

SEGMENTED AXIAL LENGTH MEASUREMENT IN CATARACT PATIENTS



Two studies examined the acquisition success and refractive accuracy of swept-source OCT-based biometers using traditional settings versus sum-of-segments.

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REFRACTIVE ACCURACY OF THE NEW BARRETT FORMULA USING SEGMENTED AXIAL LENGTH COMPARED WITH THAT OF THE TRADITIONAL BARRETT UNIVERSAL II FORMULA

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ABSTRACT SUMMARY

This retrospective observational study compared the refractive accuracy of the Barrett True Axial Length (BTAL) formula integrated into the Argos biometer (Alcon) with that of the Barrett Universal II (BUII) formula calculated using the AL measurements obtained with the IOLMaster 700 (Carl Zeiss Meditec).

Researchers assessed 209 eyes of 209 patients who underwent cataract surgery with the Clareon IOL (model SY60WF, Alcon). Patients who had corneal disease, greater than 1.25 D of corneal astigmatism, or limited visual potential were excluded.

Refractive prediction errors (RPEs) for the BTAL, the BUII with the Argos

STUDY IN BRIEF

▶ A retrospective study demonstrated the noninferiority of the Barrett True Axial Length formula compared to the Barrett Universal II formula in terms of refractive outcome.

WHY IT MATTERS

Swept-source OCT using devices such as the IOLMaster 700 (Carl Zeiss Meditec) and OA 2000 (Tomey) is currently the standard method for axial length (AL) measurement. These machines use equivalent refractive indices to measure composite AL. Newer biometers use segmented refractive indices (cornea, crystalline lens, vitreous) to measure AL. Studies have suggested that the Barrett Universal II formula can yield hyperopic surprises in short eyes and myopic surprises in long eyes when the AL is derived from a segmented measurement. The Barrett True Axial Length is the first IOL calculation formula specific to segmented AL measurements.

(segmented BUII), and the BUII with the IOLMaster 700 were compared. The BTAL demonstrated noninferiority to the composite BUII in absolute RPE. Compared to the BTAL, the use of segmented BUII produced slightly more hyperopic and more myopic outcomes in shorter and longer eyes, respectively.

DISCUSSION

The BUII is widely used to calculate

the RPE, whereas the BTAL is specifically designed to use segmented AL measurements. The study demonstrated the noninferiority of the BTAL compared to the BUII and provided support for the BTAL's use for both short and long eyes.

Patients with extremely long eyes (AL > 28 mm) were excluded from the study, and refractive error measurement was limited to 1-month follow-up.

COMPARISON OF ACCURACY AND AXIAL LENGTH ACQUISITION SUCCESS RATE BY THREE TYPES OF SWEEP-SOURCE OCT-BASED BIOMETERS

Kato Y, Ayaki M, Tanaka Y, et al²

Industry support for this study: None

ABSTRACT SUMMARY

This retrospective observational study compared three biometers equipped with swept-source OCT:

the Argos (OCTB1), the IOLMaster 700 (OCTB2), and the Anterior (Heidelberg Engineering; anterior segment [AS] OCTB). The primary aim was to evaluate the AL acquisition success rates. Secondary

aims included comparing parameters obtained with the SS-OCT devices and assessing postoperative RPEs.

The AL acquisition success rates across all patients, including those with dense cataracts, were 100%, 98.6%, and 96.7% with OCTB1, OCTB2, and AS-OCTB, respectively. The AL acquisition success rates for eyes with grade 4 or worse nuclear sclerosis was 100% for OCTB1 and 87.8% for both OCTB2 and AS-OCTB. The higher acquisition rate for OCTB1 was attributed to activation of the enhanced retina visualization mode in five difficult cases (eg, white or grade 5 mature cataracts that were not measurable with the other devices).

When comparing differences in measured AL pre- and postoperatively, OCTB1 showed no significant difference, whereas OCTB2 and AS-OCTB both measured shorter AL postoperatively. This difference was thought to be related to the AL calculation methods used by the different machines.

DISCUSSION

OCTB1 uses the sum-of-segments approach, whereas the other two devices perform traditional AL measurements. Despite the differences in calculation methods, mean AL values were statistically similar across the three devices. Only OCTB1, however, showed no significant change in AL before and after cataract surgery, suggesting higher measurement stability. OCTB2 and AS-OCTB measured slightly shorter ALs postoperatively, potentially introducing an error in IOL power prediction. Whereas OCTB1 and OCTB2 use wavelengths of 1,060 and 1,055 nm, respectively, AS-OCTB uses a wavelength of 1,300 nm, which decreases light transmission through the vitreous and subsequently lowers AL acquisition success.

Significant differences were observed in keratometry, anterior chamber depth, lens thickness, and corneal diameter among the devices. OCTB1 had the steepest keratometry readings and deepest anterior chamber depth values. AS-OCTB measured the

highest lens thickness, and OCTB2 had the largest corneal diameter measurements. These variations were not found to affect the postoperative refractive outcomes, because the mean RPEs did not differ significantly across all devices using the BUII formula and a single IOL model (SN60WF) with a lens factor of 1.94. The postoperative RPE—assessed at 1 month postoperatively—was defined as the difference between the subjective refractive error and predicted refractive error.

Kato and colleagues noted the exclusion of patients with poor fixation. The study was performed at a single center with Japanese patients. Further multicenter studies are warranted to explore device performance across broader patient demographics and in individuals with other ocular comorbidities or media opacities, including vitreous opacities. ■

1. Hata S, Kobayashi M. Refractive accuracy of the new Barrett formula using segmented axial length compared with that of the traditional Barrett Universal II formula. *J Cataract Refract Surg.* 2025;51(4):294-299.
2. Kato Y, Ayaki M, Tanaka Y, et al. Comparison of accuracy and axial length acquisition success rate by three types of swept-source OCT-based biometers. *J Cataract Refract Surg.* 2025;51(4):287-293.

STUDY IN BRIEF

- A retrospective observational study compared the performance of three swept-source OCT-based biometers: the Argos (OCTB1; Alcon), IOLMaster 700 (Carl Zeiss Meditec), and Anterior (Heidelberg Engineering) with respect to axial length (AL) acquisition success rates, measurement accuracy, and postoperative refractive prediction error. The OCTB1 had the highest AL acquisition success rate and could measure AL even in eyes with a dense cataract.

WHY IT MATTERS

The superior AL acquisition capability of the OCTB1 was attributed to the device's use of a sum-of-segments AL formula and enhanced retinal visualization mode. The biometer could thus be a workhorse in practices that have a high volume of mature or hyperdense cataracts.

Although some individual differences were noted in measurement parameters, overall refractive predictions were consistent across biometers. This suggests that, for routine cases, the choice of device may be of less significance. Accurate AL measurements are critical for achieving optimal refractive outcomes in cataract surgery, especially as patients increasingly expect postoperative spectacle independence.

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