Refractive Stability and Ocular Biometric Changes After Customized LASEK for Correction of Myopia; 8 Years Follow up

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Abstract

BACKGROUND: To assess long-term Visual and refractive stability and ocular biometric changes in low to moderate myopic subjects treated by customized LASEK.

METHODS: Seventy eyes of 35 patients were treated by customized LASEK for correction of less than 6 diopter myopia in this cohort study. Uncorrected visual acuities (UCVA) and distance corrected visual acuities (DCVA), keratometry values and ocular biometric data by Lenstar LS900 including anterior chamber depth (ACD), aqueous depth, central corneal thickness(CCT),lens thickness(LT) and axial length(AL) were evaluated pre and 8 years postoperatively.

RESULTS: Mean pre-operative spherical equivalent was -3.99 ±1.38 diopter (D) that improved to 0.01 ±0.27 D and -0.10 ±0.31 D, 6 months and 8 years postoperative respectively. Mean pachymetry, flat, steep and mean keratometry values increased significantly from 6 months to 8 years postoperative. Although, these changes had no significant effect on visual outcomes and subjective refraction. ACD decreased and LT increased significantly over 8 years follow-up in comparison with preoperative values. The change in AL was not significant at 8 years follow up.

CONCLUSIONS: The long-term visual and refractive outcomes of customized LASEK in correction of low to moderate myopia were stable and predictable, although changes in ocular biometric parameters have occurred.

Background

With increasing demand of perfect clear vision in today's modern life, refractive surgery modalities have made tremendous advances in this regard. However, the challenge of predicting the refractive stability and long-term outcomes of excimer laser ablation has remained as an important area of research in this issue.[1–4]

Much has been done to elucidate the main factors associated with myopic regression after myopic laser ablation surgeries, but they showed variable results in terms of their clinical efficacies. Advancement in ablation profiles and modalities of treatments have drawn renewed interest in detecting the correlation between corneal changes and ocular biometric parameters with refractive stability but still discrepancies exist .[5–7]In spite of several studies that evaluated short-term changes in ACD and AL[8,9], there is still uncertainty in terms of long-term changes in ocular biometry parameters using similar measurement methods pre and post myopic excimer laser surface ablation. In current study we report long-term visual and refractive outcomes and ocular changes in biometric parameters following LASEK for correction of low to moderate myopia. In this context, we used an optical biometer (Lenstar LS900) to compare the subsequent changes in post refractive biometric axial distances with baseline values of the patients in order to provide better insight into long-term outcomes and associations between these changes.

Methods

This study comprised 70 consecutive eyes of 35 patients who underwent customized LASEK between 2008 and 2009 to correct low to moderate myopia(-1.0 to -6.0 diopters(D)) and up to -5.0 D of astigmatism at a single center(Iranian Eye Clinic, Tehran, Iran) and by one experienced refractive surgeon (SJ.H). Manifest and cycloplegic refraction were performed for each patient and UCDVA and CDVA using a standard Snellen acuity chart at 6 meter were determined. Visual acuities were converted in the logarithm of the logMAR equivalent .All subjects underwent a comprehensive ophthalmic examination including slit-lamp biomicroscopy, Gold-mann tonometry (CT-80; Topcon, Tokyo, Japan) and dilated fundoscopy. All patients had both eyes evaluated with Orbscan IIz (Bausch & Lomb, Rochester NY) scanning slit device to screen and detect any corneal irregularities, measuring CCT, corneal k values including keratometry in flat meridian (K1), keratometry in steep meridian (K2) and mean keratometry (K_{mean}) for subsequent analysis .All participants were assessed with Zywave aberrometer (Bausch and Lomb, Rochester, New York, USA). Preoperatively ocular biometric parameters (AL ,ACD ;measured from central corneal epithelium to the lens, aqueous depth and LT) were determined using Lenstar-LS900 (Haag-Streit AG, Koeniz, Switzerland). All measurements were done under mesopic condition (3 Candelas/m^2). At least five measurements were captured for each patient and the mean of these were used in final analysis. Eyes with previous ocular trauma or surgery, any systemic disease that may interfere wound healing such as diabetes and collagen vascular disease, any optical opacities, severe dry eye, keratoconus, irregular astigmatism and participants who had follow up less than 8 years were excluded from the study.

Statistical analysis were performed with SPSS software (version 20.0,IBM Corp.),and continuous variables were expressed as the mean ± SD, and categorical variables were expressed as individual counts. Preoperative and postoperative parameters were compared with the paired -sample t test. Differences were considered statistically significant when P value was less than 0.05.

