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# Decentration of a toric intraocular lens implant in a patient with simple megalocornea

Irene C. Kuo

*Wilmer Eye Institute, Department of Ophthalmology, Johns Hopkins University School of Medicine, 4924 Campbell Blvd. #100, Baltimore, MD, 21236, USA*

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ABSTRACT

*Purpose:* To describe a patient who developed radial displacement of the capsular bag and toric intraocular lens implant within approximately 5 weeks after surgery.

*Observations:* A patient underwent uncomplicated cataract extraction and implantation of a toric IOL for 2.5 diopters (D) of preoperative corneal astigmatism. Uncorrected visual acuity (UCVA) on postoperative day 1 was 20/20. Blurriness developed 5 weeks after surgery when UCVA was 20/70 but corrected to 20/20 with 2 D of cylinder in a new axis. The IOL was in the proper axis, but it and the capsular bag were radially displaced. Dilated examination revealed posterior capsular opacification superotemporally, outside the visual axis. The patient's biometry revealed axial myopia and megalocornea (white-to-white measurement of 13.44 mm), suggesting a larger than average capsular bag. Surgery was performed at postoperative week 6 to expand the capsular bag using a capsular tension ring and to re-center the IOL keeping the same axis. The patient recovered UCVA of 20/25 after the IOL was recentered.

*Conclusions and Importance:* It is important to review biometry for large white-to-white measurements. Eyes with megalocornea may require capsular tension rings at time of toric IOL implantation so as to maintain IOL centration and good UCVA.

## 1. Introduction

In patients with a significant amount of corneal astigmatism, toric intraocular lens (IOL) implants provide better uncorrected distance visual acuity (UCVA), greater spectacle independence, and lower degrees of residual astigmatism than do nontoric IOLs.[1] Approximately 20–30% of patients who have cataract surgery have corneal astigmatism measuring 1.25 diopters (D) or more and about 10% of patients have at least 2 D.[2–4]

The success of toric IOLs depends on centration and precise alignment of the IOL relative to the intended axis. It has been reported that 20° of misalignment will eliminate 2/3 of the corrective effect of toric IOLs[5]; surgical interventions are sometimes required to realign the IOL. To our knowledge, repositioning of an open loop-haptic toric IOL has been reported only in cases where the IOL had to be rotated back into the proper axis. One group in Japan studying the results of almost 6500 eyes implanted with toric IOLs found 0.653% required repositioning.[6]

We report the case where the toric IOL was in the correct axis but the capsular bag and IOL complex were radially displaced, presumably because the capsular bag was much larger than normal. Rotation of the IOL would not have resolved the problem.

### 1.1. Case report

A 55 year-old Caucasian man was evaluated for cataract surgery in January 2019. He worked in a family-owned machine equipment repair company. His complaints were gradual development of glare, blurriness, and difficulty with night driving in his right eye. His past medical and ocular history were unremarkable except for a “lifetime” of spectacle dependence; family ocular history was noncontributory. His most recent pair of glasses measured −2.50 + 2.50 × 087 OD. His best-spectacle corrected visual acuity (BSCVA) was 20/50 with a manifest refraction of −3.75 + 3.00 × 097. Examination was significant for anterior capsular and posterior subcapsular cataractous changes in the right eye; the left lens was clear. Using optical biometry (Lenstar, Haag Streit, Switzerland), axial length was 25.28 mm, horizontal white-to-white measurement (WTW) was 13.44 mm, anterior chamber depth was 3.93 mm, lens thickness was 4.10 mm, and keratometry was 40.58/43.2 × 102° (Fig. 1) and both the axis and magnitude of astigmatism were confirmed by topography (Fig. 2). Applanation tonometry was 14 mm Hg. Measurements were similar for the fellow eye. His corneas were clear; there was no iridodonesis, phacodonesis, iris stromal hypoplasia, or glaucoma in either eye. Angle structures were normal and devoid of pigment deposition. Toric intraocular lens (IOL) implant and

*E-mail address:* ickuo@jhmi.edu.

