



Alignment of Toric IOLs

By

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ASCRS clinical survey 2017

More than **80%** of the survey's respondents said they use toric IOLs in their current cataract surgery practice.

11% of surgeons place toric IOLs in about **20%** of their patients.

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Why Toric IOL

33% of cases scheduled for cataract surgery have astigmatism of 1 Diopter (D) or greater.

Corneal Astigmatism can be addressed at the time of surgery resulting in reduced refractive cylinder and improved quality of unaided vision.

**Ferrer-Blosco T et al. Prevalence of corneal astigmatism before cataract surgery. J Cataract Refract Surg 2009;35:70-75.*

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Adv. of Toric IOL

- **Unbeatable quality of vision.**
- **Do not require a healing response.**
- **Do not require a biomechanical coupling.**
- **Do not induce dryness.**
- **Regardless of the astigmatism level, the implantation technique is the same.**

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Toric IOL Alignment

- During surgery, the marks on the toric IOL should be aligned with the previously marked meridian of alignment. The marks on the IOL indicate the flat meridian (plus cylinder axis) of the toric lens.



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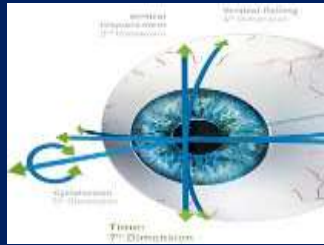
Misalignment

- When a toric IOL is misaligned, there is a reduction in the cylinder correction along the desired meridian and induction of cylinder at a *new* meridian.
- The amount of residual cylinder is approximately **3.5%** per degree.
- A **30°** misalignment induces an estimated residual cylinder of **100%** of the toric IOL cylinder power, with the new astigmatic meridian far away from the original steep meridian.
- Importantly, the residual cylinder can be large and visually disturbing to the patient.

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Corneal marking techniques

- Preoperatively, the eye should be marked with the patient in an upright position to compensate for cyclotorsion.
- When the patient goes from the upright to the supine position, a cyclotorsion of approximately 2° to 3° usually occurs, with some patients having up to 14° of cyclotorsion



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Methods of corneal marking

• Manual marking

3-step procedure

Tools for better marking:

- Bubble level markers
- Akahoshi electronic marker
- Wet-Field Osher ThermoDot Marker

• Digital marking

1. **Callisto Eye with Z-Align** (Carl Zeiss Meditec AG, Jena, Germany),
2. **iTrace with Zaldivar Toric Caliper** (Tracey Technologies, Houston, USA),
3. **TrueGuide software** (TrueVision 3D Surgical, Inc., Santa Barbara, USA),
4. **VERION Digital Marker** (Alcon Laboratories, Ft. Worth, USA).

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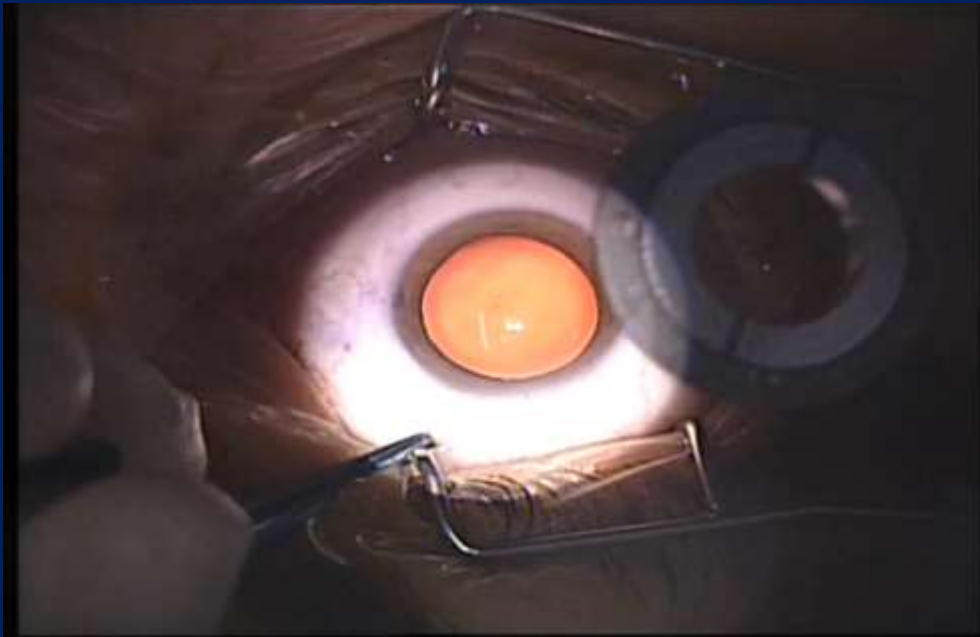
Manual**3-step procedure**