Surgical Technique

Before initiation of the surgery a povidone-iodine 5% solution was applied to the skin and the conjunctiva. After preparation and draping an eyelid speculum was positioned. All surgeries were performed using topical anesthesia with tetracaine 0.5%.Alcohol 20% diluted in BSS was instilled inside an 8.5 millimeter well which was centered on the pupil and left for 20 seconds. A cellulose sponge was used to remove alcohol and ocular surface was irrigated copiously with BSS ,and after that cornea was dried with a surgical sponge and the epithelial flap was peeled back with spatula leaving a hinge at 12 o'clock position. After drying the stromal bed with a sponge and setting the eye tracker at the center of the pupil, ablation was performed with TECHNOLAS 217P Excimer Laser using Advanced Personalized Technology (APT) nomogram. The optical zone was 6.5 millimeters in all cases. Then a surgical sponge soaked in Mitomycin C 0.02% was inserted over the ablated zone of the stroma for 15 seconds cautiously to prevent any leakage of the Mitomycin C. After copious irrigation of stromal bed with BSS, the epithelial flap was replaced and a therapeutic soft contact lens was used.(AirOptix Night & Day AQUA ;CIBA VISION, Novartis AG Company, USA) .

Postoperative Management And Follow Up

Postoperatively, all patients received Ciprofloxacin0.3% drops (Sina Darou, Tehran, Iran) four times a day for 5 days, Fluorometholone 0.1% drops (Sina Darou, Tehran, Iran) four times a day for one month, tapering to 3 times a day for 1 month, 2 times for 1 month and once daily for last one month. Artificial tears (Artelac; Bausch & Lomb) four times a day for 12 weeks. The bandage contact lens is removed when epithelial healing is complete (3 to 5 days postoperative). At 8 years, ocular biometric measurements were repeated with the same Lenstar LS 900 machine and recorded for the purpose of the study.

Results

Current study comprised 70 eyes (35 patients). The mean age was 27.63 years (range 19 to 45 years). There were 28 females (80%). All patients had bilateral LASEK.

No perioperative and postoperative complications such as infectious keratitis and corneal haze were recorded during follow up period.

Visual Acuity and Refraction

Figure 1 shows the cumulative postoperative CDVA in 6 months and 8 years after LASEK compared with the preoperative CDVA.

Cumulative preoperative CDVA and postoperative UCDVA are shown in Fig. 2.

Figure 3 illustrates the stability of refraction from 6 month to 8 years postoperatively.

The percentage of eyes with no change in CDVA was 91.2% and 91.4% at 6 months and 8 years post LASEK respectively(Fig. 4).

Mean ± SD SE at 6 months and 8 years were 0.018 and − 0.102 respectively; and were significantly lower than mean ± SD preoperative SE of -3.99 ± 1.38 (p.001) (Tables 1 and 2).

Table 1
Demographic and preoperative refractive data

Number	Eyes/Patient	70/35
Age	Mean ± SD	27.63 ± 7.25
	(Range)	(19–45)
Sex	Female (%)	28 (80%)
	Male (%)	7 (20%)
Pre-Op SE	Mean ± SD	-3.99 ± 1.38
	(Range)	(-6.50 to -1.88)
Pre-Op Cylinder	Mean ± SD	-0.75 ± 0.68
	(Range)	(-3.50 to 0.00)

SE Spherical Equivalent, SD Standard Deviation

Table 2
Refractive outcomes at 6 months and 8 years post -operation.

Refractive Outcomes	Preop Median (Q1,Q3) Mean (SD)	6Months Postop Median (Q1,Q3) Mean (SD)	8 years Postop Median (Q1,Q3) Mean (SD)	P-value
Sphere (Diopter)	-3.50 (-4.750, − .2.500)	0.000 (0.000, 0.250)	0.000 (-0.062,0.250)	< 0.001*
	-3.617 (1.346)	0.114 (0.271)	0.007 (0.312)	
Cylinder (Diopter)	-0.625 (-1.000, -0.500)	0.000 (-0.500, 0.000)	0.000 (-0.500, 0.000)	< 0.001*
	-0.754 (0.684)	-0.191 (0.287)	-0.218 (0.321)	
SE (Diopter)	-3.750 (-5.031, -2.843)	0.000 (0.000,0.250)	0.000 (-0.250, 0.000)	< 0.001*
	-3.994 (1.380)	0.018 (0.271)	-0.102 (0.310)	
Steep K	44.50 (41.50, 50.00) 44.28(1.53)	40.75 (37.00, 44.50) 41.13(1.71)	40.62 (37.25, 44.25) 40.85(1.69)	< 0.001*
Flat K	43.50 (39.00, 46.50) 43.31(1.56)	40.12 (35.50, 43.00) 39.96(1.75)	40.00 (35.75, 43.00) 40.69(1.80)	< 0.001*
Mean K	44.00 (40.50, 48.00) 43.79(1.51)	40.37 (36.25, 43.75) 40.31(1.72)	40.31(36.50, 43.63) 40.50(1.67)	< 0.001*

D *Diopter*, SE Spherical Equivalent, K Keratometry

Statistically significant at 0.1%level(P001).

