Differences Between the Estimated and Scheimpflug Image-Measured Axial Intraocular Lens Positions and Their Relation to Refractive Error After Cataract Surgery

One of the main goals of cataract surgery is to achieve the planned postoperative refraction, thus minimizing the prediction error to prevent large refractive surprises. Uncertainty of the postoperative intraocular lens (IOL) position (described by postoperative anterior chamber depth [ACD]) is one of the unavoidable errors that arise when planning the diopter of the IOL. It can cause a postoperative refraction error of up to 0.75 diopter (D)\(^1,2\) and account for 22% to 38% of the refractive prediction error,\(^3\) depending on the axial length and formula used for the calculation.\(^2\)

Our aim was to analyze the differences between preoperatively measured, postoperatively measured, and “formula-estimated ACDs” to assess the relationship between these differences and the postoperative subjective refractive error.

The same type of SRK/T formula-calculated IOLs (Ar40e; Abbott Medical Optics, Inc., Santa Ana, CA) were implanted during cataract surgery in 102 eyes of 102 patients (age range: 36.2 to 87.5 years), with a target refraction of almost zero. Three photographs were taken with the Pentacam HR (Oculus Optikgeräte, Wetzlar, Germany) to record the external ACD, which was repeated postoperatively for a minimum of 8 weeks. The visual acuity and refractive error were determined with a subjective visual acuity test. The subjective diopter deviation from the planned postoperative refractive outcome was identified as the “refraction error.” The difference between the postoperatively and preoperatively measured ACD was calculated in all cases. Next, we calculated the estimated ACD using the SRK/T formula, which we called the “formula-estimated ACD” (referring to effective lens position). We then subtracted the postoperatively measured ACD from the “formula-estimated ACD” and called it the “ACD estimation error.”

The “ACD estimation error” had a median of -0.58 mm. The subjective refraction error was within ±0.25 D in 68.63% of cases and 0.25 or 0.5 D in 20.59% of cases. The differences between the different ACD values are presented in Bland–Altman graphs (Figure 1). The correlation between the axial length and preoperatively measured ACD was significant (r = 0.31, \(P < .001\)), as was the correlation between the axial length and preoperatively calculated “formula-estimated effective lens position” (r = 0.56, \(P < .001\)). The correlation was not significant between the axial length and the “ACD estimation error” (r = -0.12, \(P = .21\)) or between the “ACD estimation error” and the subjectively measured refraction error (r = 0.12, \(P = .26\)).

The main reason for the unwanted refractive error after cataract surgery is the incorrect prediction of the postoperative axial position of the IOL.\(^4\) The main finding of our examinations is that the deviation from the “formula-estimated ACD” is large, whereas the range of the subjective residual refraction error is small. Moreover, we could not find any significant correlation between the “ACD estimation error” and this subjective refraction error. We concluded that the error involved in performing subjective refraction also

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**Figure 1.** Difference in anterior chamber depth (ACD) between (A) preoperative and (B) postoperative ACD values and estimated ACD by the SRK/T formula against their mean (Bland–Altman plot).
plays a role in the total prediction error, as previously suggested.\textsuperscript{5} It is also partly explained by the patients’ differing tolerances to defocusing and blur acceptance. Other factors (eg, pupil diameter and capsular- and age-related factors) can influence the refractive results, suggesting that these are not just ACD estimation errors.

Error in the prediction of the effective lens position can move within a broad range without influencing the subjective postoperative refractive result.

REFERENCES


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