1. Preoperatively marking the eye at the horizontal meridian using a coaxial thin slit beam of the slit-lamp turned to the 3- and 9-o'clock position
2. Intraoperatively aligning to these marks a secondary device with angular graduations, such as the Mendez gauge



3. Marking the limbus or the cornea at the desired angle of alignment using a surgical marking pen or a needle.

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Manual

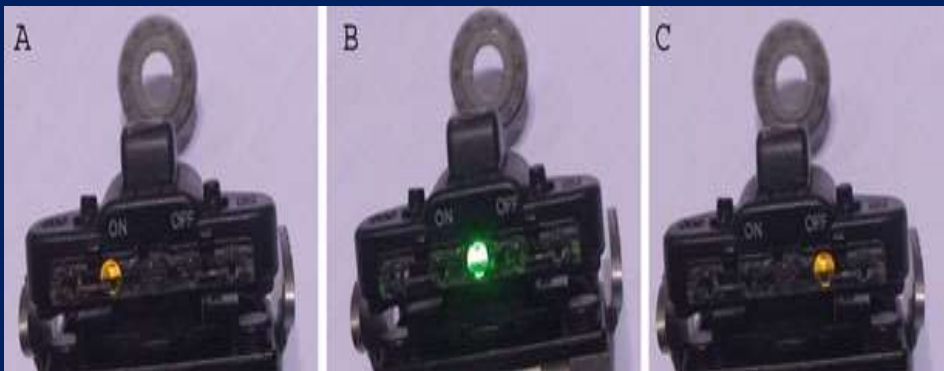
Devices with a bubble level



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Manual

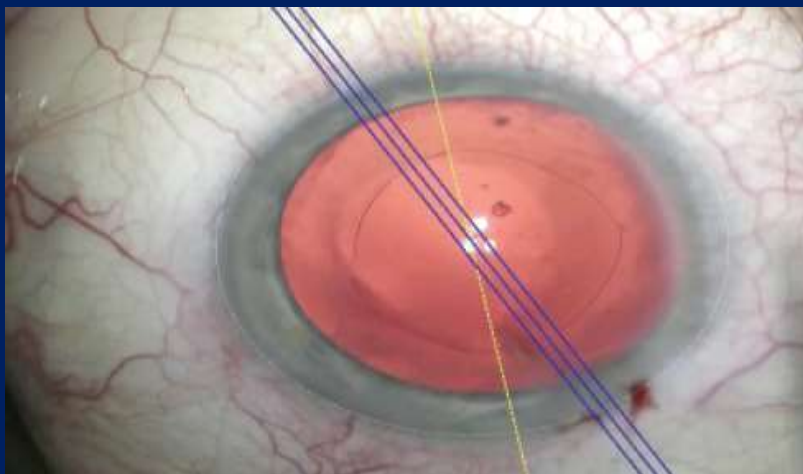
Akahoshi electronic marker



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Digital marking

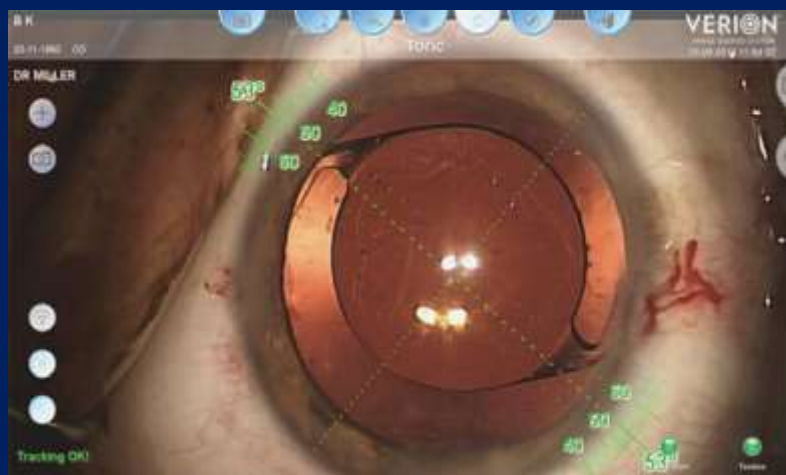