Mean ± SD postoperative AL at 8 years was 24.91 ± 0.92 mm comparing AL of 24.92 ± 096 mm preoperatively; there was no significant change in AL (p = .664)(Table 3).

Table 3
Preoperative and 8 years postoperative ocular biometric values

Optical Biometry Values	Preop Mean (SD)	8 Years Postop Mean (SD)	P Value
Axial Length (mm)	24.92 (0.96)	24.91 (0.92)	0.664
Central Corneal Thickness (μm)	549.3 (28.25)	476.94 (29.94)	<.001*
Aqueous Depth (mm)	3.25 (0.30)	3.07 (0.31)	<.001*
Anterior Chamber Depth (mm)	3.80 (0.30)	3.55 (0.31)	<.001*
Lens Thickness (mm)	3.59 (0.24)	3.86 (0.27)	<.001*
Flat Keratometry (D)	42.87 (1.54)	40.28 (1.62)	<.001*
Steep Keratometry (D)	43.99 (1.46)	41.13 (1.71)	<.001*
Mean Keratometry (D)	43.42 (1.46)	40.70 (1.66)	<.001*
Astigmatism (D)	-1.12 (0.67)	-0.86 (0.40)	0.006
Lens Power (D)	16.21 (2.22)	20.01 (1.66)	<.001*

SD Standard Deviation, mm Millimeter, μm *Micrometer*, D Diopter

*Statistically significant at 0.1% level(P<.001).

Keratometry Changes

At 8 years the mean values of flat, steep and mean keratometries had a significant increase from post operative values at 6 month (P<.001) .Moreover, postoperative measurements showed a significant increase in mean keratometry values from 40.31 ± 1.72D at 6 months to 40.50 ± 1.67D at 8 years follow up(P<.001) (Table 2).

Pachymetry Changes

Mean preoperative CCT was 549.3 ± 28.25 μm compared to 476.94 ± 29.94 μm eight years post-operatively.

In 22 eyes of 11 patients CCT was measured at 6 months post LASEK surgery; they had a mean thickness of 467.05 ± 32.247 μm, which was significantly lower than the mean value of 8 years (476.94 ± 29.94 μm) (P<.001).

Biometric Axial Distances

Table 3 shows the preoperative and 8 years postoperative AL; there were no significant differences in AL values from baseline to 8 years follow up measurements(24.92 ± 0.96 mm and 24.91 ± 0.92 mm respectively) .

Mean 8 years postoperative ACD was 3.55 mm, showing a significant decrease in comparison to preoperative values of 3.80 mm (P<.001).Moreover, there was a significant decrease in aqueous depth(p<.001)(Table 3).

There was a significant increase in LT from 3.59 mm preoperatively to 3.86 mm in 8 years postoperative (Table 3).

Safety

The safety indices (postoperative CDVA /preoperative CDVA) were1.03 ± 0.09 and 1.03 ± 0.09 in 6 months and 8 years respectively.(Table 4)

Table 4
Safety and efficacy indices at 6 months and 8 years post-operation.

Indices	6 Months Post-operation Mean ± SD (Range)	8 years Post-operation Mean ± SD (Range)
Safety	1.03 ± 0.09	1.03 ± 0.09
	(1.00 to 1.59)	(1.00 to 1.59)
Efficacy	1.02 ± 0.07	0.98 ± 0.14
	(1.00 to 1.27)	(0.40 to 1.27)

Efficacy

The efficacy indices (postoperative UDVA /preoperative CDVA) were 1.02 ± 0.07 and 0.98 ± 0.14 in 6 months and years respectively. (Table 4)

Discussion

In this prospective study, 35 patients who had bilateral LASEK were followed for 8 years to assess refractive stability and changes in ocular biometric parameters in long-term follow-up in patients with low to moderate myopia.

Previous studies showed variable results regarding the efficacies of LASIK and LASEK for the correction of myopia.[1–3]

In a twelve-year follow up study in LASIK for moderate to high myopia, Ikeda et al. found a refractive regression of 0.74 ± 0.99D from 3 months to 12 years postoperatively. 53% and 75% of the eyes were within 0.5 and 1.0 diopter respectively and they found a significant correlation of refractive regression with the changes in keratometric readings, but not with the changes in CCT and amount of regression from 3 months to 12 years. The safety index was 1.09 ± 0.21,12 years after the surgery.[4]

In a long term observational case series conducted by O'Brart et al. to evaluate the 20 year efficacy and safety of PRK, all eyes underwent – 3.00 or -6.00 diopter corrections. The efficacy index at 20 years was 0.49, and the safety index was 0.97.[5]

Due to the promising reliability of the optical biometer we tested its accuracy in detecting biometric changes after LASEK. The advantage of optical biometers over ultrasound is being more precise non-contact measurements. Lenstar LS900 is the first optical biometer, which uses the precision of optical low-coherence reflectometry for all its measurements, including ACD and LT.[10]

Reports in literature regarding the change in biometric parameters of the eye are diverse and in most of them reassessment have been performed in short-term after refractive ablation.

