Post-small incision lenticule extraction phacoemulsification with multifocal IOL implantation: A case report

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A 54-year-old patient presented with cataract, 5 years after undergoing SMILE for high myopia in both eyes. He was motivated in achieving spectacle free vision and his post SMILE-induced aberrations were minimal, due to which he was found suitable for a trifocal IOL implant. Of the various methods considered, the IOL power predicted by a novel combined telecentric keratometry and swept source OCT-based method was finally selected. One month post-operatively, the patient achieved a binocular UDVA of 20/20p and near vision of N.6, suggesting that newer IOL formulae could be superior in providing satisfactory outcomes in post refractive patients.

Key words: Multifocal IOL, post SMILE cataract, total keratometry

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With the increasing popularity of the minimally invasive Small Incision Lenticule Extraction (SMILE) procedure for myopia, the possibility of these patients presenting with cataract in the future is expected. Although the technology of tissue removal for myopia correction in SMILE is different from that of Laser *In Situ* Keratomileiusis (LASIK), i.e., femtosecond laser created corneal lenticule removal versus excimer laser ablation, the basic principle, i.e., flattening of the central cornea remains the same. Hence, it is suggested that calculating the IOL power in post-SMILE eyes may be no different from that of a post-LASIK scenario.

In this case report, we discuss the treatment planning and visual outcomes of a post SMILE case, who underwent bilateral cataract surgery with a multifocal IOL implantation using newer methods of biometry.

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Case Report

A 54-year-old male, presented in January 2018 with complaints of diminished vision and night glare, 5 years after undergoing SMILE for correction of high myopia (−9.5DS/−0.50DC @45° OD and − 10.0DS/−0.50DC @115° OS) in both eyes. Post SMILE, he was satisfied and achieved an uncorrected distance visual acuity (UDVA) of 20/20 OU.

On clinical examination, he had a nuclear sclerotic cataract of grade 2 OD and grade 1 OS. His Snellen's uncorrected vision had dropped to 20/80 OD and 20/40 OS. Subjective refraction was -2.75DS/−0.75DC @30° OD and − 2.0DS/−0.75DC @140° OS; which improved his CDVA to 20/32 OD and 20/25 OS. Fundus examination was unremarkable in both eyes. Patient was advised cataract surgery for both eyes and chances of refractive surprises due to potential biometry errors were explained.