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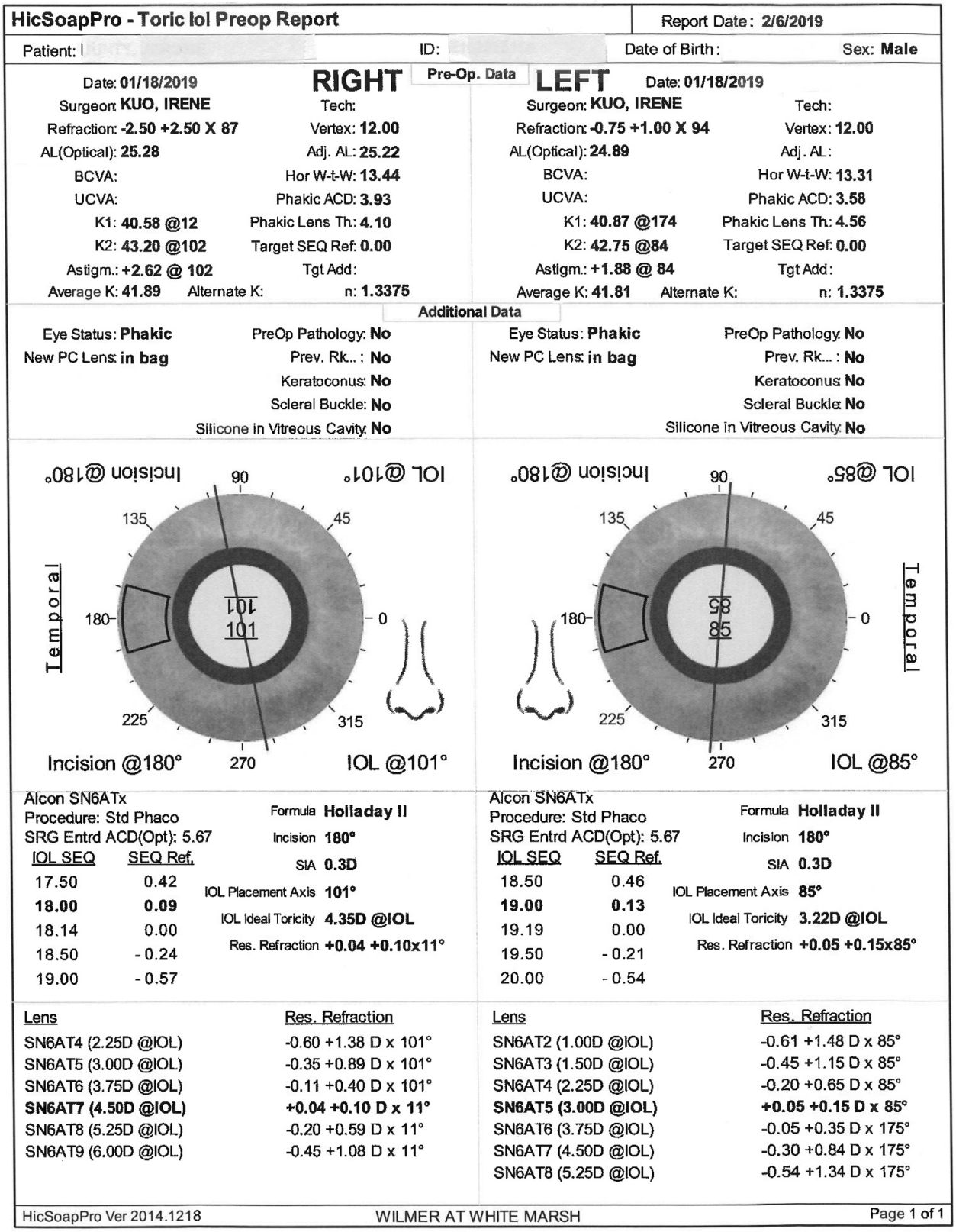

**HicSoapPro - Toric Iol Preop Report** — Report Date: 2/6/2019

Patient: [redacted] ID: [redacted] Date of Birth: [redacted] Sex: Male

Pre-Op. Data

| RIGHT | | LEFT | |
|---|---|---|---|
| Date: 01/18/2019 | | Date: 01/18/2019 | |
| Surgeon: KUO, IRENE | Tech: | Surgeon: KUO, IRENE | Tech: |
| Refraction: -2.50 +2.50 X 87 | Vertex: 12.00 | Refraction: -0.75 +1.00 X 94 | Vertex: 12.00 |
| AL(Optical): 25.28 | Adj. AL: 25.22 | AL(Optical): 24.89 | Adj. AL: |
| BCVA: | Hor W-t-W: 13.44 | BCVA: | Hor W-t-W: 13.31 |
| UCVA: | Phakic ACD: 3.93 | UCVA: | Phakic ACD: 3.58 |
| K1: 40.58 @12 | Phakic Lens Th: 4.10 | K1: 40.87 @174 | Phakic Lens Th: 4.56 |
| K2: 43.20 @102 | Target SEQ Ref: 0.00 | K2: 42.75 @84 | Target SEQ Ref: 0.00 |
| Astigm.: +2.62 @ 102 | Tgt Add: | Astigm.: +1.88 @ 84 | Tgt Add: |
| Average K: 41.89 Alternate K: | n: 1.3375 | Average K: 41.81 Alternate K: | n: 1.3375 |

