Improving Second-Eye Vaulting in Deferred Bilateral Implantable Collamer Lens Surgery

We read with great interest the paper by Russo et al in the May 2024 issue.[1] Their study assessed the clinical outcomes and safety profiles of patients who underwent immediate sequential bilateral phakic intraocular lens (pIOL) surgery.

The article makes a notable comparison between sequential bilateral cataract surgery and Implantable Collamer Lens (ICL) surgery. ICL surgery has proven to be extraordinarily safe regarding intraoperative complications, with highly predictive and consistent refractive outcomes, as highlighted by Russo et al. Although the advantages of immediate sequential bilateral surgery are clear, this focus may divert attention from the critical issue in pIOL surgery: lens sizing, the true battleground of this surgery, and our "last frontier."

In a study published in 2018, we assessed vault and the decision-making process involved in selecting the lens size for the fellow eye in a series of patients who received bilateral pIOL implants for myopia correction.[2] The study included 269 patients who underwent bilateral ICL insertion at different days. The decision to change the size of the pIOL in the fellow eye was made in 25 patients (ratio: 1/9.3 patients), including patients with 4 first-implanted eyes with central vaults below 100 µm and 5 eyes with vaults greater than 1,000 µm. A smaller ICL size was implanted in the second eye in 9 patients, whereas a larger pIOL was necessary in 16 patients. Despite no lenses needing to be explanted, these decisions enabled a safer vault value for the second eye in all cases (**Figure 1**).

When implanting the same size of pIOL in both eyes, it is reasonable to expect similar vault values, because the biometric parameters of the anterior segment are typically similar in the same individual. In a recent study, Martínez-Plaza et al[3] found that the vault of the first implanted eye at the 1-day visit highly predicts the vault of the second eye (R^2 = .87; P < .001). They concluded that the vault in the first implanted eye 1-day postoperatively allows for highly anticipating the vault in the fellow eye, providing an excellent reference for surgeons to reconsider the ICL size in the second eye before implantation.

As mentioned in the study, unfortunately to date, none of ICL sizing formulas have achieved the predictability that refractive surgeons desire. Regardless of the formula used, we have outliers that compromise the safety of the operated eyes. In the article by Russo et al, the probability of low vaulting in the second eye, following low vaulting in the first eye, was 67%, and the probability of high vaulting in the second eye, given its occurrence in the first eye, was 35%. Although the advent of the central port has given us greater tolerance to inadequate vaults, we should not be complacent about tolerating these results. Furthermore, we should not allow unsatisfactory sizing results to be reproduced in the second eye. Therefore, we firmly maintain that although the vault in the first eye may be outside the expected range, this should not happen in the second eye in bilateral surgeries, especially when we have the powerful tool of separating the two surgeries on different days.

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Disclosure: FG-L is a research consultant for STAAR surgical and TOMEY corporation. The remaining authors have disclosed no potential conflicts of interest, financial or otherwise.

doi: 10.3928/1081597X-20240717-02

Reply

We appreciate the comments by Gonzalez-Lopez et al and their interest in our study.[1] We agree that issues related to phakic intraocular lens (pIOL) sizing remain a significant challenge in bilateral pIOL surgery.

To clarify, the reported 67% probability of hypovault in the second eye, given its occurrence in the first eye, is accurate but must be understood within the context of the overall sample characteristics. As we stated in our article, only 16% of the eyes in our sample exhibited hypovault. Therefore, the probability of hypovault occurring in both eyes across the