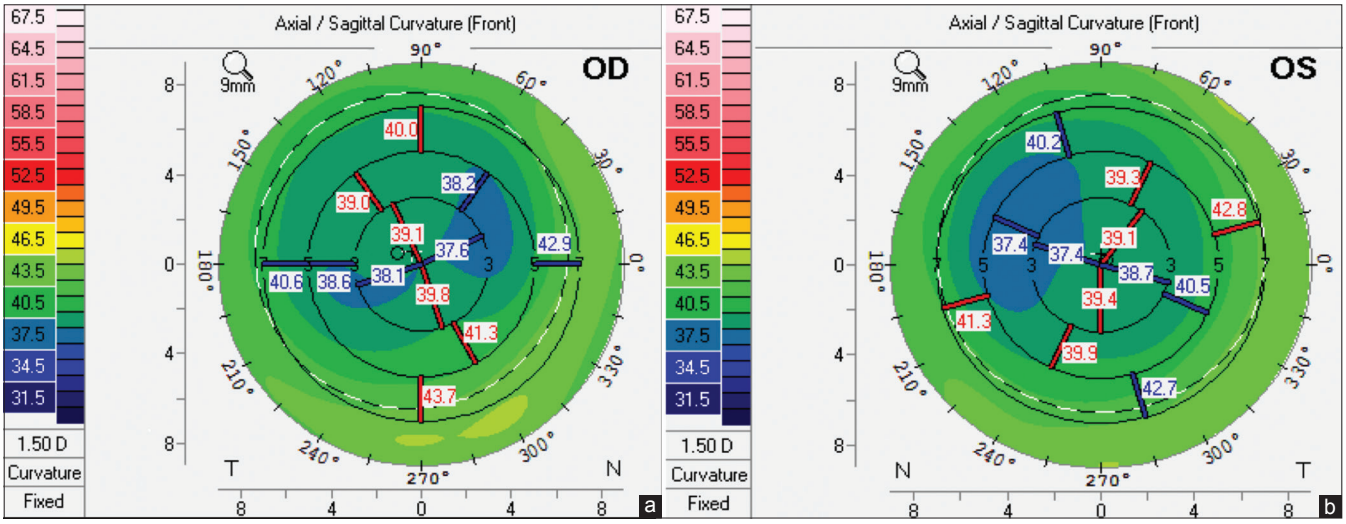

Figure 1: Post SMILE topography maps of right (a) and left (b) Eyes showing good central flattening

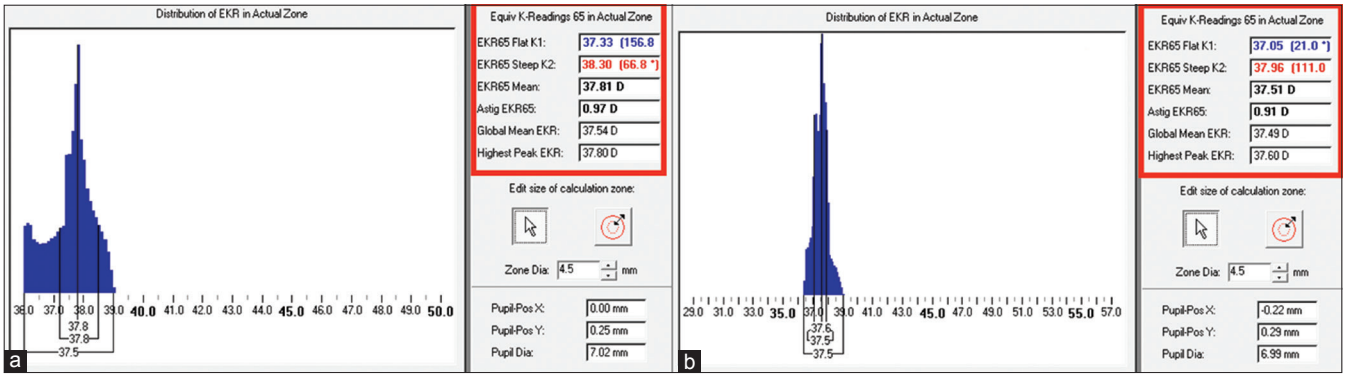

Figure 2: Holladay-EKR maps of right (a) and left (b) Eyes showing peak at 4.5 mm with good power distribution