In present study mean postoperative AL at 8 years was 24.9 ± 0.92 mm in comparison with AL of 24.92 ± 0.96 mm preoperatively, showing no significant change during follow up period($p = .664$).

In 22 eyes of 11 patients CCT was measured at 6 months post LASEK; they had a mean of 467.05 ± 32.247 μm, which was significantly less than the mean value at 8 years (476.94 ± 29.94 μm)($P < .001$). Although, we had no epithelial map for these patients but it could be contributed to epithelial remodeling hyperplasia during follow up period.

In their retrospective study, Fu D et al. evaluated the refractive regression and changes in CCT following LASEK for high myopia in 76 eyes with thin corneas. At 3 years after the procedure, CCT was significantly greater than the measurements at 3 months post LASEK (with mean change of 40.46 ± 14.02 μm).Moreover, there was no significant change in mean AL compared with preoperative values.[6]

Von Mohrenfels et al. conducted the first study on measuring the AL before and 1 month after LASEK. In their study they showed a statistically significant difference in AL 1 month after refractive surgery for myopia.[7]

In their publication Rosa et al. revealed that IOLMaster does not correlate well with theoretical ablation depth after myopic PRK .[8]

Another study to evaluate the relationship between programmed ablation depth and AL change after LASIK with IOLMaster (Carl Zeiss Meditec, Dublin, CA) demonstrated that 1 μm increase in ablation depth resulted in 0.00118 ± 0.00005 mm decrease in AL. At one month follow up ,mean AL was less than preoperative measurement (25.11 ± 0.14 mm vs. 25.20 ± 0.14 mm respectively ,$P < .001$).[9]

In present study at 8 years the mean values of flat ,steep and mean keratometries had a significant increase from postoperative values at 6 month (P<.001). Nevertheless, we must point that; these changes in refractive parameters were not significant in terms of manifest refraction from 6 months to 8 years (Table 2).

In assessment of refractive stability and safety after PRK for low to moderate myopia by O'Connor et al., 67.0% of eyes achieved a UCDVA of ≥ 20/20 and the percentage of eyes within 0.5D was 62.1%(36 of 58 eyes) at 12 years follow up .[11]

O'Brart et al. measured preoperative and twenty years postoperative biometric data using ultrasound and and partial coherence interferometric(IOL Master) respectively. At 20 years, they showed a statistically significant increase in AL of 0.84 ± 0.43 mm (P<.0001). AL increased by a mean of 0.84 mm. Furthermore, there was a statistically significant decrease in ACD of -0.42 ± 0.68 mm (P<.02). They explained the myopic shift as a consequence of growth in eye's AL, rather than to regression of correction at surface of the cornea.[5]

Nevertheless, it is known that AL measurements by partial coherence interferometric biometry are mostly more precise than those measured by ultrasound.[12]

In another study in 10 eyes underwent LASIK to treat myopic refractive errors ranging from − 2.50 to -8.00 diopters of SE (mean:-5.23 ± 1.30), preoperative and postoperative AL measurements using IOL Master showed a change in AL from mean 25.80 ± 1.01 mm to 25.68 ± 0.93 mm ,one month after surgery ,showing a decrease in AL that did not have a good correlation with theoretical ablation depth.[13]

In Rajan et al. Study to evaluate long term refractive stability for myopic PRK, they reported stability of refraction at 12 years ,with no significant change in mean SE between 1, 6, and 12 years and no late regression in long term.[14]

Other studies of myopic refractive surgeries have also shown mild regression in long term.[15,16]

In another report for PRK to treat low to moderate myopia by Guerin et al., they showed a slight regression over 16 years. At 2 years, the mean SE was − 0.25 D and at 16 years, − 0.58 D.[17]

Ivarsen et al., in a randomized study of PRK and LASIK in high myopia, reported stabilization of corneal power from 1–7 years after PRK but not after LASIK. No significant changes were observed from 1 to 7 years after surgery, and no significant correlation was found between changes in corneal power and spherical equivalent refraction (Pearson's r = 0.00; P = .99) or CCT (Pearsons's r = − 0.31; P = .41).[18]

A limitation of current study is the small number of patients. Although, initially 240 eyes of 120 patients were included in this cohort, however ,35 patients who were underwent bilateral LASEK attended follow up visits in 8 years. Second limitation is that we did not include patients with high degrees of myopia to compare possible effects of higher ablation depth on myopic regression and associated keratometric and refractive changes. Third, there is a problem that resides in the anterior chamber depth measurements. Lenstar measures ACD from the epithelium to the anterior lens surface. Having done excimer ablation would lead to false impression of drop of ACD; although, aqueous depth measurements similarly revealed a significant decrease in comparison to pre-operative values. The extended follow up (8 years) in this study, enabled analysis of biometric changes including keratometry, pachymetry, ACD, aqueous depth, LT and AL in long term to provide sufficient data regarding refractive stability.