Additional Data

| | | | |
|---|---|---|---|
| Eye Status: Phakic | PreOp Pathology: No | Eye Status: Phakic | PreOp Pathology: No |
| New PC Lens: in bag | Prev. Rk... : No | New PC Lens: in bag | Prev. Rk... : No |
| | Keratoconus: No | | Keratoconus: No |
| | Scleral Buckle: No | | Scleral Buckle: No |
| | Silicone in Vitreous Cavity: No | | Silicone in Vitreous Cavity: No |



Incision @180° IOL @101°

Alcon SN6ATx
Procedure: Std Phaco
SRG Entrd ACD(Opt): 5.67

| IOL SEQ | SEQ Ref. |
|---|---|
| 17.50 | 0.42 |
| **18.00** | **0.09** |
| 18.14 | 0.00 |
| 18.50 | - 0.24 |
| 19.00 | - 0.57 |

Formula **Holladay II**
Incision **180°**
SIA **0.3D**
IOL Placement Axis **101°**
IOL Ideal Toricity **4.35D @IOL**
Res. Refraction **+0.04 +0.10x11°**

| Lens | Res. Refraction |
|---|---|
| SN6AT4 (2.25D @IOL) | -0.60 +1.38 D x 101° |
| SN6AT5 (3.00D @IOL) | -0.35 +0.89 D x 101° |
| SN6AT6 (3.75D @IOL) | -0.11 +0.40 D x 101° |
| **SN6AT7 (4.50D @IOL)** | **+0.04 +0.10 D x 11°** |
| SN6AT8 (5.25D @IOL) | -0.20 +0.59 D x 11° |
| SN6AT9 (6.00D @IOL) | -0.45 +1.08 D x 11° |

Incision @180° IOL @85°

Alcon SN6ATx
Procedure: Std Phaco
SRG Entrd ACD(Opt): 5.67

| IOL SEQ | SEQ Ref. |
|---|---|
| 18.50 | 0.46 |
| **19.00** | **0.13** |
| 19.19 | 0.00 |
| 19.50 | - 0.21 |
| 20.00 | - 0.54 |

Formula **Holladay II**
Incision **180°**
SIA **0.3D**
IOL Placement Axis **85°**
IOL Ideal Toricity **3.22D @IOL**
Res. Refraction **+0.05 +0.15x85°**

| Lens | Res. Refraction |
|---|---|
| SN6AT2 (1.00D @IOL) | -0.61 +1.48 D x 85° |
| SN6AT3 (1.50D @IOL) | -0.45 +1.15 D x 85° |
| SN6AT4 (2.25D @IOL) | -0.20 +0.65 D x 85° |
| **SN6AT5 (3.00D @IOL)** | **+0.05 +0.15 D x 85°** |
| SN6AT6 (3.75D @IOL) | -0.05 +0.35 D x 175° |
| SN6AT7 (4.50D @IOL) | -0.30 +0.84 D x 175° |
| SN6AT8 (5.25D @IOL) | -0.54 +1.34 D x 175° |

HicSoapPro Ver 2014.1218 WILMER AT WHITE MARSH Page 1 of 1

**Fig. 1.** Patient's preoperative toric intraocular lens calculations using toric calculator in Holladay IOL Consultant and Surgical Outcomes program.

