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Intraocular Lens Power Calculation after Myopic Lasik with no Previous Data: A Review of Available Methods

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Introduction

Intraocular lens (IOL) power calculation after keratorefractive surgery has been a major challenge for the ophthalmic community and has generated numerous scholarly works and efforts trying to optimize current formulas and tailor new methods to better predict the correct intraocular lens (IOL) power [1-8]. Aramberri's work on the double-K adjustment of third-generation IOL formulas significantly improved the hyperopic results stemming from inaccurate estimation of the effective lens position by those formulas [9].

IOL power calculation can lead to unexpected refractive outcomes for 2 primary reasons. The first is that the surgically induced corneal power change, as measured by keratometry or corneal topography, is underestimated because the standard keratometric refractive index (usually 1.3375) is not valid once the laser modifies the anterior to posterior corneal curvature ratio [10-13] The second reason is that the IOL position is erroneously predicted by third-generation theoretical formulas (eg, Hoffer Q, Holladay 1, SRK/T) that derive the prediction from the corneal curvature [13-17]. A third reason may be partially responsible for the inaccuracy of IOL power calculation for eyes with a small optical zone and large correction; in this case, the difference between the paracentral corneal area (where keratometry [K] and simulated K readings are taken) and the central cornea area (where the visual axis passes) can be clinically relevant [11,18-20].

When no previous data are available the calculations are more misleading as no double-K adjustment can be done, unless an average value (eg, 43.13 D) is presumed to be the preoperative corneal power. Various formulas have been described, and surgeons can now choose from many methods. This can easily generate confusion rather than accuracy. The aim of the present study was to provide with various methods of calculating IOL power in patients with no pre-refractive surgery data available.

We address two possible scenarios with no preoperative corneal power known. When neither preoperative corneal power nor refractive changes are available the lowest mean absolute error is achieved with the methods of Masket, Seitz/Speicher/Savini, Shammas, and Camellin/Calossi. When preoperative corneal power is unknown but the surgically induced refractive change is known the lowest mean absolute error is achieved with the Masket method followed by the the Savini method, Speicher/Seitz method modified by Savini, and Shammas no-history method. Good results can also be obtained with the Awwad and Camellin/Calossi methods when the calculated corneal power is entered into the double-K Holladay 1 formula instead of the double-K SRK/T [21].

Preoperative corneal power and refractive change unknown

According to a recent paper these are the most reliable methods [21].

Shammas no-history method + Shammas-PL formula

KShammas = 1.14 x K – 6.8

The main advantage of this method is that the corrected corneal power is used in the Shammas post-LASIK (Shammas-PL) formula and in this formula the effective lens postion (ELP) does not vary with the corneal curvature, which has been altered by the LASIK procedure [22].

Seitz/Speicher/Savini + Double-K SRK/T formula

The method of separately considering the anterior corneal curvature and posterior corneal curvature, first described by Seitz and Langenbucher and later reviewed by Speicher, could be considered the most accurate, at least when coupled with the double-K SRK/T formula [2,23]. If the preoperative corneal power is unknown, the Seitz/Speicher method can be modified according to Savini et al., who suggest using a mean value of –4.98 D for posterior corneal curvature [21,24]. The Seitz/Speicher/Savini method:

K = simulated K x 1.114 - 4.98
is similar to other methods like the one proposed by Maloney [25]:
K = central corneal power x 1.114 - 4.9
and the modified version developed by Wang (4):
K = central corneal power x 1.114 - 6.1
equation 6 of Awwad (11, 26).
SimKadj no history = 1.114 x SimK – 6.062
and, to a lesser extent, the Shammas et al. no-history method [22]:
K Shammas = simulated K x 1.14 - 6.8

Ho et al.found that the Seitz/Speicher method modified according to Savini et al. is highly accurate [27, 28]. Obviously, this method (developed for eyes for which the preoperative corneal power is not known) must be used in conjunction with double-K formulas, which require entry of the preoperative corneal power. There are 3 possibilities to solve this contradiction: (1) calculate the preoperative corneal power by adding the refractive change to the postoperative corneal power, (2) use a mean value such as 43.13 or (3) estimate the effective lens position (ELP), as suggested by Ho (27-29). The good results obtained with the Seitz/Speicher method (with or without the Savini modification) could be related to its total independence of the surgically induced refractive change (a likely source of errors) [27].