Callisto Eye with Z-align



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Digital marking

VERION Digital Marker



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Verion

Image

- *Measures keratometry, pupillometry.*
- *Captures a high-resolution diagnostic reference image of the patient's eye.*
- *Auto-detects scleral vessels, limbus, pupil and iris features.*

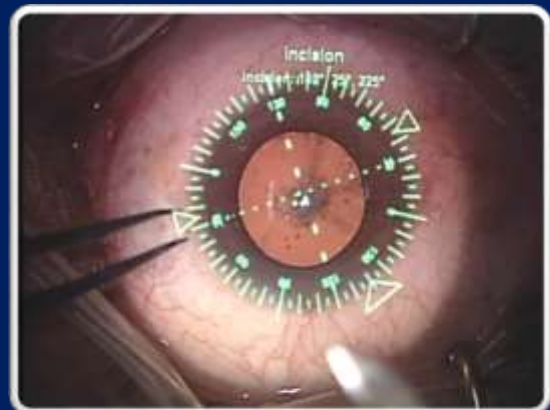


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Verion

Plan

- *Advanced formula IOL calculations for power selection*
- *Incision and implantation axis planning customized for the doctor's preference.*

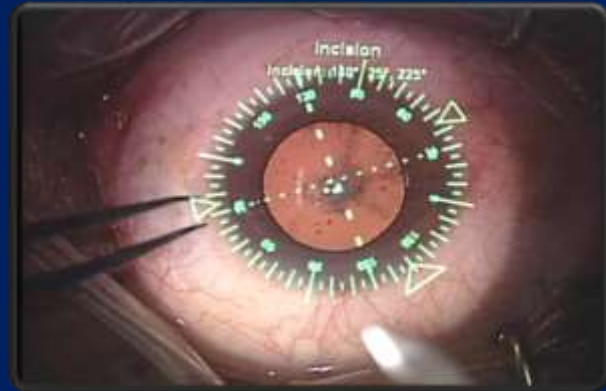


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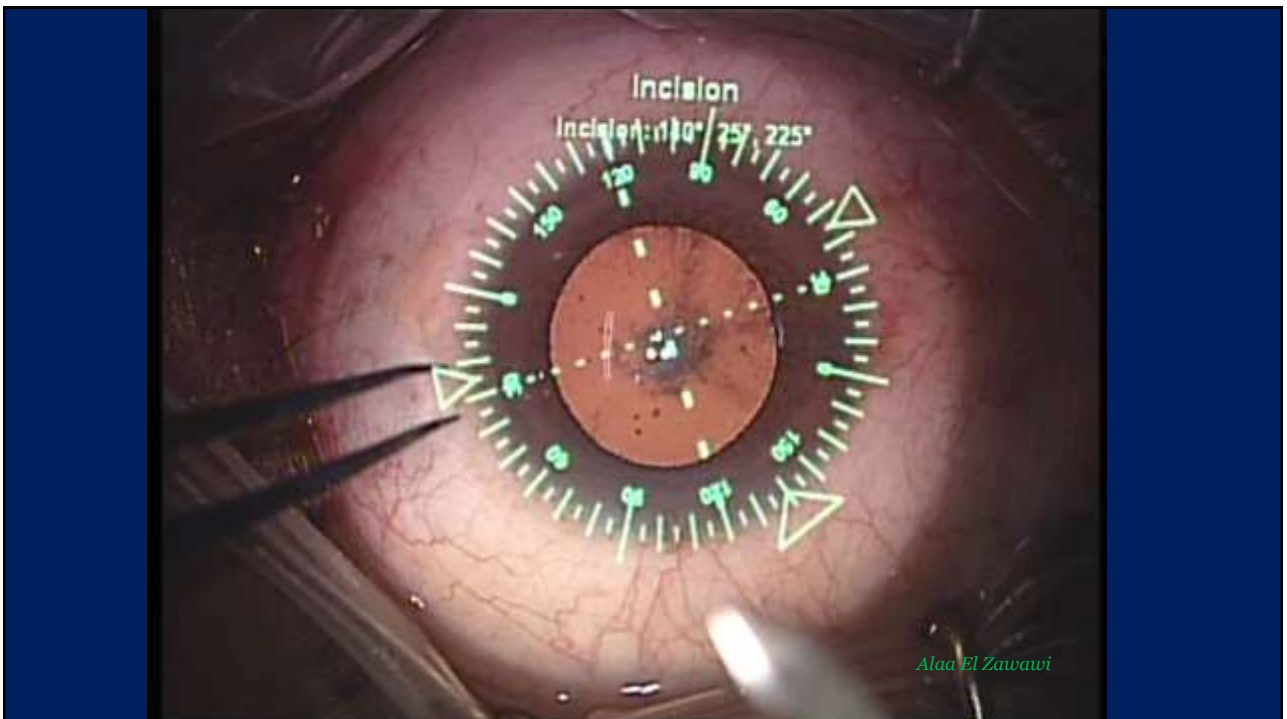
Verion