Conclusions

In conclusion, present study was conducted to illustrate changes in 8 years follow up of patients underwent customized LASEK through focusing on factors related to refractive regression. AL measurements using same optical biometer showed no significant change in extended follow up to 8 years. Furthermore, stability of subjective refraction in spite of significant change in keratometric values from 6 months to 8 years may propose surface ablation to be recommended as a safe and stable refractive procedure in individuals with low to moderate myopia.

Abbreviations

LASEK: Laser assisted subepithelial keratectomy

LASIK: Laser in situ keratomileusis

PRK: Photorefractive keratectomy

ACD: Anterior chamber depth

LT: Lens thickness

CCT: Central corneal thickness

AL: Axial length

CDVA: Corrected distance visual acuity

UCDVA: Uncorrected distance visual acuity

BSCVA: Best spectacle corrected visual acuity

D:Diopter

BSS: Balanced salt solution

SE: Spherical equivalent

LogMAR :: Logarithm of the minimum angle of resolution

MRSE*:* Manifest refraction spherical equivalent

Declarations

Ethics approval and consent to participate

Present study received ethical approval from the institutional Review Board of Iran University of Medical Sciences (IUMS) and adhered to the tenets of Declaration of Helsinki. Written informed consent was obtained from all participants at the time of the procedure.

Consent for publication

Not applicable.

Availability of data and materials

The data used and/or analyzed for present study are available from the corresponding author on reasonable request.

Competing interests

None.

Funding

None.

Authors' Contributions

SJ.H contributed to the concept, design and revision of the study ,administrative and technical support, and final approval of the manuscript. AE, HA, LG, MS.H, SM.H contributed to acquisition, analysis and interpretation of the data, drafting and revising of the manuscript. MEJ and L.J contributions included statistical analysis for present study.

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References

1. Tobaigy FM, Ghanem RC, Sayegh RR, Hallak JA, et al.A Control-Matched Comparison of Laser Epithelial Keratomileusis and Laser In Situ Keratomileusis for Low to Moderate Myopia.Am J Ophthalmol 2006;142:901-8.
2. Scerrati E. Laser In Situ Keratomileusis vs. Laser Epithelial Keratomileusis (LASIK vs. LASEK). J Refract Surg 2001;17:S219-21.

3. Kim JK, Kim SS, Lee HK, Lee IS, et al. Laser In Situ Keratomileusis versus Laser-Assisted Subepithelial Keratectomy for the Correction of High Myopia. J Cataract Refract Surg 2004;30:1405-11.
4. Ikeda T, Shimizu K, Igarashi A, Kasahara S,et al. Twelve-Year Follow-Up of Laser In Situ Keratomileusis for Moderate to High Myopia. Biomed Res Int. 2017;2017:9391436.
5. O'Brart DP, Shalchi Z, McDonald RJ, Patel P ,et al.Twenty-Year Follow-Up of a Randomized Prospective Clinical Trial of Excimer Laser Photorefractive Keratectomy. Am J Ophthalmol 2014;158:651–63.
6. Fu D, Zhang ZY, Wang L, Zhou XT, et al. Refractive Regression and Changes in Central Corneal Thickness Three Years after Laser-Assisted Subepithelial Keratectomy for High Myopia in Eyes with Thin Corneas: A Retrospective Study. Semin Ophthalmol. 2017;32:631-41.
7. Winkler von Mohrenfels C, Gabler B, Lohmann CP. Optical Biometry Before and After Excimer Laser Epithelial Keratomileusis (LASEK) for Myopia. Eur J Ophthalmol. 2003;13:257-59.
8. Rosa N, Capasso L, Lanza M, Romano A. Axial Eye Length Evaluation Before and After Myopic Photorefractive Keratectomy. J Refract Surg.2005;21:281–87.
9. Eugene Tay, Xiang Li, Howard V. Gimbel, Geoffrey Kaye. Assessment of Axial Length Before and After Myopic LASIK With the IOL Master. J Refract Surg. 2013;29:838-84.
10. Cruysberg LP, Doors M, Verbakel F, Berendschot TT, De Brabander J, Nuijts RM. Evaluation of the Lenstar LS 900 non-contact biometer. Br J Ophthalmol. 2010;94:106–10.
11. O'Connor J, O'Keeffe M, Condon PI. Twelve-Year Follow-up of Photorefractive Keratectomy for Low to Moderate Myopia.J Refract Surgery 2006; 22:871–77.
12. Rose LT, Moshegov CN. Comparison of the Zeiss IOL Master and Applanation A-scan Ultrasound Biometry for Intraocular Lens Calculation. Clin Exp Ophthalmol 2003;31:121–24.
13. Chalkiadakis SE, Amariotakis GA, Parikakis EA, Peponis VG.Axial Length Measurements Pre and Post Laser-Assisted In Situ Keratomileusis Using the IOL Master: a Pilot Study. Clin Ophthalmol. 2010;4:1267-69.
14. Rajan M, Jaycock P, O'Brart DPS, Nystrom HH, Marshall J.A Long-Term Study of Photorefractive Keratectomy: 12-Year Follow-up. Ophthalmology 2004;111:1813–24.
15. Koshimizu J, Dhanuka R, Yamaguchi T. Ten-Year Follow-up of Photorefractive Keratectomy for Myopia. Graefes Arch Clin Exp Ophthalmol 2010;248:1817–25.
16. de Benito-Llopis L, Alio JL, Ortiz D, Teus MA, et al. Ten Year Follow-up of Excimer Laser Surface Ablation for Myopia in Thin Corneas. Am J Ophthalmol 2009;147:768–73.
17. Guerin MB, Darcy F, O'Connor J, O'Keeffe M. Excimer Laser Photorefractive Keratectomy for Low to Moderate Myopia Using a 5.0 mm Treatment Zone and No Transitional Zone: 16- Year Follow-up. J Cataract Refract Surg 2012;38:1246–50.
18. Ivarsen A, Hjortdal J. Seven-Year Changes in Corneal Power and Aberrations After PRK or LASIK. Invest Ophthalmol Vis Sci 2012;53:6011–16.