Rosa method + Single-K SRK/T formula

Refraction with Rosa method (Rrosa) = R x (0.0276 AL + 0.3635)

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K(Rrosa) = 337.5/Rrosa
AL = Axial length; R=k/337.5
Another method proposed by Rosa is as follows [30]
KRosa = (1.3375-1)/((K x RCF)/1000).
RCF: Rosa Correction Factor based on axial length (mm)
22 - <23: 1.01
23 - <24: 1.05
24 - <25: 1.04
25 - <26: 1.06
26 - <27: 1.09
27 - <28: 1.12
28 - <29: 1.15
29:1.22

Ferrara method [31]

K = ((-0.0006 x AL^2 + 0.0213 x AL + 1.1572) -1) / (Kr/1000).
AL: Axial lengh.
Kr: Keratometry (radius of curvature in mm).

Rosa and Ferrara method may easily lead to postoperative myopia [32].

BESSt method + Double-K formula

The formula takes into account anterior and posterior corneal radii and pachymetry (Pentacam, Oculus) and does not require pre-keratorefractive surgery information [33].

Input Variables
rF: Front corneal radius (mm)
rB: Back corneal radius (mm)
CCT: central corneal thickness (microns)
Formula
n.air =1
n.vc = 1.3265
n.CCT = n.vc + (CCT x 0.000022)
K.conv = 337.5/rF
n.adj:
if K.conv <37,5 n.adj = n.CCT + 0.017
if K.conv <41,44 n.adj = n.CCT
if K.conv <45 n.adj = n.CCT - 0.015
ELSE; n adj EQUALS n CCT
n.acq = 1.336
d = d.cct /n.vc
d.cct = CCT /1000000
Fant = 1/rF x (n.vc – n.air)
Fpost = 1/rB (n.acq – n.vc)

Using the BESSt formula, 46% of eyes were within +/-0.50 D of the intended refraction and 100% were within +/-1.00 D.

Output

KBESSt (corneal power after keratorefractive surgery, D) =
{ [1/rF x (n.adj – n.air)] + [1/rB x (n.acq – n.adj)] - [d x 1/r x (n.adj – n.air) x 1/rB x (n.acq – n.adj)] } x 1000.

BESSt formula has been replaced by the BESSt2 algorithm. Corneal power is still estimated with gaussian optic formula as with BESST1 but some improvements can be found:

- prediction of preoperative anterior radius from postoperative posterior radius measurements.
- automatic application of double-K adjustment to the the predicted preoperative anterior radius.
- It uses a modified 3rd generation formula for IOL power calculation, preventing the cusp phenomenon which may happen using SRK/T formula.
- Automatic adjustments for extreme axial lengths.
- Contribution of corneal wavefront (espherical aberation) from Pentacam.
- It has two separate algoriths: one for myopia and other one for hyperopia.

According to his author BESSt2 is more accurate than BESSt1 in hyperopia and more accurate than Haigis-L in myopia (34, 35).

Awwad method + Double-K Holladay I

In the absence of information about the change (D) in spherical equivalent (ΔSE), a regression based solely on average corneal central power (ACCP) in the central 3.0 mm area (ACCP3mm) should be used (26):

ACCPadj no history = 1.151 x ACCP3mm – 6.799

In the absence of topographic data a regression based on SimK is to be used:

SimKadj no history = 1.114 x SimK - 6.062

Quantitative area topography (Orbscan II) and Total corneal power (Galilei)

In 2004, Sónego-Krone et al reported that the refractive change at the corneal plane after myopic LASIK had a difference of -0.08+/-0.53 D with the corneal power change determined by quantitative area topography in a 4-mm–diameter central zone of Orbscan II total-mean postoperative maps (36).

Quantitative area topography is distinct from quantitative point topography, which assesses the average of only two single steeper and flatter values. The total-mean power maps represent the spherical equivalent refraction of both corneal curvatures with regard to the corneal thickness and are comparable to the equivalent power of the cornea assessed by the thick lens formula. The total-optical power maps represent the ray tracing of light through the whole cornea. The advantage of this method is that the final total corneal powers to be used in IOL calculation may be obtained directly from the topographic maps, as measured after the previous corneal refractive surgery without depending on regression formulas, artificial refraction indices, contact lens over-refraction, aphakic intraoperative refraction, previous refractive or topographic data, algorithms, or correction factors [36,37].

