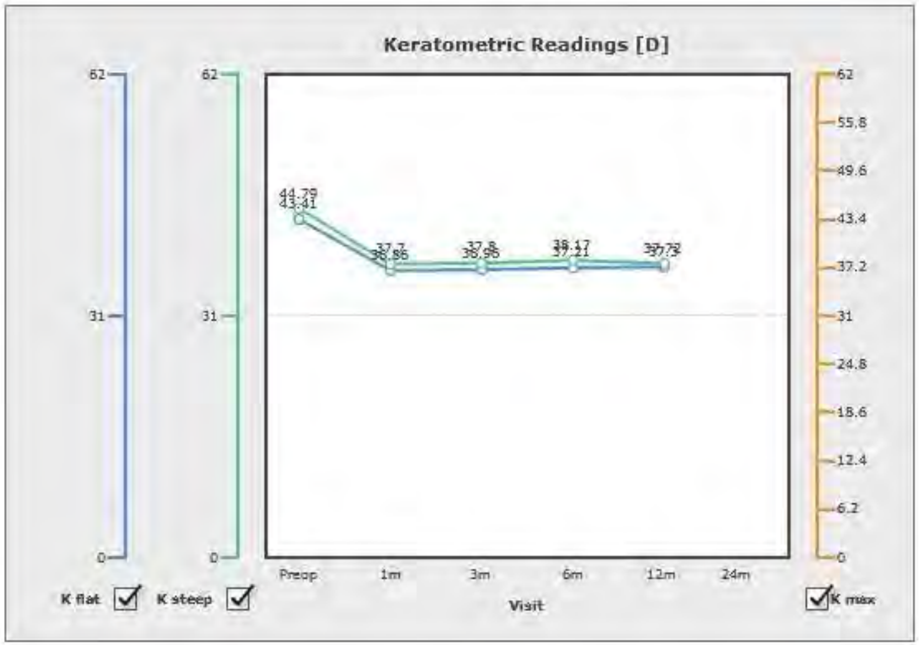
RefSuite over -8D K stability



Demographics			
Eyes analysed (n):	51 of 51	Preop. Parameters:	
Right:	27 (52.9 %)	dUCVA mean/SD:	0.01 +- 0.01
Left:	24 (47.1 %)	dUCVA range:	0.001 to 0.1
Female:	34 (66.7 %)	SE mean/SD:	-9.33 +- 1.3
Male:	17 (33.3 %)	SE range:	-15.5 to -8
Age mean/SD:	29.8 +- 7.33	Cyl mean/SD:	-1.28 +- 0.94
Age range:	20 to 48 (l)	Cyl range:	-3.5 to 0