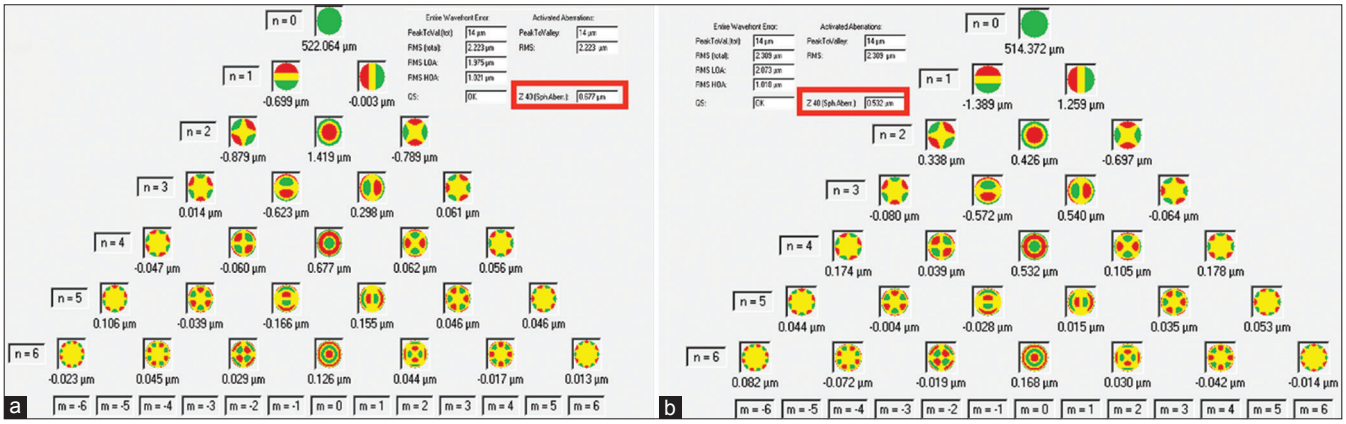

Figure 3: Zernike analysis map of right eye (a) and left eye (b) showing aberrations; Z (4,0) values OD 0.677µ and OS 0.532µ

Preoperative assessment included Scheimpflug imaging for topography and corneal aberrometry with the Pentacam® (Oculus Optikgeräte GmbH, Wetzlar, Germany), along with the IOLMaster® 700 (Carl Zeiss Meditec, Jena, Germany) for biometry.

Topography showed uniform central flattening with distinct peaks and regular keratometric distribution on Holladay-EKR report [Figs. 1 and 2]. Zernike analysis revealed positive spherical aberrations of 0.677 µ OD and 0.532 µ OS [Fig 3]. Considering the favorable topographic profile and patient's need for spectacle independence for all distances, a trifocal multifocal IOL (AT LISA TRI 839MP IOL, Carl Zeiss Meditec) was found suitable for implantation.

Various formulae were compared to predict the IOL power [Table 1], of which the EKR with Holladay II and TK® with Barrett Universal II, suggested close IOL powers for emmetropia [Table 2]. TK® with Barrett Universal II, was finally chosen and the patient received an implant of + 19.0 D OD and + 18.0 D OS.

One month poste-operatively, his binocular UDVA was 20/20p which improved to 20/20 with 0.00DS/+0.50DC @130° OD and +0.50DS/−0.50DC @160° OS, respectively. His binocular uncorrected near visual acuity was N6 and intermediate vision at 60 cm with ETDRS chart was LogMAR- 0.1. The patient was satisfied and spectacle free at all distances. He reported minimal haloes at night, which were acceptable, and is expected to improve with neuro-adaptation over time.

Discussion

LASIK and PRK have been shown to induce higher order aberrations, leading to reduction of contrast and visual quality.[1-3] Hence, there have been concerns about further reduction in image contrast with diffractive multifocal IOLs at the time of subsequent cataract surgery.[4] However, various studies have shown that SMILE may induce lesser higher order aberrations than LASIK/PRK,[1,5] thus making these eyes potentially more suitable for a multifocal IOL implant. The fact that for the degree of myopia corrected, our patient's post-op induced HOAs after SMILE were reasonably low, encouraged us to select a MFIOL implant in this case. The trifocal IOL chosen for this patient has been shown to provide good image quality, functional vision at all distances and contrast sensitivity under photopic and mesopic conditions within the normal range.[6-8]

It is known that achieving a predictable outcome after cataract surgery in eyes with prior history of LASIK/PRK can be challenging, due to fallacies in measuring true corneal power, accurately.[9-12] Similar challenge is expected in post-SMILE cases also. Various methods introduced for estimating the true corneal power in post LASIK eyes are included in various online calculators such as the ASCRS IOL calculator.[13-15] No single formula, however, has been found to outperform the others.

