Comparison of Visual Performance between Image-Guided and Non-Image-Guided Implantation of an X-WAVE Extended Depth-of-Focus IOL

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Purpose – Setting - Methods

Purpose

- To compare the postoperative visual acuity curves between image-guided and non-image-guided implantation of an X-WAVE Extended Depth-of-Focus (xEDOF) intraocular lens (IOL)

Setting

- Department of Ophthalmology, University Hospital of Alexandroupolis, Greece
- January 2024 and December 2024

Methods

- Prospective, comparative study
- Stage 2 LOCS-III Cataract patients populated two study groups:
  1. the **image-guided Group (IMG)**, who received the xEDOF Vivity IOL (Alcon, FortWorth, TX) using the Image-Guided System VERION (Alcon)
  2. the **non-image-guided Group (nIMG)**, who received the xEDOF Vivity IOL without using an Image-Guided System
- Postoperative monocular uncorrected vision acuity (UVA) was measured using the ETDRS mode of the DDARTVC visual acuity test [1-3] at:
  25.5, 28, 33, 40, 50, 66, 100, 200, and 300 cm distances
- *Spline curve fitting* was performed, and *areas of the curves (AoC)* were calculated.
- *IOL centration*: evaluation of the IOL alignment with the visual axis
  - A postoperative reference image was obtained with Argos (ensuring that the central ring of the Vivity IOL was visible) → it was then imported into the VERION Digital Marker (intraoperative unit)
  - The visual axis was identified with VERION Image-Guided System, captured as a screenshot, and marked on the Argos reference image.
  - The distance between the center of the Vivity central ring and the visual axis was measured.
  - Considering that the central ring of the Vivity IOL has a diameter of 2.2 mm, the visual axis was defined as being within the area of the central ring if the distance between the visual axis and the IOL ring center was < 1.1 mm, corresponding to the radius of the central ring.

[1] Labiris G, et al. J Cataract Refract Surg. (2023), [2] Labiris G, et al. Clin Ophthalmol. 2024, [3] Labiris et al. J Clin Med. 2025

Results

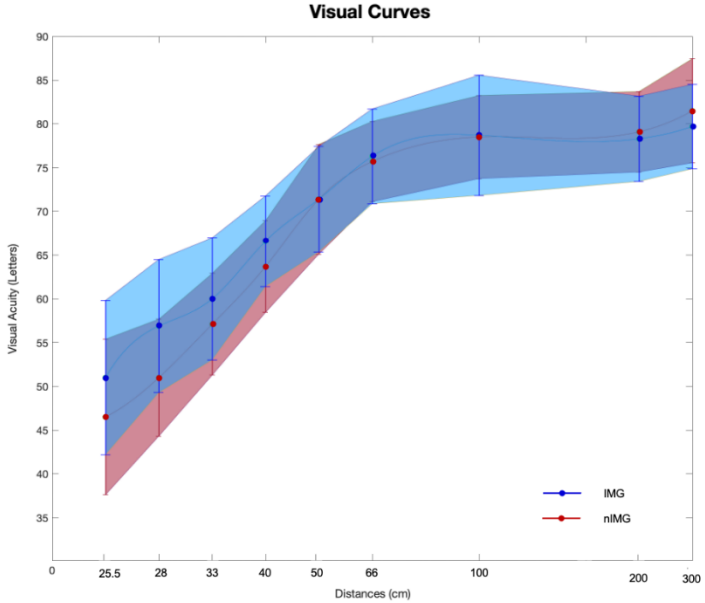
- A total of 40 eyes were included in the study
  - 20 had undergone image-guided xEDOF IOL implantation (IMG)
  - 20 had undergone non-image-guided implantation with an xEDOF IOL (nIMG)

Parameters	IMG	nIMG	p value
N (eyes)	20	20	NA
Age	69.1 ± 6.15	64.1 ± 7.13	0.122
Sex (M/F)	9/11	8/12	NA
Ocular dominance (R/L)	10/10	9/11	NA
Preoperative spherical equivalent (D)	-0.54 ± 1.02	-0.68 ± 1.32	0.797
Preoperative CDVA	0.57 ± 0.12	0.61 ± 0.16	0.567
Axial length (mm)	23.85	23.84	0.363

