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Case report

Intraocular lens power calculation after radial keratotomy and LASIK - A case report

Chun-Fu Liu[a,b,c], Chi-Chin Sun[a,b], Yun-Hsuan Lin[a,b], Shu-Yen Peng[a,b], Ling Yeung[a,b,*]

[a] Department of Ophthalmology, Keelung Chang Gung Memorial Hospital, No.222, Maijin Rd., Keelung City, 204, Taiwan
[b] College of Medicine, Chang Gung University, No.259, Wenhua 1st Rd., Guishan Dist., Taoyuan City, 333, Taiwan
[c] Program in Molecular Medicine, National Yang Ming University, Taipei, Taiwan

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ABSTRACT

Purpose: To report a challenging intraocular lens (IOL) power calculation case who received both radial keratotomy (RK) and laser-assisted in situ keratomileusis (LASIK).

Observations: A 51-year-old man had received refractive surgery with RK and later enhanced by LASIK more than 20 years ago. He developed severe cataract in left eye with best-corrected visual acuity of 20/100. The IOL power calculation was made using several methods available at the American Society of Cataract and Refractive Surgery (ASCRS) online calculator, including IOL calculation formulas for post-LASIK condition (Shammas, Haigis-L, Barrett True K no history, and Potvin-Hill Pentacam) and formulas for post-RK condition (Double K-modified Holladay 1 based on Oculus Pentacam and IOL Master, and Barrett True K). Haigis-L, Shammas and Barrett true K no history were found to be most accurate in predicting IOL power.

Conclusions: Haigis-L, Shammas and Barrett true K no history are reliable formulas for IOL power calculation in patients who received both RK and LASIK.

1. Introduction

The challenge of calculating the appropriate intraocular lens (IOL) power after previous refractive surgery such as radial keratotomy (RK) or laser-assisted in situ keratomileusis (LASIK) remained unresolved for the past two decades.[1–3]

The American Society of Cataract and Refractive Surgery (ASCRS) offers an online calculator (http://iolcalc.org/) with 13 IOL power calculation methods for patients with prior myopic LASIK or RK. Using as much available information as possible from a given eye, the calculator displays results for all formulas for which sufficient data have been provided as well as the average, minimum, and maximum IOL powers determined by the relevant methods.[4,5]

As far as we know, there is still no study on how to calculate the IOL power in patients receiving both RK and myopic LASIK. Herein, we report our experience for IOL calculation in a rare case who received double refractive surgery with RK and myopic LASIK. This study was approved by the Institutional Review Board of Chang Gung Memorial Hospital, Taiwan (Reference No. 104–9208B) in accordance with the Declaration of Helsinki. Informed consent to participate in the study was obtained from the patient.

2. Case report

A 51-year-old man presented to our clinic due to progressively decreased vision in his left eye (OS). The uncorrected visual acuity was 20/40 in the right eye (OD) and 20/600 in the left eye. The cycloplegic refraction was OD -1.00 -1.25 × 60 and OS -7.00 -1.25 × 103. The best corrected visual acuity (BCVA) were 20/20 with OD -0.50 -0.75 × 70 correction and 20/100 with OS -6.50 -1.00 × 100 correction.

His medical history revealed that he had received bilateral RK at age 28, followed by bilateral enhanced procedure with LASIK at age 40 due to myopia regression to around −4 diopter (D) in both eyes. His left eye also received a scleral buckle surgery for retinal detachment 15 months before visiting us. Then he received a trans pars plana vitrectomy (TPPV) for macular pucker 1 year ago. His post-operation condition was stable. All the above surgeries were done in other hospitals and the pre-operative refractive data could not be obtained.

In ocular examination, the anterior segments were essentially normal except sixteen cut radial keratotomy wounds in both eyes and severe cataract in the left eye (Fig. 1A). The optical zone of the cornea in the left eye was 3.1 mm horizontally and 2.4 mm vertically. Fundus exam found well-attached retina and pinkish optic disc in both eyes. Decreased foveal reflex and a small extrafoveal pigmented scar were

* Corresponding author. Department of Ophthalmology, Keelung Chang Gung Memorial Hospital, No.222, Maijin Rd., Keelung City, 204, Taiwan.
E-mail address: lingyeung@gmail.com (L. Yeung).

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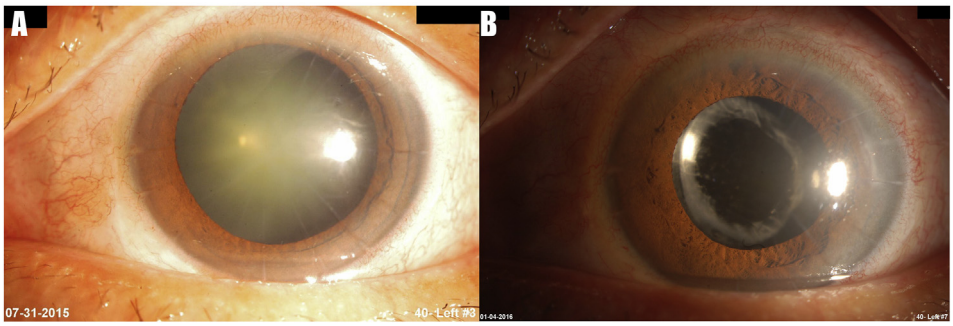

Fig. 1. (A) Pre-operative and (B) post-operative anterior segment photographs of the left eye.