Guide

- *Tracking overlay enables the surgeon to see all incisions and alignment in real time*
- *Account for cyclorotation*
- *No manual markings*
- *Automatically registers the patient for accurate centering and alignment of axis*
- *Guide for rhexis size and centration*



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Is there a difference between manual and digital techniques?



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Study Design

- A prospective study to compare the clinical outcome of VERION digital marking and manual ink marking for toric IOL alignment in cataract surgery.

40 eyes were randomly assigned to the manual group or the verion group

The verion group comprised 20 eyes of 15 patients

The manual group comprised 20 eyes of 16 patients

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Subjects

Inclusion criteria

- Immature senile cataract.
- Coexisting corneal astigmatism more than 1.5 diopters (D).

Exclusion criteria

- Cases with ocular comorbidities that affected the visual acuity such as amblyopia, maculopathy, glaucoma, and uveitis.
- Cases of traumatic cataract or subluxated lens.
- Cases with intraoperative complications that compromised the toric IOL position. Significant media opacities that preclude fundus examination or imaging.
- Cases with irregular corneal astigmatism, keratoconus or other corneal ectatic conditions.

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Demographic data

- Preoperatively, there were no statistically significant differences as regard age and sex distribution between the 2 groups.

	Manual (n = 20)	Digital (n = 20)	p
	No.(%)	No.%	
Gender			
Male	9(45.0%)	8(40.0%)	0.749
Female	11(55.0%)	12(60.0%)	
Age (years)			
Mean ± SD	60.70 ± 12.53	60.25 ± 18.01	0.927

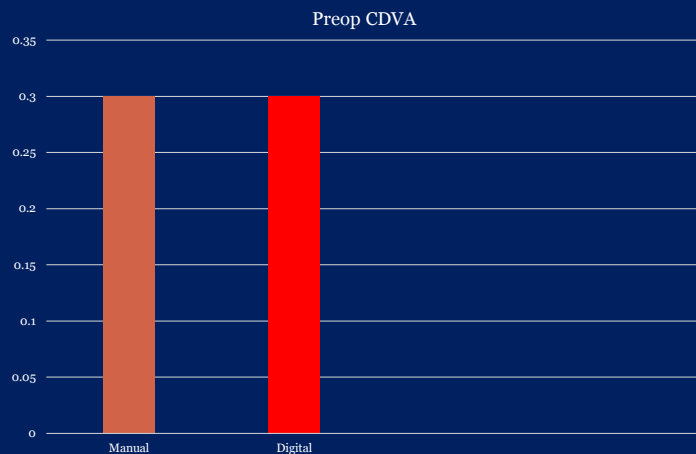
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Pre-op corneal astigmatism

- The amount of pre-operative corneal astigmatism ranged from **1.65 – 3.52 D** in the manual group and from **1.63 – 4.88 D** in the digital group.
- The difference between both groups was NOT statistically significant (P=0.49).

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Mean pre-op CDVA



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Misalignment

Misalignment was **lower in the verion group** than in the manual group; however, it is **not statistically significant** ($P=0.078$).