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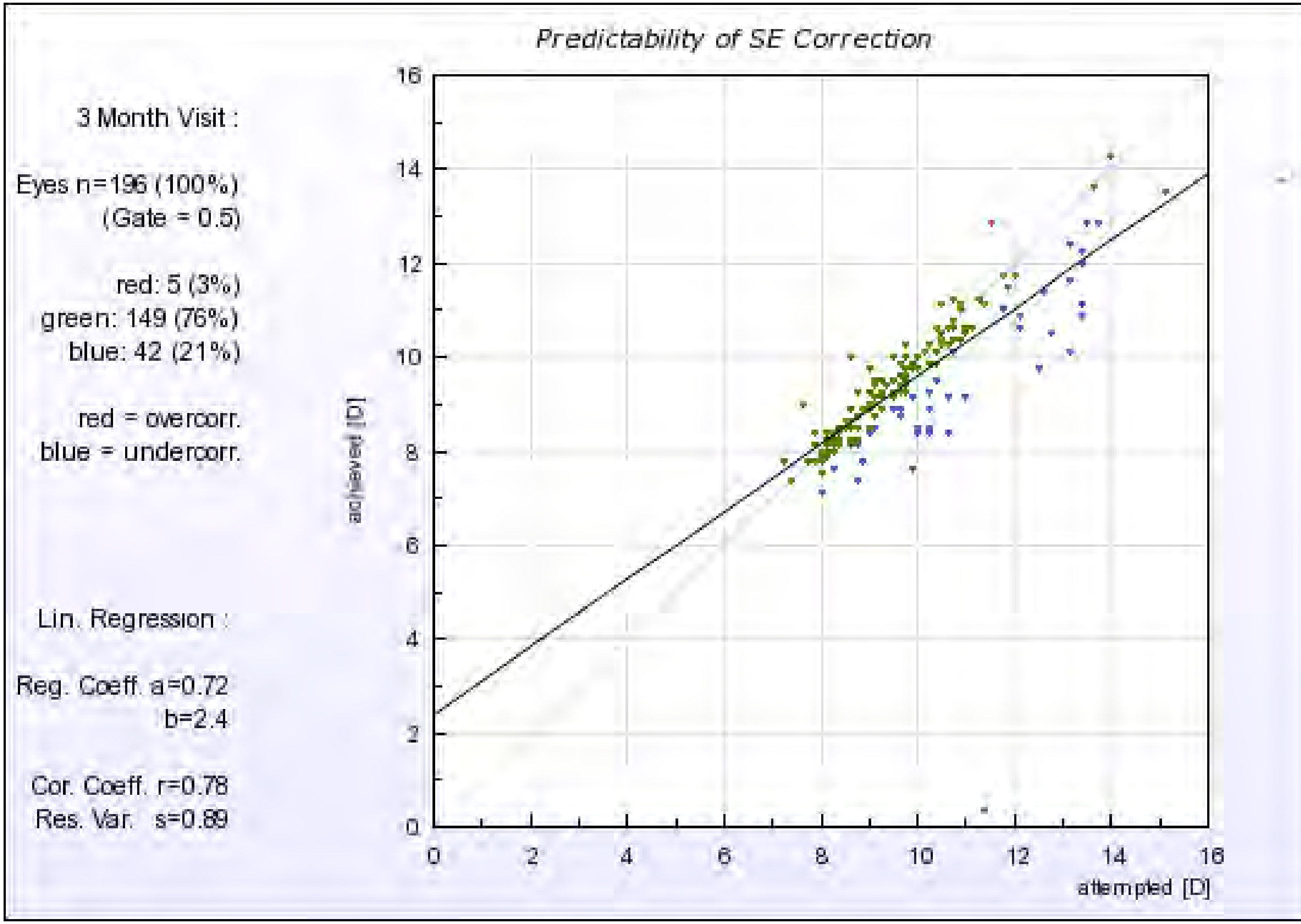
LASIK for over -8D



