CASE REPORT

Myopic outcome after intraocular lens implantation in a patient who previously had small-incision lenticule extraction

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Introduction: This is a report of cataract surgery in a post–small-incision lenticule extraction (SMILE) patient with low myopia.

Patient and clinical findings: A 49-year-old man underwent bilateral SMILE 18 months previously, and the visual acuity of both eyes recovered to 20/20. The patient noticed a gradual reduction in visual acuity in his left eye and blurring for 3 months. The corrected distance visual acuity (CDVA) was 20/67 in his left eye.

Diagnosis, intervention, and outcomes: The slitlamp examination revealed an anterior subcapsular cataract. The intraocular lens (IOL) power was calculated by using a multiformula averaging method. A standard femtosecond laser–assisted phacoemulsification cataract surgery was performed and a trifocal IOL implanted. 2 months after IOL implantation, the uncorrected distance visual acuity of the left eye was 20/33, the autorefraction values were −1.37 −0.25 × 146, and the CDVA was 20/20.

Conclusions: This case report showed that current postrefractive IOL power calculation formulas or methods may lead to myopic outcomes in patients who previously received SMILE. A standard IOL calculation may be more suitable for such patients. Additional case studies are needed to accurately calculate IOL power after SMILE similar to laser in situ keratomileusis.

JCRS Online Case Rep 2022; 10:e00071 Copyright © 2022 The Author(s). Published by Wolters Kluwer Health, Inc. on behalf of ASCRS and ESCRS

The calculation of the appropriate intraocular lens (IOL) power after previously refractive surgery is still unresolved. Small-incision lenticule extraction (SMILE) is considered a new and effective corneal refractive surgical method after excimer laser surgery. The calculation of IOL power in patients who develop cataracts after SMILE is a new challenge. At present, Haigis-L formula, Barrett True-K No History formula, Shammas No History formula, ray-tracing method, and Mackool method are commonly used in clinics.

Ganesh et al. presented the first case report of cataract surgery in a post-SMILE patient with high myopia. In this article, to our knowledge, we report the first case of cataract surgery in a post-SMILE patient with low myopia.

Patient Consent Statement

Written consent was obtained from the patient to publish the details of the case. This study was approved by Beijing Aier Intech Eye Hospital and was conducted in accordance with the tenets of the Declaration of Helsinki. Informed consent to participate in this study was obtained from the patient.
refraction was CDVA improved to 20/20, and the spherical equivalent well recognized. The 3 main sources of prediction error in previously undergone keratorefractive surgeries has been the challenge of IOL calculation in patients who have DISCUSSION

tation, after which manifest aphakic refraction was per-
formed the next day (Table 2). After these procedures, the
IOL power was determined by averaging these 5 calculated
results.

We and other scholars have reported relatively satisfactory results of refraction in cataract surgery for postlaser in situ keratomileusis (LASIK)/photorefractive keratectomy (PRK) patients by choosing appropriate formulas. It is unclear that whether these formulas are useful to the patients after SMILE. But, several prospective studies have calculated the IOL power after SMILE. Luft et al. suggested that when using the ASCRS calculator for IOL power calculation after SMILE, the Barrett True-K/Masket formula (when a clinical history is available), and the Barrett True-K No History or Potvin-Hill formula (when a clinical history is unavailable) may provide the highest accuracy. Lazaridis et al. suggested that ray tracing yields the most accurate prediction for IOL power after myopic SMILE.

We also noticed that Wang et al. showed that the mean ratio of the posterior to anterior instantaneous radii of curvature was 0.76 ± 0.03 (0.69-0.83) in myopic LASIK/PRK eyes. In our case, the patient’s ratio was 0.775, which is similar to that in patients after LASIK/PRK. So, we applied those formulas to the patient, but the postoperative spherical equivalent refraction was −1.50 D, and it meant 1.00 D higher than we expected.

We analyzed several possible explanations for the myopic outcome in the case. First, measurement errors of the devices, which are difficult to avoid completely, are common causes for inaccuracy of IOL power calculation. Some studies showed that axial length measurement error was a key factor for IOL power calculation. There is a certain difference in the axial length measured by different devices for the case. Second, different formulas had calculation error, and it could have led to refractive error in this patient.