It has been applied in a multicenter study using the total mean power (equivalent power) and the total optical power [38,39].Total optical power maps by the Orbscan Topography System appear to be relatively accurate in detecting the changes in corneal power measured by refraction after LASIK. The correlation is highest when averaging within the central 4.0 mm zone. The corneal power change derived from axial power maps correlates less well than that derived from the TOP maps, as expected. Total optical power maps appear to provide an accurate measure of corneal power change in LASIK [37-39].

This same method has been applied with success using the Galilei's total corneal power (TCP) by ray tracing from a central zone of 0 to 4 mm diameter. Similar to the Orbscan II total-optical power, the Galilei uses a 4-mm diameter central zone for the TCP derived from ray tracing. Galilei TCP represents the average total corneal power fot the central 4 mm diameter of the cornea. This TCP is calculated using the ray tracing method, which takes the actual refractive indices of the cornea into account. The post-LASIK corneal power is estimated using the following formula [40,41]:

post-lasik adjusted corneal power = 1.057 x tcp – 1.8348

Preoperative Corneal Power Unknown and refractive change known

Masket method

The equation was determined to be as follows:
IOL Power Adjustment = LSE x (-0.0.326) + 0.101

Where LSE is the total prior laser treatment, adjusted for vertex distance, in spherical equivalent (SE).

Clinical example is as follows:
Previously myopic eye:
- SRK/T formula suggests 14.0 D for emmetropia after cataract surgery
- Prior laser correction (SE) = - 4.0 D
- Adjustment calculation: -4.0 D x (-0.326) + 0.101 = + 1.405 D
- IOL power adjusted by adding +1.4 D to the original + 14 D = +14.5 D for emmetropia

The Masket method had a great advantage in that it omits the double-K step required by the Savini and Seitz/Speicher/Savini methods. The latter methods can be significantly influenced by the choice of the preoperative corneal power to be entered into the double-K formulas. In contrast, the Masket method (like the Shammas no-history method) does not have this drawback [5].

Savini + Double-K SRK/T

Ksavini = ((1.338+ 0.0009856 x ΔSEsp) -1) / Kr/1000)
ΔSEsp: Change in spherical equivalent at spectacle plane
Kr: Keratomety (radius of curvature in mm). [20,21,24]

Camellin + Double-K Holladay 1

KCamellin = ((1.3319 + 0.00113 x ΔSEsp) – 1) / (Kr/1000).
ΔSEsp: Change in SE at spectacle plane.
Kr: Keratometry (radius of curvature in mm).

When entered into the double-K SRK/T formula, the corneal power calculated with the Camellin/Calossi method results in a positive arithmetic error in IOL power prediction, with a subsequent myopic outcome. The suboptimal results are probably due to the fact that this method was developed to be used with the Camellin/ Calossi formula for IOL power calculation, which is a modified Binkhorst II formula, and not with the double-K SRK/T formula. The Camellin/ Calossi formula calculates the ELP from the preoperative anterior chamber depth. Considerably better results can be obtained by entering the calculated corneal power into the double-K Holladay 1 formula [8,42].

Awwad method + Double-K Holladay 1

Two variables, ACCP3mm and ΔSE, were shown to be vital and sufficient for accurate refractive power prediction. The multiple regressions based on these 2 independent variables successfully predicted corneal refractive power (26):

ACCPadj = ACCP3mm – 0.16 x (SEpostLASIK – SEpreLASIK)

Adjusting for the fact that the measured ACCP3mm overestimates the true value by about 0.16 D for every diopter of myopic laser correction [26].

In ACCP is not available, SimK and ΔSE are to be used:

SimKadj = SimK - 0.23 x (SEpostLASIK – SEpreLASIK).

As the measured SimK overestimates the true value by about 0.23 D for every diopter of laser correction [26].

Hamed-Wang-Koch method + double-k formula

This method requires knowledge of the refractive change from the surgery and the postoperative Sim-K from the topography unit. This group modifies the effective reftactive power (EffRP) of the EyeSys:

K = EffRP – (0.15 x ΔSE) – 0.05
They also offered a second method to calculate true corneal power by substituting 0.15 by 0.19
[43,44].

Jarade method + double-k formula

Requires knowing the surgically induced refractive change at the corneal plane (ΔSEcp) and the average radius of curvature of the cornea now (Kr) [45]:

KJarade = ((1.3375 + 0.0014 x ΔSEcp) – 1)/(Kr/1000)

Haigis-L method

KHaigis = –5.1625 x Kr + 82.2603 – 0.35

This method requires only the postoperative K reading form the Zeiss IOLMaster in radius of curvature (or converted to diopters using the index of refraction setting in the IOLMaster) [46].