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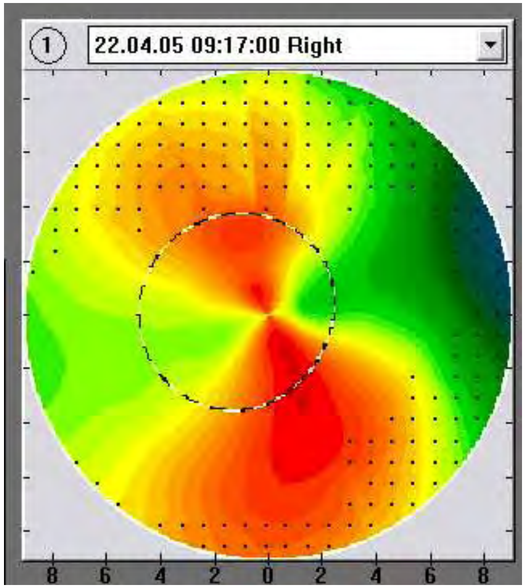
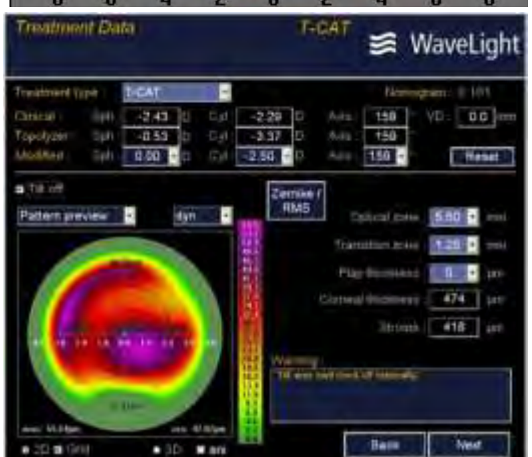
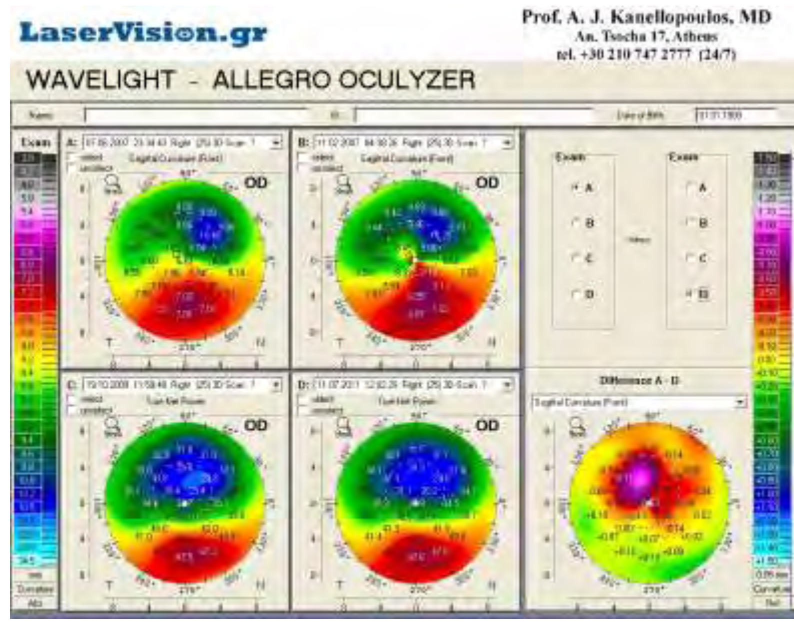
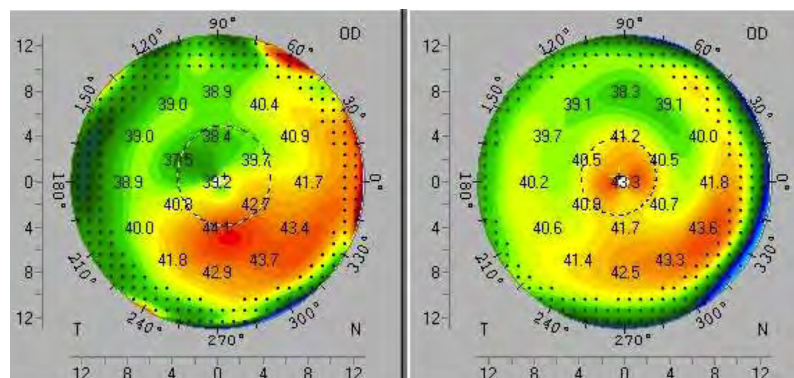
Disadvantage of LASIK: ectasia









