

Comparison of Two Swept-Source OCT Biometry Devices



The ANTERION Cataract App showed high agreement with the IOLMaster 700.

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The commercial introduction of swept-source OCT has allowed us to achieve higher precision and accuracy in IOL power calculation and to provide patients with increased refractive accuracy after cataract surgery. Swept-source OCT, which uses a wavelength laser source to scan the eye, has been shown to have better tissue penetration compared to partial coherence interferometry (PCI) technology.¹⁻⁴ To date, the gold standard in swept-source OCT is the IOLMaster 700 (Carl Zeiss Meditec); however, other biometry devices, including the ANTERION (Heidelberg Engineering), are capable of producing repeatable and reproducible measurements that are in line with the quality of measurements obtained with the IOLMaster 700.

OVERVIEW

The ANTERION is a multimodal imaging platform optimized for a wide range of applications. It uses the power of high-resolution swept-source OCT imaging to complete the examinations and measurements necessary in anterior segment surgery in one upgradeable platform. It is capable of performing topography, corneal tomography, anterior segment metrics, axial length measurements, and IOL calculations. The ANTERION automatically segments the anatomy boundaries of the anterior segment and detects the retinal pigment epithelium (RPE) peak, but it also allows physicians to manually adjust these when necessary.

The ANTERION comes standard with the *Imaging App*, which can be used to visualize the entire anterior segment using a

relatively long wavelength (1,300 nm) and a resulting optimized laser light penetration depth. It can be used to examine various anterior segment structures, including the sclera, ciliary body, and rectus muscles. The *Imaging App* includes customizable scan patterns and can also be used for anterior chamber and angle imaging, corneal and scleral imaging, and peripheral imaging.

The ANTERION platform can also be upgraded to include three additional applications: the *Cornea App*, which performs corneal tomography and topography, pachymetry, total corneal power, corneal wavefront analysis, corneal differential maps, and progression analysis; *Cataract App*, which is described in the accompanying sidebar; and *Metrics App*, which performs anterior chamber angle assessment, 360° graphs of angle parameters, anterior chamber volume, and lens vault and thickness. It also allows free-hand measurements. Combined, the innovative OCT technology of the ANTERION helps streamline cataract and refractive surgery and can also aid in the management of corneal diseases and glaucoma.

This article focuses on the *Cataract App* and discusses results from a recent retrospective study comparing the ANTERION Cataract App with the IOLMaster 700. In short, we found that the ANTERION Cataract App showed good correlation and agreement of critical parameters for IOL power calculation with the IOLMaster 700 and similar mean values for all investigated parameters, which are detailed here.

RETROSPECTIVE STUDY

We recently conducted a retrospective study to compare the biometric measurements of two swept-source OCT devices with relevant functions in preoperative cataract surgery examinations.

A total of 209 patients (389 eyes) scheduled for cataract surgery were enrolled in the study. Those with nystagmus, physical disabilities that could interfere with fixation during measurements, corneal pathologies such as keratoconus, previous ocular surgery, and macular pathologies that could compromise fixation were excluded from the study. All procedures were performed at Hanusch Hospital in Vienna, Austria between June and July 2019, and all measurements (keratometry [K], central corneal thickness [CCT], anterior chamber depth [ACD], lens thickness [LT], and axial length [AL]) were performed with the ANTERION Cataract App and the IOLMaster 700. Both eyes were measured in 180 patients, and only one eye was measured in 29 patients. All patients were instructed to blink in between measurements in order to optimize the tear film.

RESULTS

Keratometry. The mean K readings for the ANTERION and IOLMaster 700 were 7.82 ± 0.26 and 7.80 ± 0.26 mm, respectively

THE ANTERION CATARACT APP

Combining key measurements for cataract surgery planning, the optimized swept-source OCT technology of the ANTERION Cataract App allows accurate measurements even through dense cataracts, and the addition of total corneal power ensures optimal IOL selection. The full functions of the App include:

- ▶ Axial length
- ▶ Lens thickness
- ▶ Aqueous depth
- ▶ Central corneal thickness
- ▶ Anterior axial curvature
- ▶ Total corneal power
- ▶ Total corneal wavefront
- ▶ Spheric and toric IOL calculator
- ▶ SRK/T, Haigis, Holladay I, Hoffer Q, Barrett Universal II, Barrett Toric, Barrett True-K, and Barrett True-K Toric IOL power formulas
- ▶ ULIB import
- ▶ IOL CON import
- ▶ Okulix interface

(Figure). This difference between devices was statistically significant ($P < .0001$); however, it can be attributed to the various measurement zones used by each device, it is not clinically relevant, and it is consistent with studies comparing the IOLMaster to other biometry devices.⁴⁵ The mean arithmetic difference in K was -0.02 ± 0.06 mm (95% limits of agreement [LOA], -0.14 to 0.10), and the mean absolute difference between the two devices was 0.04 mm ($P < .0001$).