Maloney Central Topography method + double-k formula

Central power = (central topographic power x [376/337.5]) – 4.9

Koch and Wang obtained the best results using the Maloney method using -6.1 instead of -4.9.

[4].

They also offered a second method to calculate true corneal power if ΔSE is known [44]. The formula is:

K = EffRp – (0.19 x ΔSE)

Feiz-Mannis method

This method utilizes the change in refractive error to offset the calculated target IOL power [47].

P = PTARG – 0.595 x ΔSEcp + 0.231
P = IOL Power

PTARG = the target IOL power to produce the postoperative desired refractive error.

The historical K method, although theoretically considered the gold standard, is misleading in practice because myopic or hyperopic errors in post-LASIK refractions can easily translate into errors of the same magnitude in the final post–cataract surgery refraction. In addition, early occult cataractous stage can produce myopic shift and potentially lead to a falsely over-minused post-LASIK refraction result, introducing an error in corneal power estimation. We recommend against using the historical K method [48].

This method is based on the fact that the final change in refractive error the eye obtains from surgery was due only to a change in the effective corneal power. If this refractive change the patient experienced is algebraically added to the presurgical corneal power, we will obtain the effective corneal power the eye has now. Obviously this requires knowledge of the K reading and refractive error prior to refractive surgery (48).

K = KPRE + RPRE – RPO or [K = KPRE + RCC]

KPRE = refractive surgery preoperative corneal power
RPO = refractive surgery PO refractive error (spherical equivalent)
RPRE = refractive surgery preoperative refractive error (spherical equivalent)
RCC = surgical change in refractive error (SE) vertexed to Corneal Plane

Our concerns about the clinical history method are in good agreement with several previous studies in which the clinical history method obtained less accurate results than other methods, even when the calculated corneal power was entered into double-K formulas. Hence, we recommend extreme caution when using the corneal power generated by the clinical history method in any double-K formula and agree with Awwad that this method should no longer be considered the gold standard for IOL power calculation after refractive surgery [48,51].

Important Things to Keep In Mind

What should the clinician do when faced with the daunting problem of post-refractive-surgery IOL power calculation? It is wise to use several approaches. Ideally, it would be optimal to have a spreadsheet that allows the clinician to insert all values available. The various formulas would then be calculated automatically [48]. There is one spreadsheet available at the ASCRS website: www.ascrs.org.

When faced with a range of values for the IOL power, it is wise to look for values that are consistent with at least one other reading. Values that select higher IOL powers are preferable, leaving the patient slightly myopic rather than hyperopic [48)].

IOL power calculation is a real problem in eyes that have had refractive surgery. Because it has yet to be proven which proposed method works best in all eyes, it behooves the surgeon to use as many methods as data is available and carefully evaluate the results [48].

How to Handle Problems and Errors

The major problem is an unacceptable postoperative refractive error. The sooner it is discovered, the sooner it can be corrected and the patient made happy. Therefore, it is wise to perform K readings and a manifest refraction on the *first* postoperative day in these demanding patients. Immediate surgical correction (24 to 48 hours) will allow easy access to the incision and the capsular bag, a single postoperative period, and excellent uncorrected vision. The majority of medico-legal cases today are due to a delay in diagnosis and treatment of this iatrogenic problem [48].

Up to now, we could only correct this problem by lens exchange, which creates the dilemma of determining which factor created the IOL power error; axial length, corneal power, or mislabeled IOL or a combination of the above. Today, with the advent of low-powered IOLs, the best remedy may be a piggyback IOL. Using a piggyback IOL, it is not necessary to determine what caused the error or to remeasure the axial length of the freshly operated pseudophakic eye [48].