Total Keratometry® (TK®), available on the latest software update of the IOL Master® 700 is a new method for direct measurement of total corneal power [Fig 4]. By replacing assumptions and modelling with actual measurements, initial data indicates, that TK® may provide reliable corneal power in the challenging cases of surgically modified corneas.[16] To further optimize the benefit of TK®, Barrett *et al*., have recently developed two new formulae—the Barrett TK Universal II formula for non-toric and the Barrett TK Toric formula for toric IOLs, which is now available on the IOL Master® 700 2018 software update.[17]

We, however, used the TK® with Barrett's Universal II formula, as the dedicated formula to be used with TK (Barrett TK Universal II formula) was not available for commercial use when this case was planned. Moreover, we did not find a significant difference in the refractive predictability with TK® versus the keratometry values from the IOL Master® 700 for normal eyes in a pilot study (unpublished data).

To our knowledge, this is the first case reporting the outcomes of cataract surgery in a post SMILE patient. Through this case, we wanted to highlight some salient points which may be unique to the post SMILE cataract scenario. First, SMILE technology being different from excimer based procedures has been shown to result in a more favorable keratometric and aberrometric profile, as suggested by recent literature.[18-20] Our experience with the present case may suggest better suitability for MFIOL implants. Second, objective measurement of the true corneal power combined with newer generation IOL formulae, may help in achieving more predictable results.

Table 1: Recommended IOL powers by different formulae

Calculation Method	Recommended IOL power [D]	
Formulae requiring pre-refractive surgery data	OD	OS
Masket formula	+19.91	+19.63
Modified-Masket formula	+20.48	+20.32
Barrett True-K [With Prior History]	+19.70	+19.49
Formulae without the need of pre-refractive data		
Shammas No history formula	+20.66	+20.11
Haigis-L	+19.49	+18.95
Potvin-Hill Pentacam	+20.01	+19.45
Barrett True K [No History]	+19.74	+19.19
Holladay II with EKR	+18.54	+18.15
TK® with Barrett Universal II	+18.88	+18.03

Table 2: Predicted residual refractive error for implantation of the AT Lisa tri 839 MP

Calculation Method	Recommended IOL power [D]			
	OD	Residual refractive error	OS	Residual refractive error
Barrett True K [No History]	+19.5	+0.18	+19.0	+0.14
EKR with Barrett Universal II	+19.0	−0.09	+18.0	−0.08
TK® with Barrett Universal II	+19.0	+0.02	+18.0	+0.11

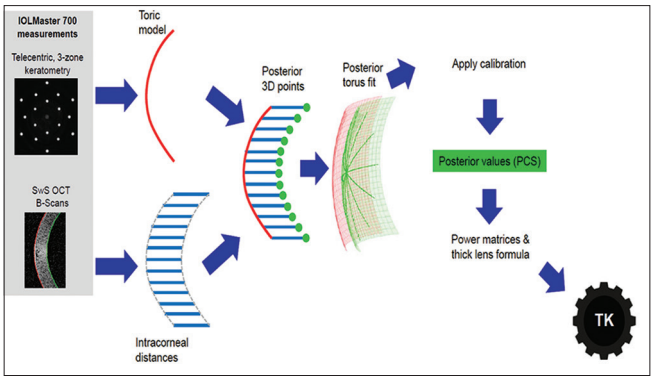

Figure 4: Principle of Total Keratometry (TK®) measurement. A toric surface model of the anterior surface of the cornea is plotted using a telecentric 3-zone keratometry, while a swept-source OCT measures corneal thickness in six different meridians. The posterior curvature is then calculated by fitting the anterior curvature to the corneal thickness. The addition of a proprietary calibration value to this posterior curvature makes the formula compatible with existing thick lens formulae[17] Courtesy, Carl Zeiss Meditec

The same formulae may also improve outcomes in post LASIK/PRK cases, however, the validity of the same needs to be verified. Although, based on one case, definite conclusions cannot be drawn and more data is required to establish a standard protocol, however, this case report being the first of its own kind, may provide some insight into this topic which is relatively new, with no prior information available.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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