Figures

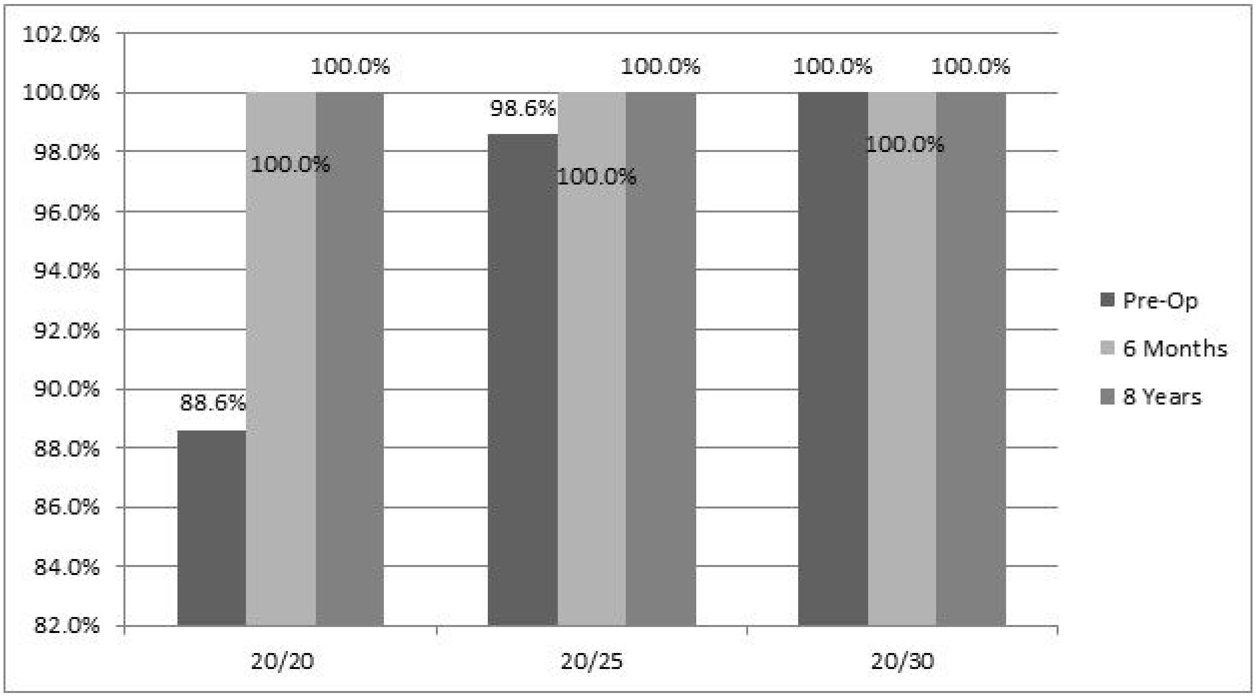

Figure 1

Cumulative pre and post LASEK surgery corrected distance visual acuity(CDVA).