Vector analysis. The mean J0 value for the ANTERION and IOLMaster 700 devices was 0.31 ± 0.30 and 0.31 ± 0.28 D, respectively (mean arithmetic difference, -0.04 ± 0.62 D; 95% LOA -1.26 to 1.17). The mean absolute difference between the two devices was 0.01 D. At J45, the mean values were 0.29 ± 0.29 and 0.32 ± 0.30 D, respectively (mean arithmetic difference, 0.00 ± 0.60 D; 95% LOA -1.17 to 1.17). The mean absolute difference between the ANTERION and IOLMaster 700 was 0.02 D.

Central corneal thickness. The ANTERION produced slightly thinner CCT values compared with the IOLMaster 700. Although this is not an important parameter for IOL power calculation, it could be useful in glaucoma diagnosis and refractive surgery examinations. The mean value with both devices was 547.86 ± 32.05 and 553.52 ± 33.38 μ m, respectively. The mean arithmetic difference between the two devices, 5.66 ± 6.00 μ m, was statistically significant ($P < .0001$). The mean absolute difference was 6.47 μ m (95% LOA -6.10 to 17.42).

Anterior chamber depth. With the ANTERION, the mean ACD was 3.20 ± 0.42 mm, and with the IOLMaster 700 it was 3.13 ± 0.43 mm. This difference between devices was statistically significant but, again, not clinically relevant. Further, we do not consider the measurements with the two devices to be interchangeable because the ANTERION measures anterior aqueous depth whereas the IOLMaster 700 measures ACD. The mean arithmetic difference between the two devices was -0.07 ± 0.04 mm (95% LOA -0.16 to 0.01), and the mean absolute difference was 0.07 mm.

Lens thickness. The mean LT with the ANTERION and the IOLMaster 700 was 4.65 ± 0.43 and 4.59 ± 0.43 mm, respectively. The difference between the devices was statistically significant; previous studies have shown that an increase of 0.2 mm in LT impacts approximately 0.20 D in the final IOL power calculation.^{3,4} The mean arithmetic difference between the devices was -0.06 ± 0.06 mm (95% LOA -0.17 to 0.05), whereas the mean absolute difference was 0.07 mm.

Axial length. The ANTERION produced a mean value of 23.54 ± 1.18 mm and the IOLMaster 700 a mean value of 23.55 ± 1.18 mm. The mean arithmetic difference between the two was statistically significant (0.01 ± 0.03 mm; 95% LOA -0.04 to 0.06). However, the measured mean difference (0.01 mm) would lead to a 0.03 D error, which can be considered negligible on the final refractive outcome. The mean absolute difference was 0.02 mm ($P < .0001$).

Swept-source OCT, which is performed at longer wavelengths than standard OCT, provides excellent tissue penetration and improves the likelihood of acquiring successful AL measurements in a higher percentage of eyes. Both devices used in this study obtained AL measurements in all eyes enrolled in the study; however, 14 eyes (13 patients) required manual correction of RPE peak, a function that is only available with the ANTERION.

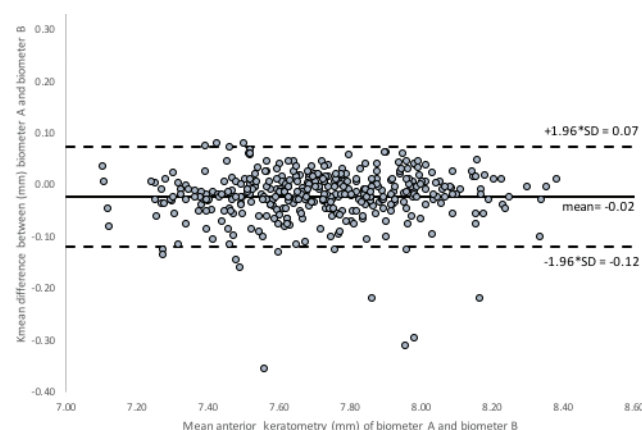


Figure. Mean anterior keratometry with the ANTERION and IOLMaster 700 biometers.

These eyes were therefore excluded from the study. Additionally, in eight eyes, there was a difference between the ANTERION and IOLMaster 700 that ranged from 0.11 to -0.11 mm. In these outliers, the ANTERION measured a slightly longer AL (25.33 ± 2.00 mm vs 25.29 ± 2.12 mm, respectively). Four of these eyes were myopic, and the other four did not have remarkable ocular findings.

In short, good agreement was found between the ANTERION and the IOLMaster 700 in terms of K readings, CCT, and AL—the critical parameters for IOL power calculation. There was a minor offset for ACD and LT. Although some of the differences between the devices were statistically significant, they were so small that they can be considered as not clinically relevant.

CONCLUSION

To our knowledge, ours was the first study to compare the ANTERION and IOLMaster 700. Previous studies have shown good agreement between the IOLMaster 700 and other swept-source OCT, PCI,^{1,2,6} and OLCR⁶⁻¹⁰ biometry devices, and now our study showed good agreement and correlation with the ANTERION. ■

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