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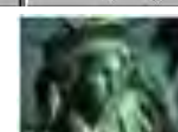
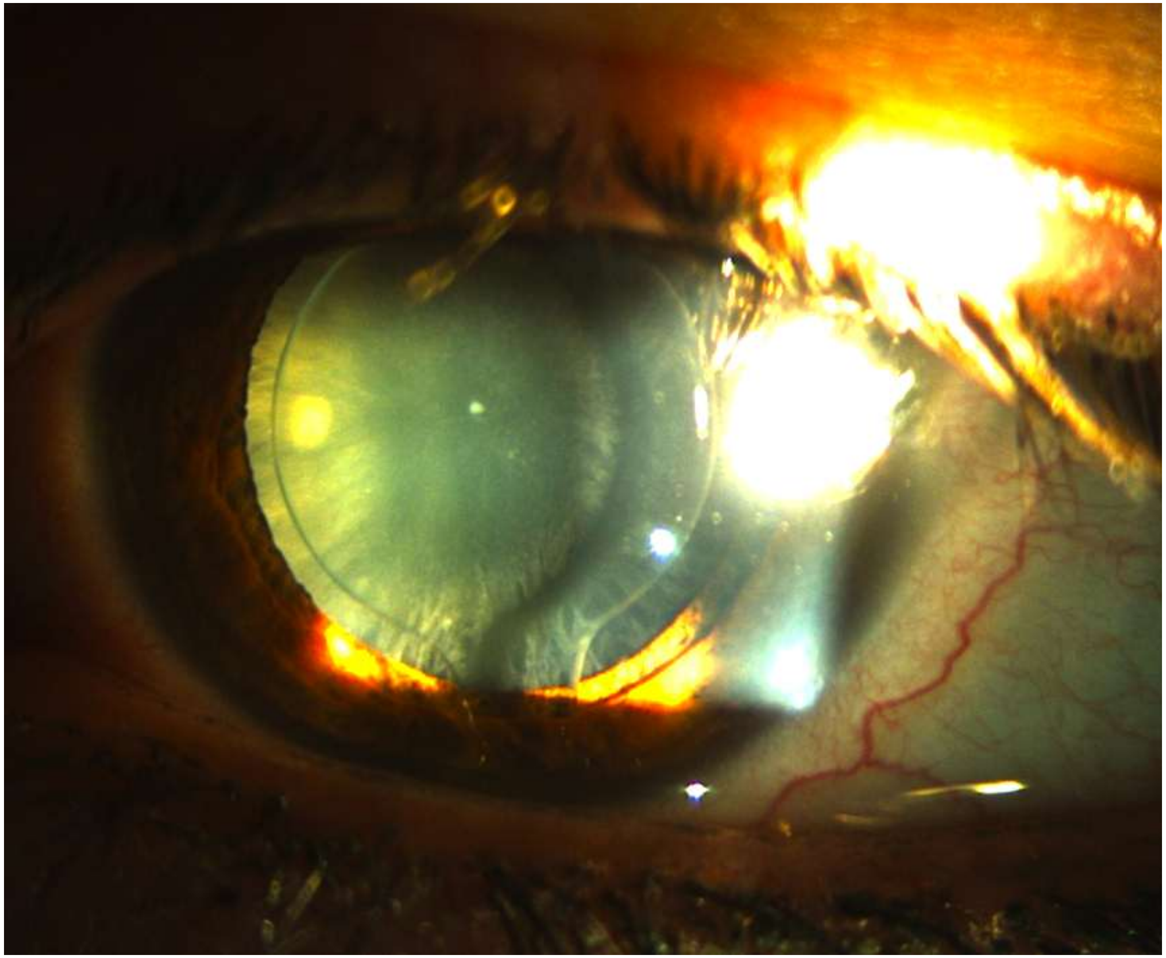


Potential disadvantage of Phakic IOL: ECC loss and/or cataract formation



Conclusions

- Both Cachet and LASIK offer excellent results and stability
- Cachet overs higher postop gain in acquity(magnification effect)
- In my practice when given the option 3/1 pts select LASIK
- LASIK main disadvantage is potential for ectasia and quality of night vision
- Phakic IOL disadvantage is mainly long term endothelium health and potential for lens changes


Clinical Ophthalmology

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CASE SERIES

Topography-guided hyperopic and hyperopic astigmatism femtosecond laser-assisted LASIK: long-term experience with the 400 Hz eye-Q excimer platform

Anastasios John Kanellopoulos

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Background: The purpose of this study was to evaluate the safety and efficacy of topography-guided ablation using the WaveLight 400 Hz excimer laser in laser-assisted in situ keratomileusis (LASIK) for hyperopia and/or hyperopic astigmatism.

Methods: We prospectively evaluated 208 consecutive LASIK cases for hyperopia with or without astigmatism using the topography-guided platform of the 400 Hz Eye-Q excimer system. The mean preoperative sphere value was +3.04 ± 1.75 (range 0.75–7.25) diopters (D) and the mean cylinder value was −1.24 ± 1.41 (−4.75–0) D. Flaps were created either with Intralase FS60 (AMO, Irvine, CA) or FS200 (Alcon, Fort Worth, TX) femtosecond lasers. Parameters evaluated included age, preoperative and postoperative refractive error, uncorrected distance visual acuity, corrected distance visual acuity, flap diameter and thickness, topographic changes, higher order aberration changes, and low contrast sensitivity. These measurements were repeated postoperatively at regular intervals for at least 24 months.

Results: Two hundred and two eyes were available for follow-up at 24 months. Uncorrected distance visual acuity improved from 5.5/10 to 9.2/10. At 24 (8–37) months, 75.5% of the eyes were in the ±0.50 D range and 94.4% were in the ±1.00 D range of the refractive goal. Postoperatively, the mean sphere value was −0.39 ± 0.3 and the cylinder value was −0.35 ± 0.25. Topographic evidence showed that ablation was made in the visual axis and not in the center of the cornea, thus correlating with the angle kappa. No significant complications were encountered in this small group of patients.