Third, the corneal curvature after treatment differs between patients who have undergone LASIK/PRK and those who have undergone SMILE. Zhang et al. compared the changes in refractive error and corneal curvature after SMILE and femtosecond laser-assisted LASIK (FS-LASIK) and found that SMILE had smaller corneal curvature changes than did FS-LASIK after 3 months (FS-LASIK 38.42 D and SMILE 39.44 D). Therefore, the patient might have retained a higher curvature after SMILE, which resulted in myopia.

Finally, there are some differences in the corneal Q value in between patients who have undergone SMILE and LASIK. Some studies have shown that SMILE has a smaller effect on the Q value. For all formulas and Q value measuring instruments, it was found that the larger the negative Q value is, the more myopic the refractive state is after cataract surgery. The patient who underwent SMILE

| Table 1. Four-formula Averaging Method. |
|--------------------------------------|
| **Formula** | **K measured by** | **IOL suggestion at target refraction 0.00 D** | **Difference from the actual IOL power used (ie, 21.00 D)** | **Difference from the IOL Power @emmetropia (ie, 19.00 D)** |
| Haggis-L | IOLMaster | 21.21 | +0.21 | +2.21 |
| Barrett True K No history | LENSTAR 900 | 20.97 | −0.03 | +1.97 |
| Shammas No History | LENSTAR 900 | 21.75 | +0.75 | +2.75 |
| Ray tracing | Sirius | 20.50 | −0.50 | +1.50 |
| Average value | — | 21.11 | +0.11 | +2.11 |

| Table 2. Modified Mackool Method. |
|----------------------------------|
| **Aphakic refraction** | **IOL suggestion at target refraction 0.00 D** | **Difference from the actual IOL power used (ie, 21.00 D)** | **Difference from the IOL power @emmetropia (ie, 19.00 D)** |
| +11.75 DS/0.00 DC | 20.56 | −0.44 | +1.56 |
had a larger negative Q value, which might also be another cause of postoperative myopia.

Of the 5 formulas or methods for IOL power selection used in this case (Tables 1 and 2), ray-tracing and modified Mackool method had the smallest refractive error in patients who previously received SMILE.

Moreover, we found that the standard IOL calculation formula seemed to be more accurate for this patient (Table 3), showing that the standard formula may be more suitable for post-SMILE patients with low myopia.

This case is unusual, and to our knowledge, the first case report of cataract surgery in a post-SMILE patient with low myopia. There are some limitations to this study. First, the calculated IOL power after refractive surgery is also related to individual differences, corneal biomechanics, laser cutting methods, and set parameters and age and other factors. Second, this is just a case report; therefore, additional large sample prospective studies are needed to find a more suitable method for calculating IOL power after SMILE. In conclusion, our report shows that, current postrefractive IOL power calculation formulas or methods may result in myopic outcome in patients with low myopia who previously received SMILE. However, this requires more cases to confirm and further improve the calculation accuracy in these patients.

### Table 3. Standard IOL Calculation Formula.

| Formula | K measured by | IOL suggestion at target refraction 0.00 D | Difference from the actual IOL power used (ie, 21.00 D) | Difference from the IOL power @emmetropia (ie, 19.00 D) |
|---------|---------------|---------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|
| SRK/T   | LENSTAR 900   | 19.05                                       | −1.95                                                  | +0.05                                                  |
| SRT/II  | LENSTAR 900   | 18.97                                       | −2.03                                                  | −0.03                                                  |
| Hoffer Q | LENSTAR 900   | 19.79                                       | −1.21                                                  | +0.79                                                  |
| Holladay | LENSTAR 900   | 19.38                                       | −1.62                                                  | +0.38                                                  |
| Haigis  | LENSTAR 900   | 19.38                                       | −1.32                                                  | +0.68                                                  |
| Barrett | LENSTAR 900   | 19.67                                       | −1.33                                                  | +0.67                                                  |
| Olsen   | LENSTAR 900   | 19.85                                       | −1.15                                                  | +0.85                                                  |
| Hill-RBF | LENSTAR 900   | 19.52                                       | −1.48                                                  | +0.52                                                  |

### WHAT THIS PAPER ADDS

- This is the first report, to the authors’ knowledge, to show that current postrefractive IOL power calculation formulas or methods may have resulted in myopic outcomes in patients with low myopia who previously received SMILE. A standard IOL calculation may be a better choice in such patients.

### DISCLOSURES

None reported.

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