References

1. Kalski RS, Danjoux J-P, Fraenkel GE, Lawless MA, Rogers C (1997) Intraocular lens power calculation for cataract surgery after photorefractive keratectomy for high myopia. J Cataract Refract Surg 13: 362-366.
2. Seitz B, Langenbucher A (2000) Intraocular lens calculations status after corneal refractive surgery. Curr Opin Ophthalmol 11: 35-46.
3. Feiz V, Mannis MJ, Garcia-Ferrer F, Kandavel G, Darlington JK, et al, (2001) Intraocular lens power calculation after laser in situ keratomileusis for myopia and hyperopia; a standardized approach. Cornea 20: 792-797.
4. Wang L, Booth MA, Koch DD (2004) Comparison of intraocular lens power calculation methods in eyes that have undergone LASIK. Ophthalmology 111: 1825-1831.
5. Masket S, Masket SE (2006) Simple regression formula for intraocular lens power adjustment in eyes requiring cataract surgery after excimer laser photoablation. J Cataract Refract Surg 32: 430-434.
6. Walter KA, Gagnon MR, Hoopes PC Jr, Dickinson PJ (2006) Accurate intraocular lens power calculation after myopic laser in situ keratomileusis, bypassing corneal power. J Cataract Refract Surg 32: 425-429.
7. Mackool RJ, Ko W, Mackool R (2006) Intraocular lens power calculation after laser in situ keratomileusis; aphakic refraction technique. J Cataract Refract Surg 32: 435-437.
8. Camellin M, Calossi A (2006) A new formula for intraocular lens power calculation after refractive corneal surgery. J Refract Surg 22: 187-199.
9. Aramberri J (2003) Intraocular lens power calculation after corneal refractive surgery: double-K method. J Cataract Refract Surg 29: 2063-2068.
10. Seitz B, Langenbucher A, Nguyen NX, Kus MM, Küchle M (1999) Underestimation of intraocular lens power for cataract surgery after myopic photorefractive keratectomy. Ophthalmology 106: 693-702.
11. Hugger P, Kohnen T, La Rosa FA, Holladay JT, Koch DD (2000) Comparison of changes in manifest refraction and corneal power after photorefractive keratectomy. AmJ Ophthalmol 129: 68-75.
12. Mandell RB (1994) Corneal power correction factor for photorefractive keratectomy. J Refract Corneal Surg 10: 125-128.
13. Gobbi PG, Carones F, Brancato R (1998) Keratometric index, videokeratography, and refractive surgery. J Cataract Refract Surg 24: 202-211.
14. Hoffer KJ (1993) The Hoffer Q formula: a comparison of theoretic and regression formulas. J Cataract Refract Surg 19: 700-712.
15. Zuberbuhler B, Morrell AJ (2007) Errata in printed HofferQ formula. J Cataract Refract Surg 33: 2.
16. Holladay JT, Prager TC, Chandler TY, Musgrove KH, Lewis JW, et al. (1988) A three-part system for refining intraocular lens power calculations. J Cataract Refract Surg 14: 17-24.
17. Retzlaff JA, Sanders DR, Kraff MC (1990) Development of the SRK/T intraocular lens implant power calculation formula. J Cataract Refract Surg 16: 333-340.
18. Chen S, Hu F-R (2002) Correlation between refractive and measured corneal power changes after myopic excimer laser surgery. J Cataract Refract Surg 28: 603-610.
19. Maeda N, Klyce SD, Smolek MK, McDonald MB (1997) Disparity between keratometry-style readings and corneal power within the pupil after refractive surgery for myopia. Cornea 16: 517-524.
20. Savini G, Carbonelli M, Barboni P, Hoffer KJ (2010) Clinical relevance of radius of curvature error in corneal power measurements after excimer laser surgery. J Cataract Refract Surg 36: 82-86.
21. Savini G, Hoffer K, Carbonelli M, Barboni P (2010) Intraocular lens power calculation after myopic excimer laser surgery: Clinical comparison of published methods. J Cataract Refract Surg 36: 1455-1465.
22. Shammas HJ, Shammas MC, Garabet A, Kim JH, Shammas A, et al. (2003) Correcting the corneal power measurements for intraocular lens power calculations after myopic laser in situ keratomileusis. Am J Ophthalmol 136: 426-432.
23. Speicher L (2001) Intra-ocular lens calculation status after corneal refractive surgery. Curr Opin Ophthalmol 12: 17-29.
24. Savini G, Barboni P, Zanini M (2006) Intraocular lens power calculation after myopic refractive surgery; theoretical comparison of different methods. Ophthalmology 113: 1271-1282.
25. Smith RJ, Chan WK, Maloney RK (1998) The prediction of surgically induced refractive change from corneal topography. Am J Ophthalmol 125: 44-53.
26. Awwad ST, Manasseh C, Bowman RW, Cavanagh HD, Verity S, et al. (2008) Intraocular lens power calculation after myopic laser in situ keratomileusis: estimating the corneal refractive power. J Cataract Refract Surg 34: 1070-1076.
27. Ho J-D, Liou S-W, Tsai RJ-F, Tsai C-Y (2008) Estimation of the effective lens position using a rotating Scheimpflug camera. J Cataract Refract Surg 34: 2119-2127.