	Manual (n = 20)	Digital (n = 20)	U	P
Misalignment (°)			1	
Min. – Max.	0.0 – 18.0	0.0 – 8.0		
Mean ± SD	4.15 ± 4.39	2.0 ± 2.60	136.50	0.078

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Astigmatism correction

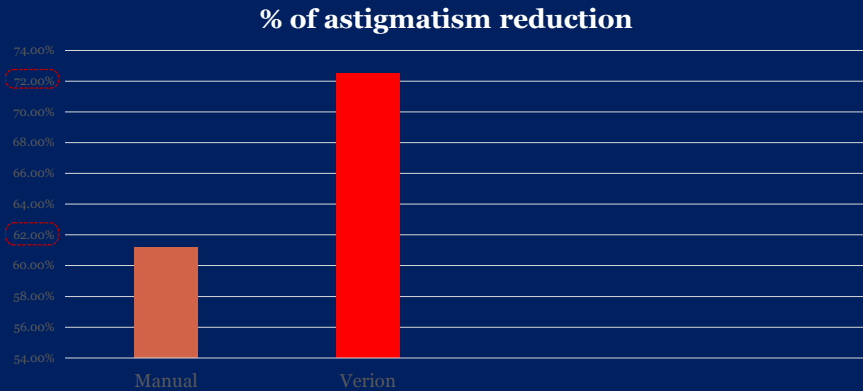
- A statistically significant reduction between preoperative corneal astigmatism and postoperative refractive astigmatism occurred in both groups (both $P < 0.001$)

	Manual (n = 20)	Digital (n = 20)
Pre-op Astig. (D.)		
Mean ± SD.	2.37 ± 0.65	2.54 ± 0.82
Post-op Astig. (D.)		
Mean ± SD.	0.93 ± 0.46	0.80 ± 0.48
Z	-3.920	-3.921
P _o	<0.001*	<0.001*

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Residual refractive astigmatism

- The mean residual refractive astigmatism 3 months postoperatively was **0.80 ± 0.48 D** in the verion group and **0.93 ± 0.46 D** in the manual group.



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Post-op VA (3 months)

- There were no statistically significant differences in terms of UDVA, CDVA between the 2 groups

Post-op VA	Manual (n = 20)	Digital (n = 20)	Test of Sig.	P
UDVA				
Min. – Max.	0.20 – 0.80	0.20 – 0.80	t=0.785	0.437
Mean ± SD.	0.56 ± 0.18	0.60 ± 0.18		
CDVA				
Min. – Max.	0.50 – 1.0	0.30 – 1.0	U=193.0	0.846
Mean ± SD.	0.78 ± 0.14	0.78 ± 0.16		

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Alpins vector analysis of the effectiveness of astigmatism correction