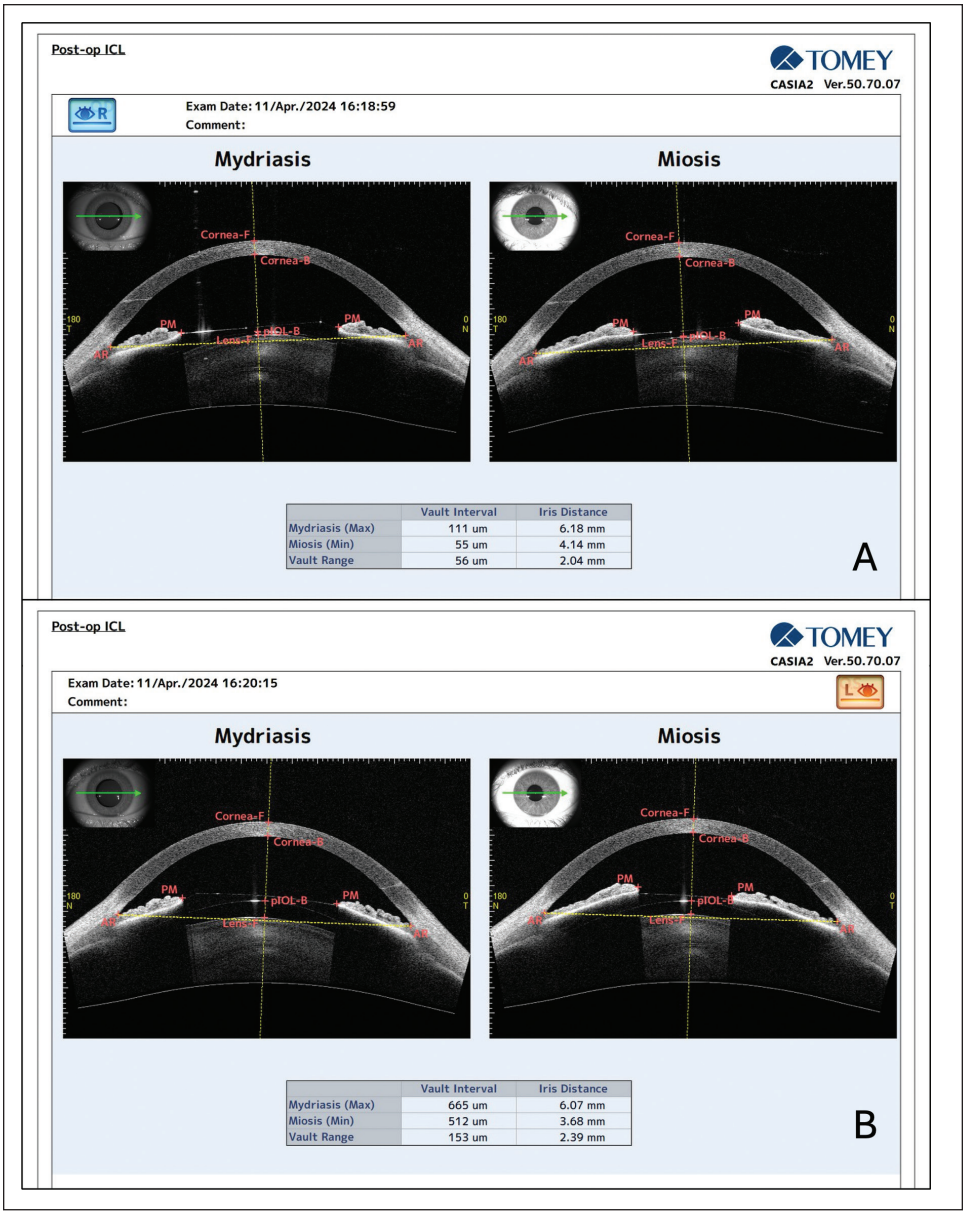

Figure 1. Images obtained from the Post-op ICL application of the AS-OCT CASIA2 (Tomey Corporation) showing the dynamic vault of a patient who underwent bilateral Implantable Collamer Lens (ICL) implantation with a 3-day interval between the surgeries. (A) In the first eye, a 12.6-size ICL was implanted. (B) In the second eye, a decision was made to implant a larger lens, size 13.2.

entire sample is 12.5%, which is consistent with our findings. This distinction is essential for accurately interpreting the risk assessment presented.

Similarly, the 35% probability of experiencing hypervault in the second eye if it occurred in the first eye is also accurate. However, only 7% of the eyes in the sample exhibited hypervault. This indicates that, when considering the entire sample, the probability of experiencing hypervault in both eyes is 3%.

We would like to reiterate that our study's primary finding—that the risk of incorrect sizing can be mitigated with adequate analysis and standardization—remains robust and supported by our data. Notably, considering the entire dataset of 176 patients, only 16% exhibited a vault value outside the optimal range of 250 to 750 µm in both eyes. However, central vaulting is not the sole parameter to consider during follow-up. Values outside this range can still be deemed safe if the angle is larger than 20 degrees and there is sufficient distance between the crystalline lens and the pIOL.[2,3] Additionally, a trend of decreasing vaulting over time has been extensively reported,[4,5] potentially weakening early postoperative decisions based on hypervault. In cases of hypervault, the surgeon might consider rotating the pIOL, because no significant differences were observed between the mean vault achieved after rotating the lens in the first eye or after implanting a smaller lens in the fellow eye, as reported by Gonzalez-Lopez et al.[6]

We trust that with the next generation of pIOL formulas, based on anterior segment ultrasound and OCT together with machine learning,[7-9] the predictability for pIOL sizing will further improve.

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Funding: The contribution of I.R.C.C.S. – G.B. Bietti Foundation was supported by Fondazione Roma and the Italian Ministry of Health

Disclosure: The authors have disclosed no potential conflicts of interest, financial or otherwise.

doi: 10.3928/1081597X-20240723-01