Conclusion: Hyperopic LASIK utilizing the topography-guided platform of the 400 Hz Eye-Q Allegretto excimer and a femtosecond laser flap appears to be safe and effective for correction of hyperopia and/or hyperopic astigmatism. The results are impressive for refractive error correction and stability and for improvement of both uncorrected and corrected distance visual acuity.

Keywords: topography-guided, LASIK, hyperopia, hyperopic astigmatism, mixed astigmatism, angle kappa

Video abstract

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Introduction

The evolution of laser technology has enabled treatment of myopic, hyperopic, and astigmatic eyes to become more accurate. There have been several reports of hyperopic laser-assisted in situ keratomileusis (LASIK) in the past.[1–11] We have previously reported on the use of standard wavefront-optimized excimer ablations in hyperopic LASIK with good results[12] and on the use of topography-guided excimer ablations.[13,14] Hyperopic patients invariably have a significant angle kappa.[15] We have anecdotally observed clinically superior visual axis centration in hyperopes when

Hyperopic LASIK Topo-guided 400Hz

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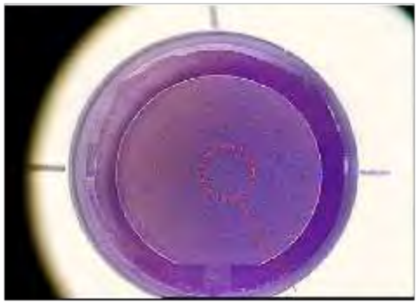

Figure 1 Flap-making report generated by the FS200 femtosecond laser.
Notes: The image of the flap created (right eye, surgeons view) is shown here in reference to the pupil highlighted by the red circle and shown by the red arrow. It is easy to ascertain that this flap has been created nasally in order to accommodate a similarly placed topography-guided ablation.

degrees, with the yellow dots representing the postoperative cylinder vectogram).

Figure 6 shows the predictability graph, with red dots showing overcorrection and blue dots showing undercorrection; the green dots are within ±0.5 D. This graph shows a slight tendency for overcorrection of higher refractive errors, which was our preoperative aim in order to compensate for any long-term regression effect. Figure 7 is the safety graph, with lines gained and lost, indicating a good safety profile with this technique and an impressive 46.6% of cases gaining at least one line of acuity postoperatively. Flap diameter was 8.9 ± 0.2 mm and flap thickness was 135 ± 8 µm, calculated by ultrasonic subtraction pachymetry. The keratometry readings showed an initial decrease within the first month, then demonstrated a progressive slow decline over the first 2 years, suggesting a predictable long-term regression of the initial hyperopic effect (Figure 8).

Figure 9 shows the results of preoperative and postoperative Scheimpflug-generated tomography. The red arrows point to the visual axis and line of sight. It is obvious that when one evaluates centration of the hyperopic ablation achieved in this hyperopic eye, the optical zone appears decentered in reference to the pupillary image (dotted circle). It is nevertheless centered on the visual axis of this eye with a significant angle kappa. The root mean square of higher-order aberrations increased by 15% from a preoperative value of 0.2–0.0 µm to a postoperative value of 0.23 µm at 12 months of follow-up. There was no epithelial downgrowth or any other significant complications noted in this small group. Low contrast sensitivity score results at 12 cycles/degree (column C on the chart) improved from an average preoperative value of 6.4 to 6.8.

Discussion

We have previously shown that a similar Allegretto excimer platform (200 Hz, wavefront-optimized excimer laser platform) can be safe and effective in hyperopic LASIK.[12] We have also shown that hyperopes have a significant angle kappa, and centering their laser correction on the pupil may be a mistake, suggesting that customized approaches to compensate for the angle kappa may be required in hyperopes.[15] In this study, we used a 400 Eye-Q topography-guided platform and a femtosecond laser for flap creation, and found that they can be superior in terms of safety and efficacy when performing hyperopic and hyperopic astigmatic corrections.