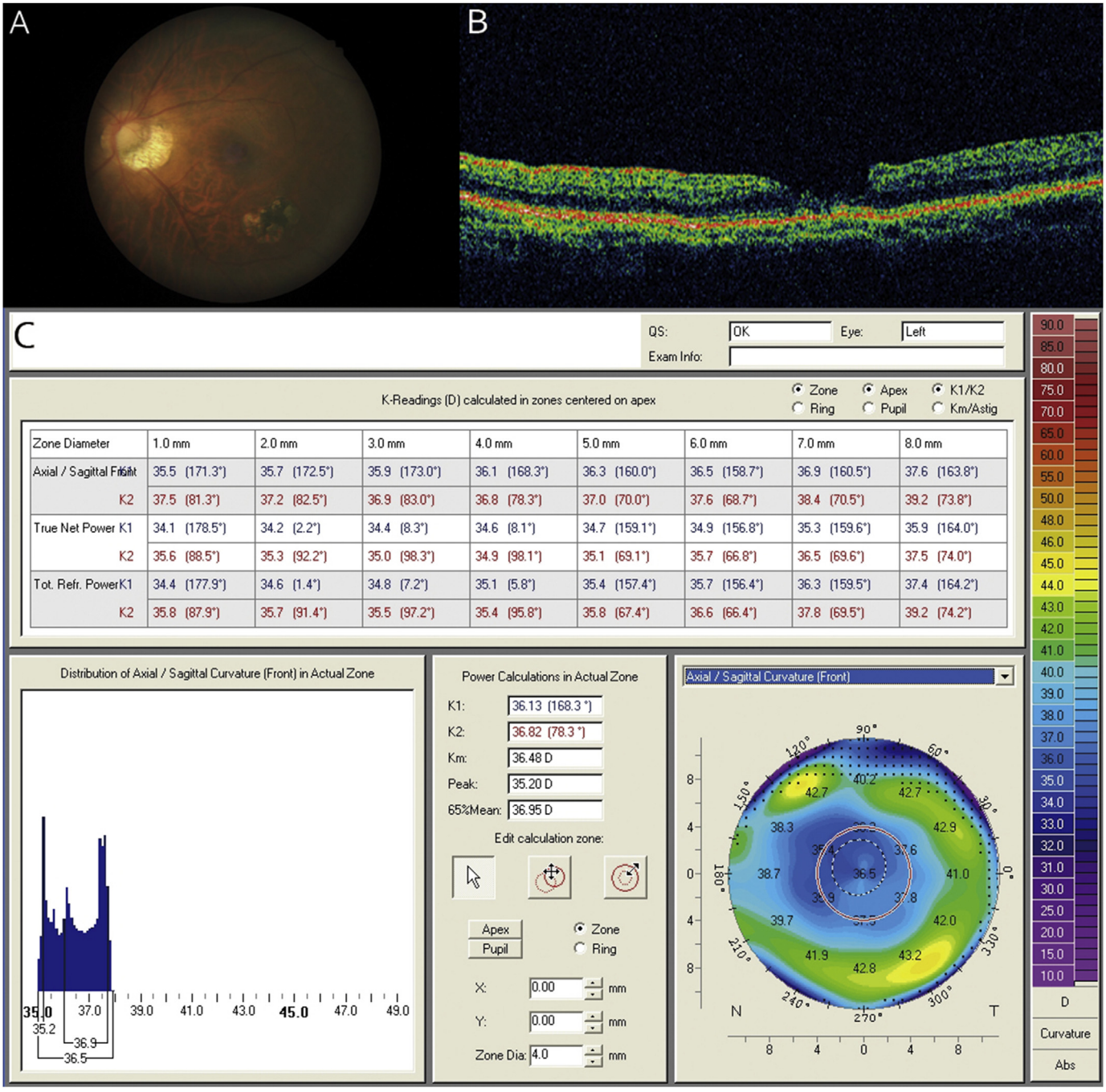

Fig. 2. (A) Color fundus photograph, (B) optical coherence tomography, and (C) Pentacam power distribution mode of the left eye. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article)

found in the left eye (Fig. 2A). Mild change of foveal contour was seen on the optical coherence tomography (OCT) (OCT III, Carl Zeiss Meditec AG, Jena, Germany) (Fig. 2B). Left-eye cataract surgery was suggested after thoughtful discussion with the patient. His keratometry and biometry data were collected by both IOLMaster (IOLMaster 500, Carl Zeiss Meditec AG, Jena, Germany) and Pentacam (Oculus, Wetzlar, Germany) (Fig. 2C). All available information was input to the ASCRS website and seven formulas were used for IOL calculation. His average post-RK corneal power was calculated to be 4 mm and post-LASIK true net power was also calculated with Pentacam as suggested by the ASCRS website.

