Refractive Prediction Accuracy of Using Intraoperative Aberrometry or Advanced IOL Formula for IOL Determination in Post-myopic LASIK/PRK Eyes

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Introduction

- Accurate IOL power calculations are essential for achievement of optimal refractive outcomes following cataract surgery[1]
  - They are particularly challenging in post-refractive eyes due to the changed anterior corneal curvature[2–4]
  - Advanced preoperative IOL power calculation formulas such as Barrett True-K have been developed and have shown improved refractive accuracy[5]
- The ORA™ System is an intraoperative aberrometer for surgeons implanting IOLs[6] that:
  - uses Talbot–Moiré aberrometry[7]
  - measures the eye during surgery, after the corneal incisions have been made and the crystalline lens has been removed[6]
  - assesses total corneal astigmatism and the aphakic spherical equivalent to recommend an IOL power and confirm toric IOL cylinder power and axis of alignment[7,8]
- Intraoperative aberrometry facilitates surgeons in improving refractive outcomes in cataract surgery by using intraoperative information to refine IOL power selection and astigmatic treatment plans[6]
- Compared with standard preoperative calculations, intraoperative aberrometry has been shown to improve outcomes,[8] including in patients with prior refractive surgery[3] and those implanted with toric IOLs[2]

IOL, intraocular lens

1. Gatinel D *et al. Trans Vis Sci Technol* 2021;10:27; 2. Woodcock MG *et al. J Cataract Refract Surg* 2016;42:817; 3. Ianchulev T *et al. Ophthalmology* 2014;121:56; 4. Savini G & Hoffer KJ. *Eye Vis (Lond)* 2018;5:18; 5. Abulafia A *et al. J Cataract Refract Surg* 2016;42:363; 6. Alcon Vision LLC. Data on file. 2021; 7. Alcon Vision LLC. IOL Power Calculations with ORA Intra-operative Aberrometer. Data on file. 2021; 8. Cionni RJ *et al. J Cataract Refract Surg* 2018;44:1230

Purpose

- To demonstrate the effectiveness of intraoperative aberrometry, with respect to that of refractive outcomes, by comparing its APE with preoperative Barrett True-K formula back-calculated APE in post-myopic LASIK or PRK eyes

APE, absolute prediction error; LASIK, laser-assisted *in situ* keratomileusis; PRK, photorefractive keratectomy

Methods

- Retrospective analysis of the intraoperative aberrometry system database from multiple sites in the US
- Post-myopic LASIK or PRK eyes implanted with AcrySof® IOLs (SN60WF, SA60WF, SA60AT, and SN60AT) that met the inclusion and exclusion criteria: N=1067 eyes

Endpoints compared the APE values from intraoperative aberrometry* and those back-calculated using the preoperative Barrett True-K advanced IOL formula,† in all eyes and in first surgery eyes only:

- Difference in percentage of eyes with APE ≤0.50 D and APE ≤0.25 D
- Difference in mean and median APE

*The difference between the MRSE predicted intraoperatively for the IOL implanted and the MRSE achieved by the IOL implanted; †The difference between the MRSE predicted by the IOL formula used for the preoperatively planned lens and the MRSE that would have been achieved if the preoperatively planned IOL had been implanted, based on the MRSE achieved by the IOL implanted

APE, absolute prediction error; D, diopter; IOL, intraocular lens; LASIK, laser-assisted *in situ* keratomileusis; MRSE, manifest refraction spherical equivalent; PRK, photorefractive keratectomy

Alcon Vision LLC. Data on file. 2021

Patient Demographics: N=1067 eyes

Parameter		Mean (range*)
Lens model implanted (%)	SN60WF	79.1
	SA60WF	18.2
	SA60AT	1.8
	SN60AT	0.9
Number of postoperative days for refractive evaluation		44.9 (10–422)
Keratometry (D)		41.19 (34.96–48.10)
Axial length (mm)		25.41 (22.12–30.26)
Preoperative cylinder (D)		0.75 (0–4.68)
White-to-white distance (mm)		12.17 (10.57–13.50)
First surgery eyes (%)		84.1