Intricacies of topography-guided hyperopic LASIK that we have encountered include the need for wider flap diameters and the difficulty of centering ablation within the stromal area exposed by the femtosecond laser flap. We aimed for slight (1–1.5 mm) nasal decentration, and slight (0.5 mm) superior decentration of the flaps in order to avoid flap edge and/or hinge placement within the ablation

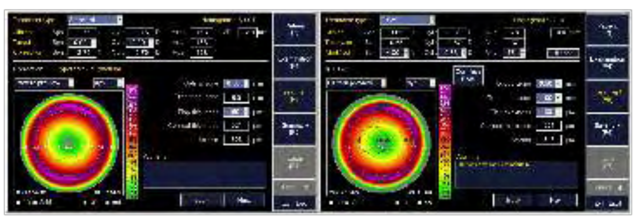

Figure 2 Concept of topography-guided ablation.
Notes: The image on the left shows the relative centration to the pupil image of a standard ablation for +3 diopters in the right eye of a patient. The image on the right shows the exact same correction planned with the topography-guided platform. It is clear that the ablation here appears decentered nasally in reference to the pupillary image (circle).

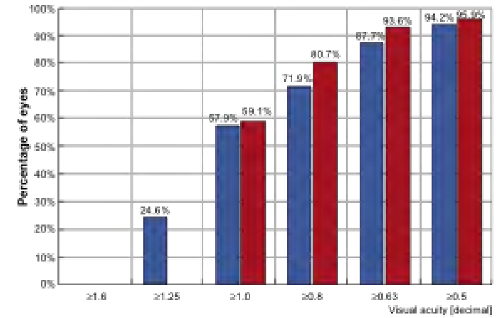

Figure 3 Comparison of preoperative corrected distance visual acuity in blue and postoperative uncorrected distance visual acuity in red, showing obvious improvement.

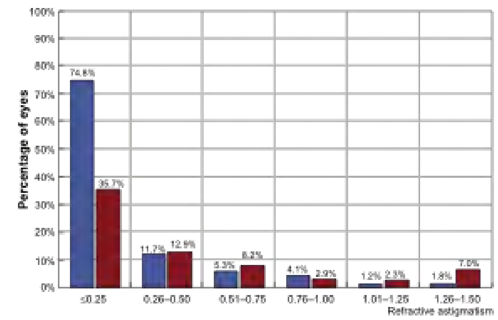

Figure 4 Preoperative (red) and postoperative (blue) cylinder distribution.

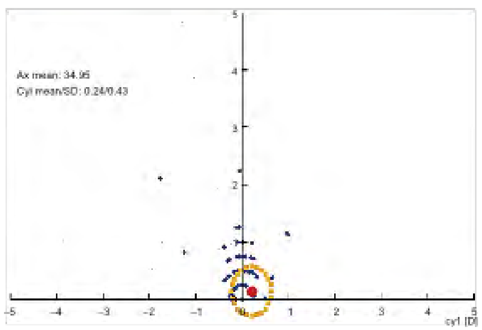

Figure 5 Vectogram of preoperative cylinder distribution in blue dots.
Notes: The distance on the y axis represents amount and the distance on the x axis represents degrees. The yellow dots represent the postoperative cylinder vectogram.

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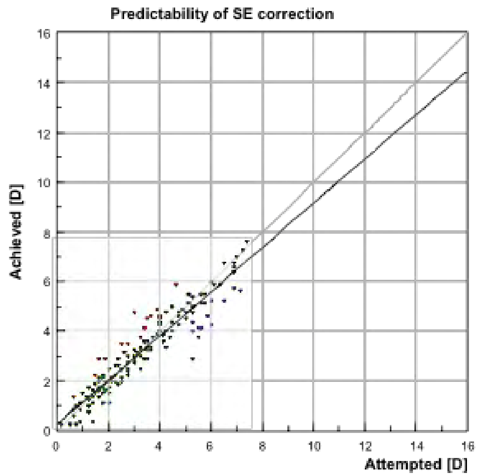

Figure 6 Predictability graph with red dots showing overcorrection and blue dots showing undercorrection, with green dots within ±0.5 diopters.
Notes: This graph shows a slight trend for overcorrection of higher refractive errors, which was our preoperative aim in order to compensate for any long-term regression effect.

zone (Figures 1 and 2). We also calculated the shortest flap diameter to be at least 9 mm in order to achieve adequate ablation (Figure 2).