Phacoemusification and IOL implantation were smoothly performed. An AAB00 23.0D IOL (Abbott Medical Optics, Abbott Laboratories Inc. Abbott Park, Illinois, USA) was implanted in this patient. We chose the IOL power according to Haigis-L formula on ASCRS IOL calculator with the target refraction power set as −1.0D. At post-operative 1.5 months, the cycloplegic refraction was −0.50 -1.00 × 50, the BCVA improved to 20/50, and the spherical equivalence was −1.0 D. Then, IOL power was recalculated using the methods provided at the ASCRS website with the post-operative target refraction set at −1.0D to achieve estimated −1.0D target power. The IOL powers obtained using the same seven formulas as before were compared with the actual IOL power used (i.e., 23.0D). The differences are shown in Table 1. As can be seen, Haigis-L, Shammas and Barrett true K no history were the most accurate formulas for calculating IOL power.

3. Discussion

As mentioned above, Haigis-L, Shammas and Barrett true K no history were the most accurate IOL power calculation formulas for an eye with prior surgeries of both RK and myopic LASIK. There would be a significant refractive error if the formulas for eyes with prior RK were used in this case (Table 1). Furthermore, the recently published Pentacam-based true net power application for post-LASIK calculation seems unsuitable for patient having undergone both RK and LAISK surgeries.[3]

According to this case report, we hypothesized that IOL calculation with Haigis-L formula using these data seems to yield accurate IOL power. In other words, using post-LASIK condition alone for IOL power calculation with Haigis-L formula may be sufficient and the post-RK condition may need not be considered.[6–8]

As the LASIK-enhanced RK procedure (both residual hyperopia and myopia) became more popular,[9,10] the present case provides an important clinical experience for IOL power calculation of patients with history of both RK and LASIK surgeries.

There were several limitations of the study. Firstly, this is only a case report, further large-scale prospective study on these cases is necessary to figure out a better method for IOL power calculation in these patients. Secondly, the patient had received scleral buckle and TPPV for retinal detachment and macular pucker; these two procedures might affect anterior chamber depth, axial length and corneal curvature. However, previous reported indicated eye condition may be stable for IOL power calculation at 3 months after sclera buckle surgery,[11] but there was still no reference data regarding to IOL power calculation in patient who received both scleral buckle and TPPV. The biometry data might be reliable in this patient because the cataract surgery was performed at 23 and 20 months after scleral buckle and TPPV, respectively (Table 2). However, our result needs confirmation by a large-scale study in the future.

Table 2
Surgical history timeline.

1993	Received RK surgery both eyes.
2005	Enhanced by LAISK both eyes.
2013/12	Scleral buckle due to retinal detachment in the left eye.
2014/03	Trans pars plana vitrectomy for macular pucker in the left eye.
2015/11	Cataract surgery in the left eye.

Patient consent

The written consent was obtained from the patient.

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Conflicts of interest

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Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2019.100495.

Table 1
Intraocular lens power calculated using formulas from ASCRS online calculator.

Condition	Formula	K measured by	IOL suggestion at target refraction −1.0D	Difference from the actual IOL power used (i.e., 23.0D)
Post myopic LASIK	Shammas	IOL master	23.50	+0.50
	Haigis-L	IOL master	22.96	−0.04
	Barrett True K No History	IOL master	22.58	−0.42
	Potvin-Hill Pentacam	Pentacam	21.71	−1.29
Post RK	Double K-modified Holladay 1 based on Oculus Pentacam[1]	Pentacam	21.00	−2.00
	Double K modified Holladay 1 based on IOL Master/Lenstar	IOL master	21.48	−1.52
	Barrett True K	IOL master	21.28	−1.72

Post-myopic LASIK parameters: IOL master cornea measurement: K1 = 35.83D, K2 = 36.33D, Axial length: 27.37mm, A constant of AAB00 on IOL master (SRK/T): 119, ACD by IOL master: 3.0mm, TNP_Apex_Zone40 value from the Pentacam: 34.75D.
Post-RK parameters: IOL master cornea measurement: K1 = 35.83D, K2 = 36.33D, Axial length: 27.37mm, A constant of AAB00 on IOL master (SRK/T): 119, ACD by IOL master: 3.0mm, Pentacam PWR_SF_Pupil_4.0mm Zone: 36.5D, CT_MIN: 544.

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