*Unless otherwise stated; D, diopter
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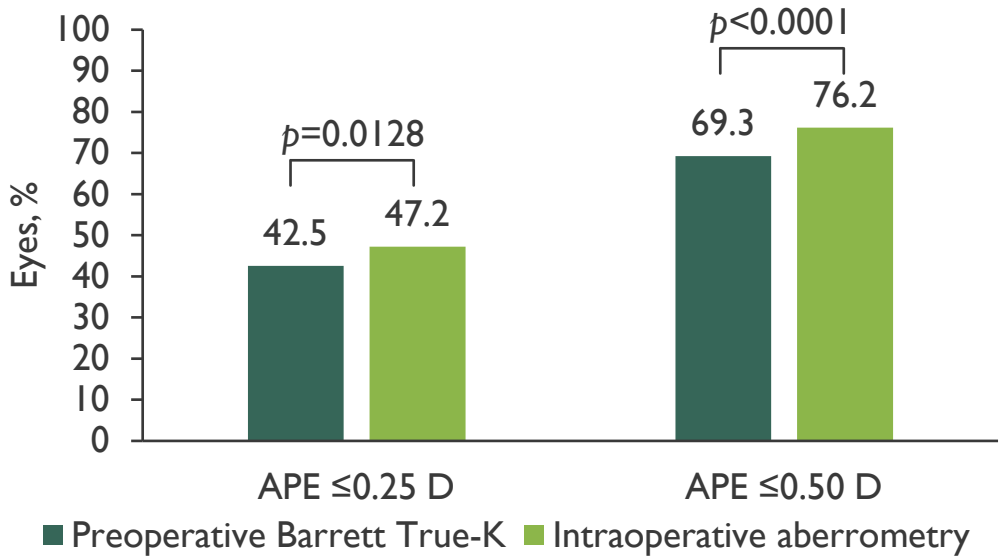
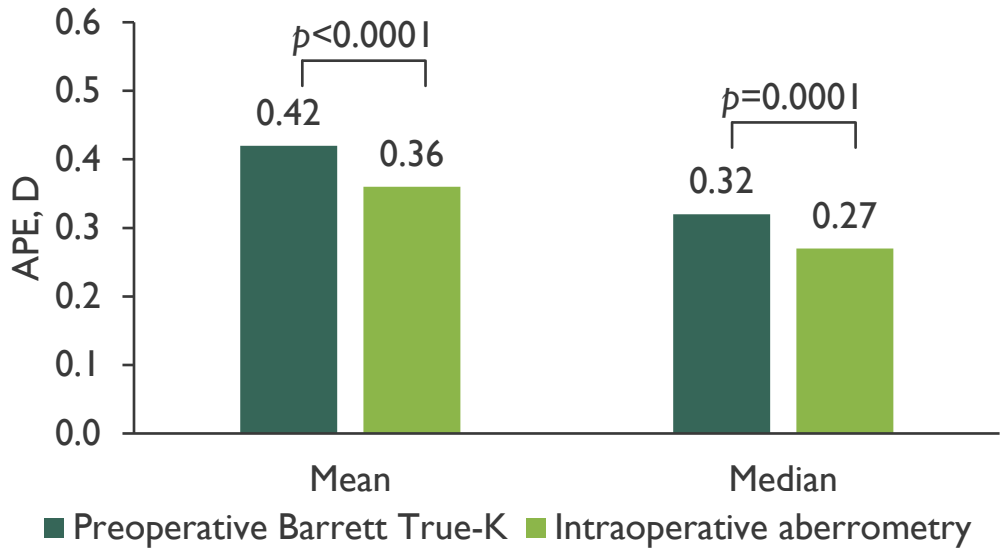
Comparison of APE Values Obtained through the Two IOL Power Calculation Methods: All Eyes (N=1067)

Proportion of eyes with APE ≤0.25 D or ≤0.50 D obtained through the two IOL power calculation methods



Mean and median APE values obtained through the two IOL power calculation methods



A significantly higher percentage of eyes had APE ≤0.25 D or ≤0.50 D using intraoperative aberrometry compared with preoperative Barrett True-K

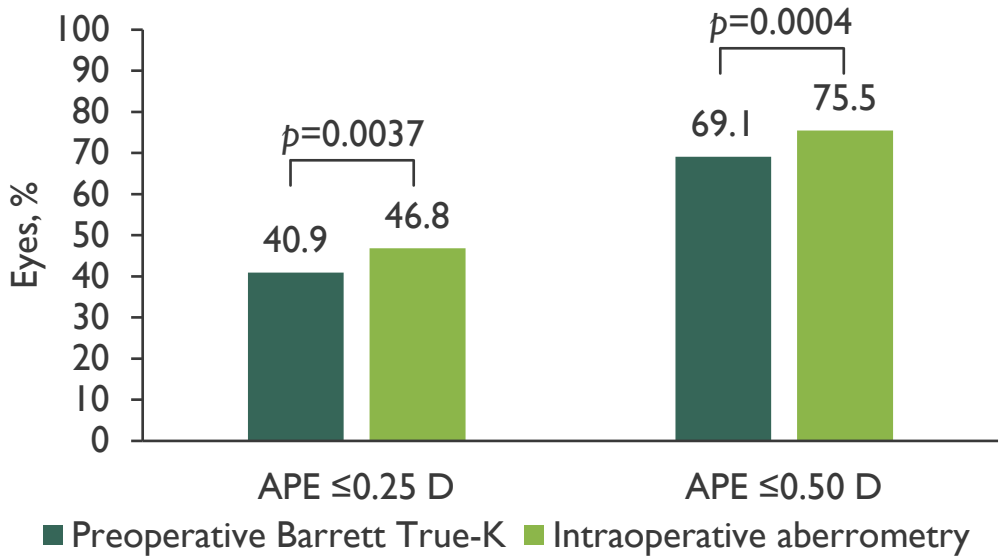
Superior (lower) mean and median APE values (paired differences of -0.06 D* and -0.02 D,† respectively) were achieved using intraoperative aberrometry compared with preoperative Barrett True-K