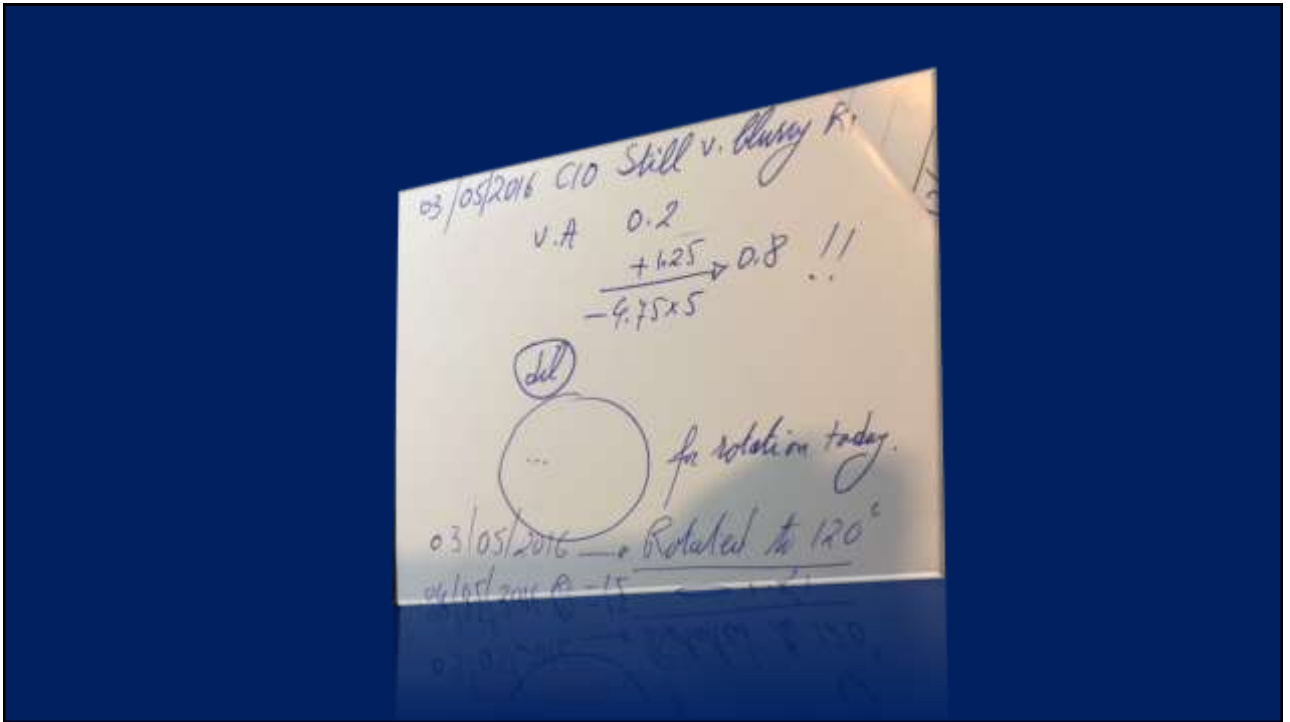
No statistically significant differences were seen in the index of success, magnitude of error, or angle of error between the 2 groups (P=0.05)

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Conclusion

- **Misalignment** was **lower** in the verion group than the manual group however, it is **not statistically significant**.
- The mean **reduction in the preexisting astigmatism** in the verion group (72.48%) was higher than the manual group (61.2%). Again the difference is **not statistically significant**.
- Both manual and digital techniques are effective methods of corneal marking

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Post-operative residual astigmatism