Results

Comparison of uncorrected visual acuity (in letters) at different distances

Measured distance	IMG (Mean ± SD) (Letters)	nIMG (Mean ± SD) (Letters)	p value	Mean difference (IMG-nIMG)
25.5 cm	51.0 ± 8.83	46.5 ± 8.90	0.335	**4.47**
28 cm	56.9 ± 7.61	51.0 ± 6.69	0.128	**5.86**
33 cm	60.0 ± 6.98	57.1 ± 5.82	0.402	**2.87**
40 cm	66.6 ± 5.18	63.7 ± 5.25	0.324	**2.90**
50 cm	71.4 ± 6.02	71.4 ± 6.27	0.992	0.03
66 cm	76.3 ± 5.42	75.7 ± 4.59	0.824	0.62
100 cm	78.7 ± 6.87	78.5 ± 4.75	0.941	0.25
200 cm	78.3 ± 4.87	79.1 ± 4.60	0.752	-0.85
300 cm	79.7 ± 4.83	81.5 ± 5.95	0.567	-1.75



*≥**2.5 letters**: clinical significance

IMG: Image-guided group, nIMG: non-image-guided group, SD: standard deviation

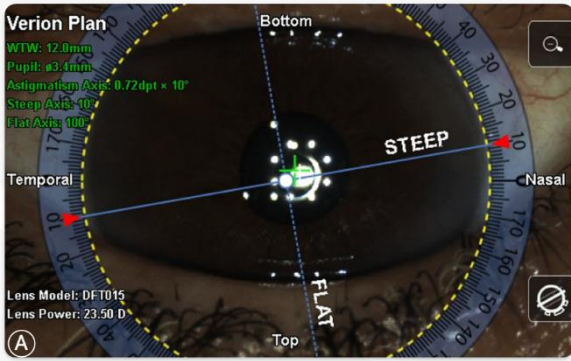
- Both surgical options provide optimal outcomes
- **Image-guided xEDOF** implantation seems to present **better** visual performance in **near distances**

•Analysis of the visual curves showed no significant difference between the IMG and nIMG groups regarding curve flattening and area of the curve (AoC).

Comparison of the area of the curve (AoC) between IMG and nIMG

	IMG (Mean ± SD)	nIMG (Mean ± SD)	p value	Mean difference (IMG-nIMG)
AoC total	92.8 ± 7.22	90.8 ± 4.52	0.446	1.95
AoC NV	79.8 ± 8.98	77.3 ± 5.70	0.443	2.45
AoC IV	94.7 ± 8.06	92.3 ± 4.55	0.378	2.40
AoC DV	95.6 ± 6.16	94.5 ± 5.71	0.677	1.13

AoC: area of the curve, DV: distance vision, IMG: Image-guided group, IV: intermediate vision, nIMG: non-image-guided group, NV: near vision, SD: standard deviation



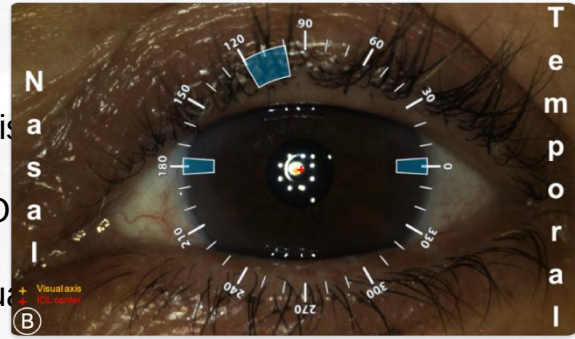


Fig. Examples of postoperative reference images from the VERION and Argos systems. The VERION reference image appears reversed

IOL centration

- All IOLs in the IMG group were successfully implanted with the visual axis located within the central IOL ring
- In the nIMG group, 2 out of 20 eyes were centered outside the central IOL ring.
- The IMG group demonstrated a smaller mean distance between the visual axis and the IOL ring center (0.37 ± 0.13 mm) compared to nIMG group (0.56 ± 0.27 mm), although this difference did not reach statistical significance (p = 0.09).

Conclusions

•Both surgical options provide optimal outcomes

•However, image-guided xEDOF implantation seems to present better visual performance at **near**