Paired difference refers to the *mean or †median of the paired differences between intraoperative aberrometry and preoperative Barret True-K for each eye. APE, absolute prediction error; D, diopter; IOL, intraocular lens

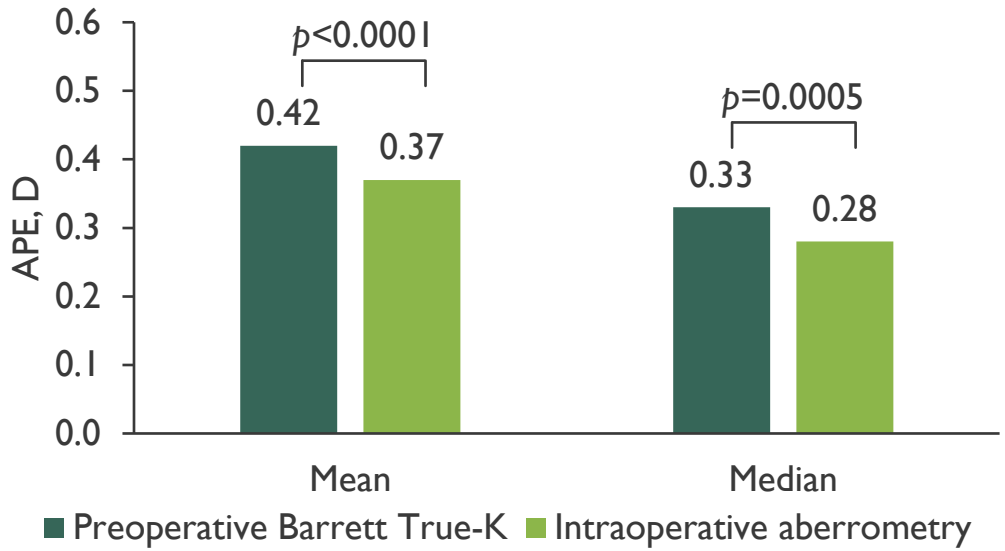
Alcon Vision LLC. Data on file. 2021

Comparison of APE Values Obtained through the Two IOL Power Calculation Methods: First Surgery Eyes Only (n=897)

Proportion of eyes with APE ≤0.25 D or ≤0.50 D obtained through the two IOL power calculation methods



Mean and median APE values obtained through the two IOL power calculation methods



A significantly higher percentage of first eyes had APE ≤0.25 D or ≤0.50 D using intraoperative aberrometry compared with preoperative Barrett True-K

Superior (lower) mean and median APE values (paired differences of -0.06 D* and -0.03 D,† respectively) were achieved using intraoperative aberrometry compared with preoperative Barrett True-K

Paired difference refers to the *mean or †median of the paired differences between intraoperative aberrometry and preoperative Barret True-K for each eye. APE, absolute prediction error; D, diopter; IOL, intraocular lens

Alcon Vision LLC. Data on file. 2021

Discussion and Conclusion

- In this first large study comparing the two IOL calculation methods in post-myopic LASIK or PRK eyes, intraoperative aberrometry produced significantly more accurate spherical equivalent outcomes than the preoperative Barrett True-K advanced IOL formula
- Possible reasons for this are:
  - Real-time IOL power calculation information is provided during the aphakic measurement phase[1]
  - Axis positioning for toric IOLs is provided during the pseudophakic phase[1]
  - Postoperative data entered in the AnalyzOR™ secure database facilitates global and surgeon-specific lens constants optimization for IOL power calculation[2–4] without cumbersome calculations by the surgeon[4]

IOL, intraocular lens; LASIK, laser-assisted *in situ* keratomileusis; PRK, photorefractive keratectomy

1. Cionni RJ *et al. J Cataract Refract Surg* 2018;44:1230; 2. Alcon Vision LLC. Data on file. 2021; 3. Alcon Vision LLC. IOL Power Calculations with ORA Intra-operative Aberrometer. Data on file. 2021; 4. Blaycock JF & Hall B. *Clin Ophthalmol* 2020;14:4373