The astigmatism fix calculator

astigmatismfix.com/calculate.php

Patient Eye: Right Eye
 Originally Calculated IOL Axis (Degrees): 27

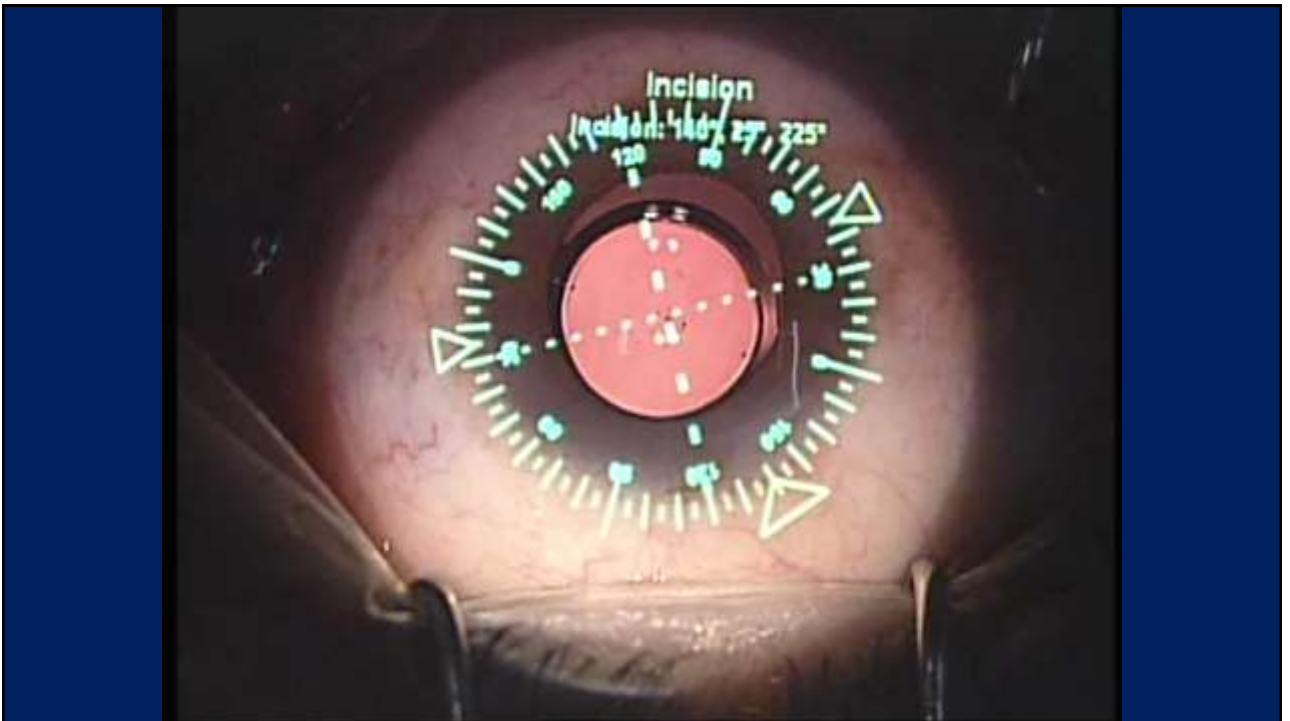
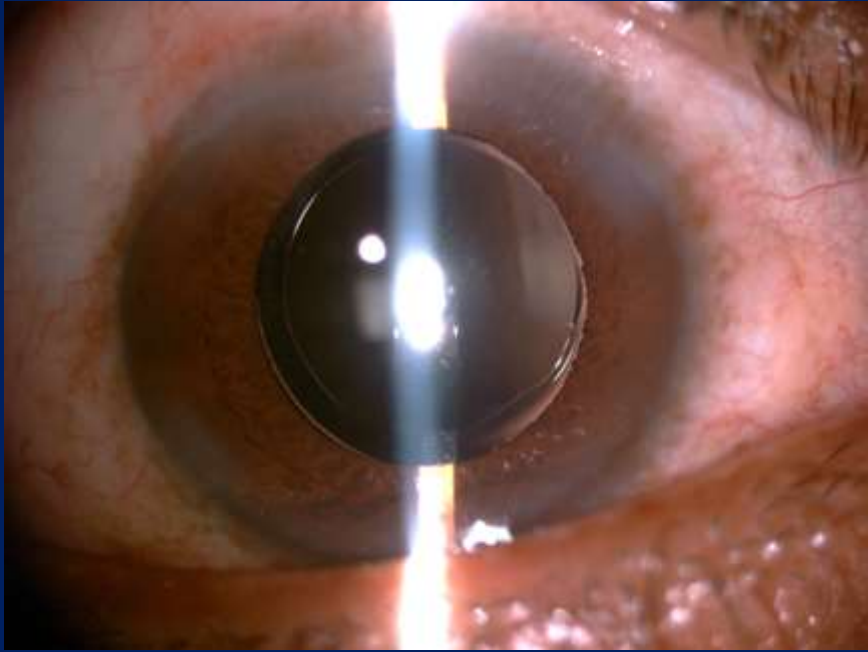
Entered Data

	Sphere	Cylinder (plus power)	Axis (Deg)
Current Refraction	-0.75	1.00	152
Toric Lens		1.55	27

Calculated Results

	Sphere	Cylinder (plus power)	Axis (Deg)
Ideal Position of the Toric		1.55	8
Expected Residual Refraction	-0.26	0.02	100

Rotating the Toric IOL 19° Clockwise should minimize the astigmatism.



1009
5/MAY/2016 01:23 PM
VD=12.00mm
WD=40cm

<R>	S	C	A
-	1.25	- 0.25	78
-	1.00	- 0.50	80
-	1.25	- 0.25	79
<-	1.25	- 0.25	79>
<L>	S	C	A
+	0.25	- 1.25	110
+	0.25	- 1.25	112
+	0.25	- 1.25	106
<+	0.25	- 1.25	110>
PD 64			N 60
NTDEK		AR-310A	

Toric IOLs Underpromise and overdeliver

A mean overcorrection or undercorrection of 0.3 to 0.4 D by a toric IOL (relative to the intended correction) is usually found.

* Alio JL – J Cat Ref Surg 2011

* Goggin M – Arch Ophthalmol 2015

* Hoffman PC – J Cat Ref Surg 2011



DO NOT PROMISE SPECTACLE
INDEPENDENCE, BUT RATHER TO
DIMINISH THE NEED FOR SPECTACLES.



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