Some authors have expressed concern about inducing higher order aberrations and astigmatism with hyperopic LASIK ablation.[4,5] No significant wavefront changes occurred in our group. This may be in part attributable to use of the femtosecond laser instead of microkeratome flaps, as has been reported in the past.[16] More than half of our patients gained at least one line of corrected distance visual acuity.

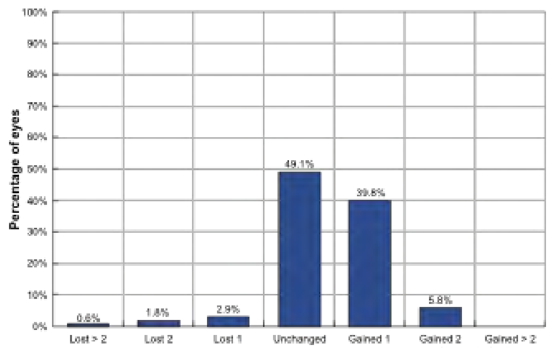

Figure 7 Safety graph with lines gained and lost, showing a good safety profile with this technique and an impressive 46.6% of cases gaining at least one line of acuity postoperatively.

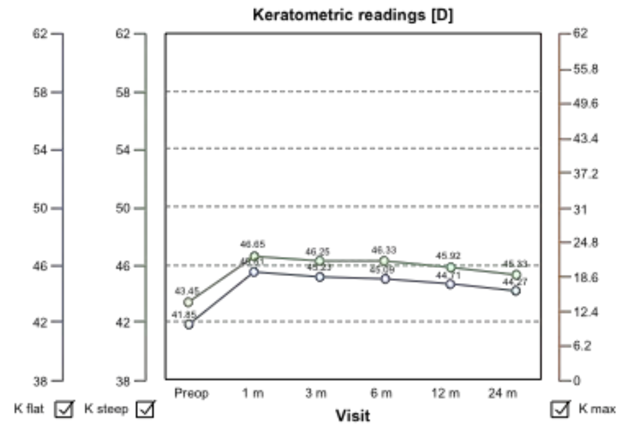

Figure 8 Keratometry readings showed an initial increase within the first month, indicative of effective hyperopic correction, but demonstrated a progressive slow decline over the first 2 years postoperatively, suggesting long-term regression of the initial hyperopic effect.

At 24 months of follow-up, the mean refraction spherical equivalent was ±0.50 D of the intended postoperative refraction in over 80% of cases, which is comparable with or even better than the published results achieved using similar systems for correction of hyperopic refractive errors.[1–11,17] This efficacy also extended to the treatment of mixed hyperopic and astigmatic refractive errors which we theorize may be in part attributable to positive cylinder conversion and treatment of astigmatism on the steep meridian as well as addressing the angle kappa. We consider it inadvisable to perform hyperopic ablations in the center of the pupil, because this will invariably decenter the actual ablation in regard to the visual axis and line of sight, potentially inducing astigmatism. This principle leaves the central optical zone in these procedures untreated by the excimer because both the hyperopia and the cylinder are treated in a theoretical peripheral ring of 6.5–9.5 mm from the center of the visual axis. However, the keratometric regression noted over the average two-year follow-up period suggests that there is an intrinsic biomechanical mechanism in hyperopic LASIK,

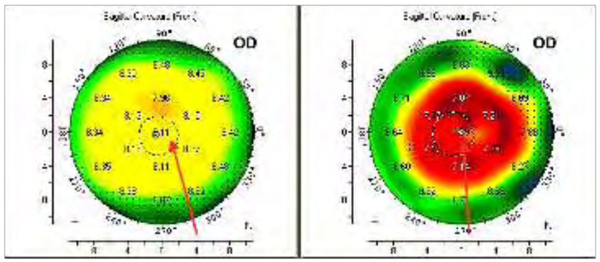

Figure 9 Preoperative and postoperative Scheimpflug-generated tomography.
Notes: The red arrows point to the visual axis and line of sight. It is obvious that when one evaluates the centration of the achieved hyperopic ablation in this hyperopic eye the optical zone appears nasally decentered in reference to the pupillary image (dotted circle). It is nevertheless centered on the visual axis of this eye with a significant angle kappa.
Abbreviation: OD, right eye.


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