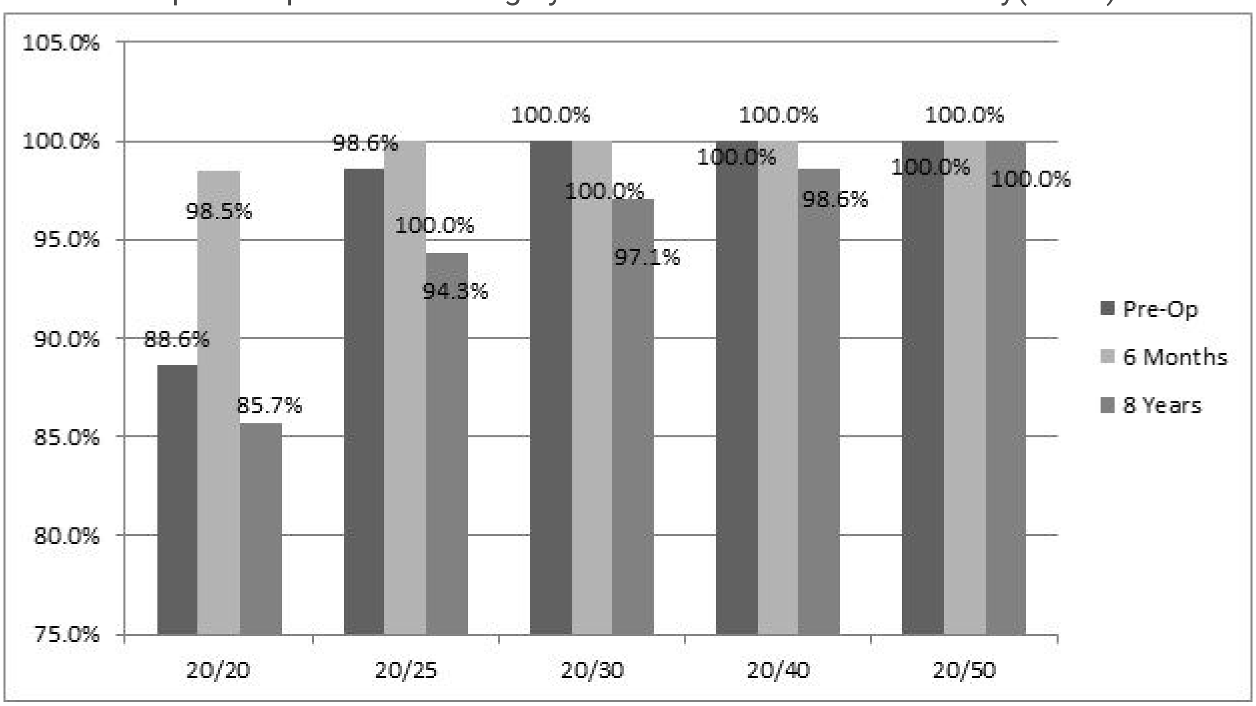

Figure 2

Cumulative preoperative corrected distance visual acuity(CDVA) and postoperative uncorrected distance visual acuity(UCDVA)