28. Savini G, Barboni P, Zanini M (2007) Correlation between attempted correction and keratometric refractive index of the cornea after myopic excimer laser surgery. J Refract Surg 23: 461-466.
29. Hoffer KJ (1980) Biometry of 7,500 cataractous eyes. AmJ Ophthalmol 90: 360-368.
30. Rosa N, Capasso L, Lanza M, Iaccarino G, Romano A (2005) Reliability of a new correcting factor in calculating intraocular lens power after refractive corneal surgery. J Cataract Refract Surg 31: 1020-1024.
31. Ferrara G, Cennamo G, Marotta G (2004) New formula to calculate IOL power. J Cataract Refract Surgery 20: 465-71.
32. Mesa-Gutiérrez JC, Ruiz-Lapuente C (2009) The intraocular lens calculation after corneal refractive surgery photo. Literature review. Arch Soc Esp Oftalmol 84: 283-292.
33. Borasio E, Stevens J, Smith G (2006) Estimation of true corneal power after keratorefractive surgery in eyes requiring cataract surgery: BESSt formula. J Cataract Refract Surgery 32: 2004-2014.
34. www.edmondoborasio.com
35. www.besstformula.com
36. Sónego-Krone S, López-Moreno G, Beaujon-Balbi O, Arce CG, Schor P, et al. (2004) A direct method to measure the power of the central cornea after myopic laser in situ keratomileusis. Arch Ophthalmol 122: 159-166.
37. Srivannaboon S, Reinstein DZ, Sutton HF, Holland SP (1999) Accuracy of Orbscan total-optical power maps in detecting refractive change after myopic laser in situ keratomileusis. J Cataract Refract Surg 25: 1596-1599.
38. Arce CG, Soriano ES, Weisenthal RW, Hamilton SM, Rocha KM, et al. (2009) Calculation of Intraocular Lens Power Using Orbscan II quantitative area topography after corneal refractive surgery. J Refract Surg 25: 1061-1074.
39. Mc Cormick GJ, Aquavella JV, MacRae SM (2007) Use of the Orbscan II for IOL power calculation after laser refractive surgery. Presented at: American Society of Cataract and Refractive Surgery annual meeting; April 28 - May 2, 2007; San Diego Calif.
40. Wang L, Shirayama M, Pruet CM, Weikert MM, Koch DD (2010) Role of Galilei in IOL power calculations in post-LASIK/PRK and post-RK eyes.
41. Koch DD, Shirayama M, Wang L, Weikert MP (2009) How do we use the Galilei for cataract and refractive surgery?
42. Binkhorst RD (1979) Intraocular lens power. Int Ophthalmol Clin 19: 83-94.
43. Hamed AM, Wang L, Misra M, Koch D (2002) A comparative analysis of five methods of determining corneal refractive power in eyes that have undergone myopic laser in situ keratomileusis. Ophthalmology 109: 651-658.
44. Koch D, Wang I (2003) Calculating IOL power in eyes that have had refractive surgery. J Cataract Refract Surg 29: 2039- 2042.
45. Jarade EF, Tabbara KF (2004) New formula for calculating intraocular lens power after laser in situ keratomileusis. J Cataract Refract Surg 30: 1711-1715.
46. Haigis W (2008) Intraocular lens calculation after refractive surgery for myopia: the Haigis-L formula. J Cataract Refract Surg 34: 1658.
47. Feiz V, Moshirfar M, Mannis MJ, Reilly CD, Garcia-Ferrer F, et al. (2005) Nomogram-based intraocular lens power adjustment after myopic photorefractive keratectomy and LASIK: a new approach. Ophthalmology 112: 1381-1387.
48. Hoffer K (2010) Intraocular lens calculation after prior refractive surgery. J Emmetropia 1: 46-52.
49. Odenthal MT, Eggink CA, Melles G, Pameyer JH, Geerards AJ, et al. (2002) Clinical and theoretical results of intraocular lens power calculation for cataract surgery after photorefractive keratectomy for myopia. Arch Ophthalmol 120: 431-438.
50. Randleman JB, Loupe DN, Song CD, Waring GO III, Stulting RD (2002) Intraocular lens power calculations after laser in situ keratomileusis. Cornea 21: 751-755.
51. Hamilton DR, Hardten DR (2003) Cataract surgery in patients with prior refractive surgery. Curr Opin Ophthalmol 14: 44-53.