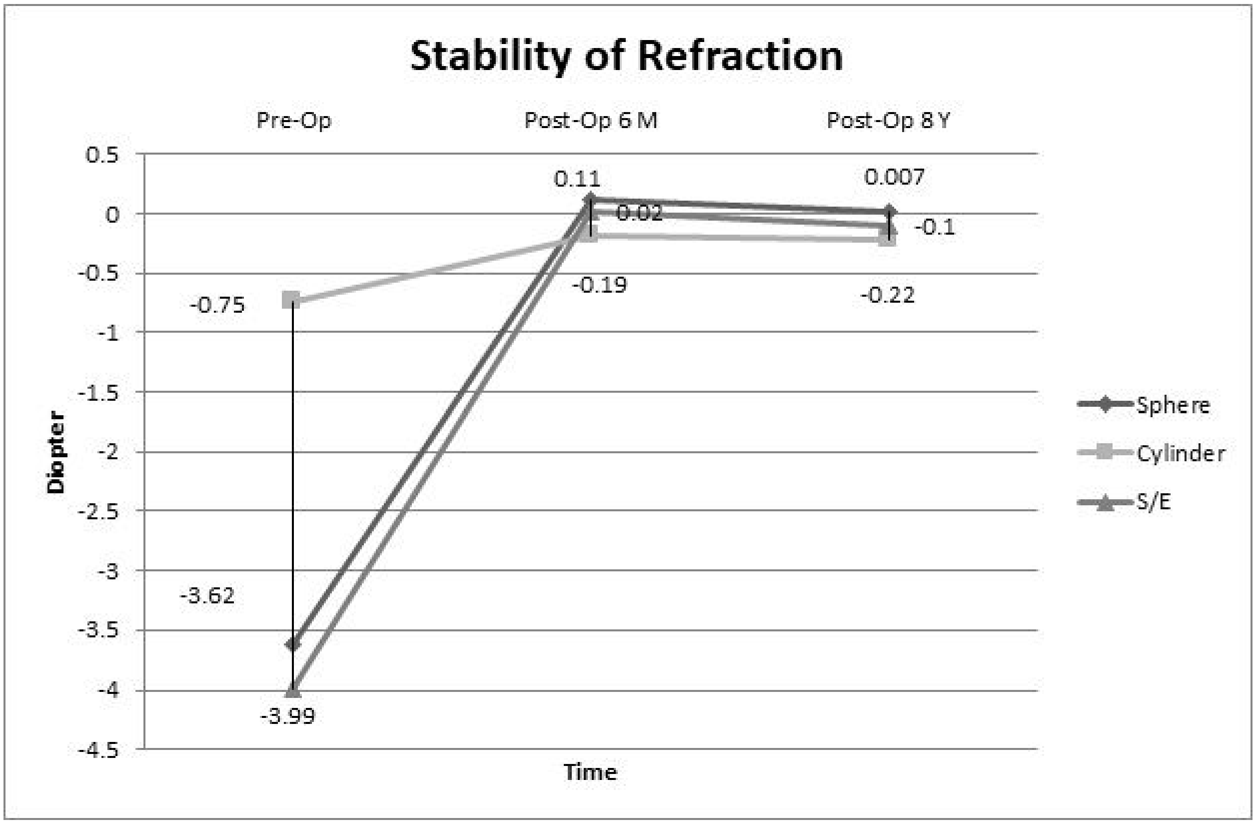

Figure 3

Stability after LASEK in 70 eyes with low to moderate myopia. All figures denotes spherical equivalents(SE) in diopter.

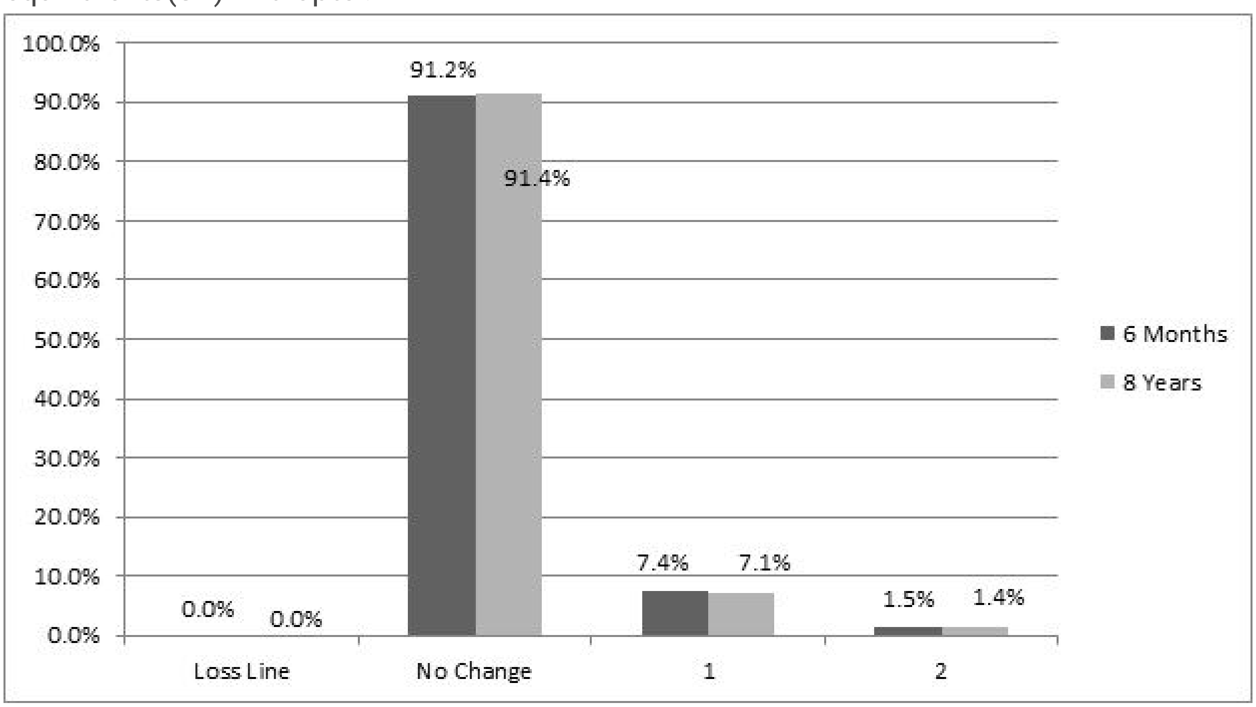

Figure 4

Changes in corrected distance visual acuity(CDVA). (The horizontal axis denotes the changes in reading Snellen chart lines and the vertical axis illustrates the percentage of patients .No patients lost 3 or more lines on Snellen chart.)