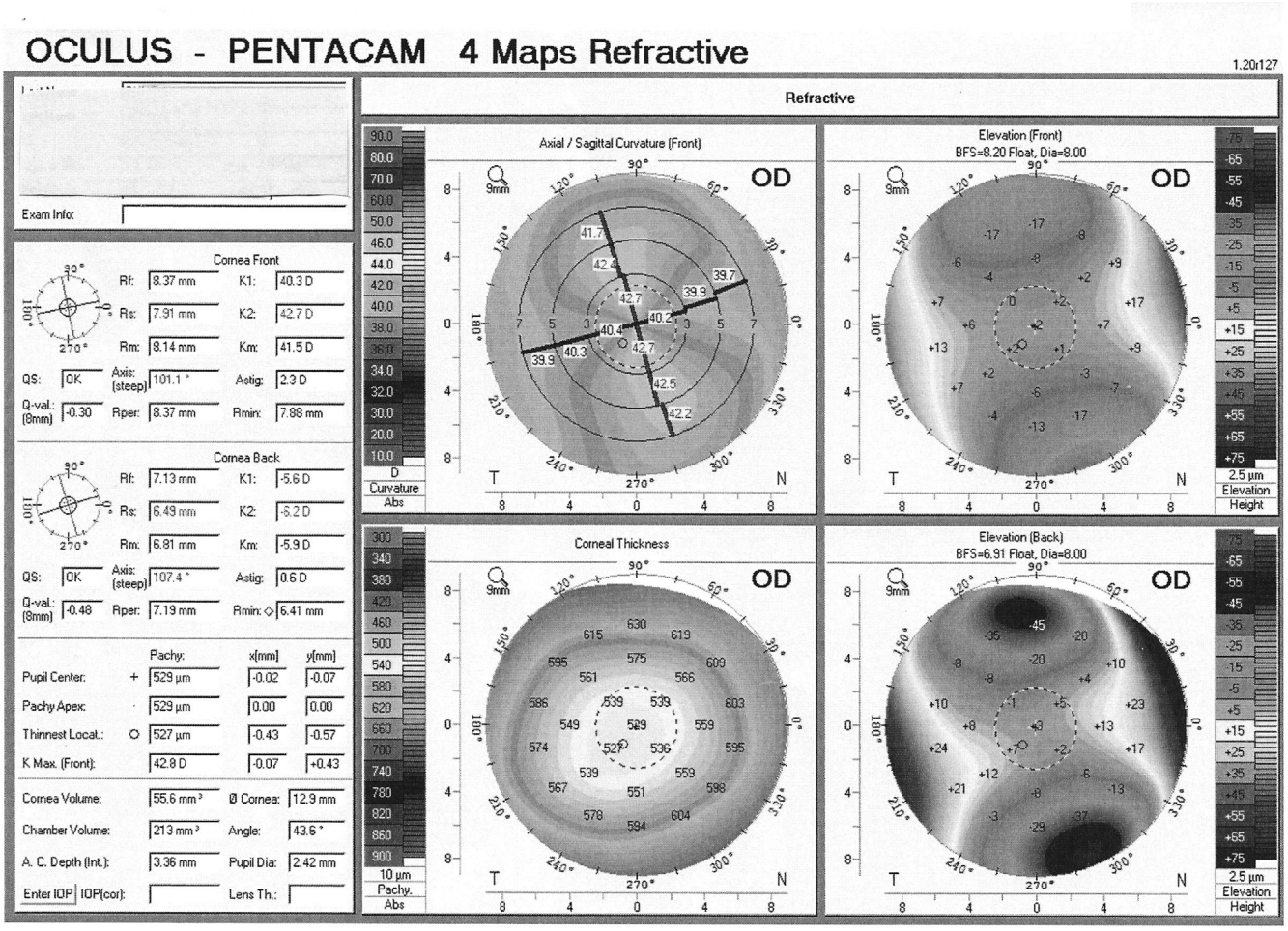


**Fig. 2.** Patient's preoperative topography, which confirmed the axis and magnitude of corneal astigmatism found on toric calculator program.

standard IOL options were discussed with the patient; he called back a week later stating he wanted the former.

In February 2019, he underwent uncomplicated cataract extraction with implantation of an 18.0 diopter SN6AT6 Acrysof (Alcon, Fort Worth, TX) toric IOL placed at the 101° axis.

On postoperative day 1, his uncorrected visual acuity (UCVA) was 20/20. He said he was enjoying good vision and not seen again until postoperative week 5, when he called to say his vision had decreased over the previous week. On examination, his UCVA was 20/70; BSCVA was 20/20 with a manifest refraction of $-1.25 + 2.00 \times 065$. The central posterior capsule appeared to have a few striae orthogonal to the planned axis of 101° (Fig. 3). On dilation, the IOL appeared superotemporally displaced with posterior capsular opacification in that

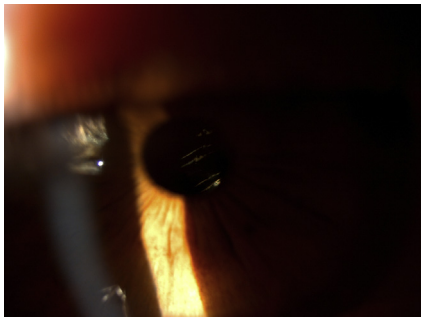

**Fig. 3.** Patient's undilated right eye 5 weeks after surgery showing intraocular lens and posterior capsular striae.

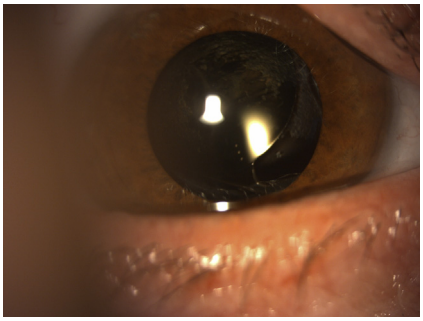

**Fig. 4.** Decentered toric intraocular lens with superotemporal posterior capsular opacification is evident on dilated exam.

quadrant (Fig. 4). The IOL, however, appeared to be in the proper axis, indicating rotation would not solve the problem.

The decision was made to reposition the IOL and, given the implicit size of the capsular bag, to place a capsular tension ring or segment to prevent future displacement of the capsular bag and IOL complex.

In surgery, the capsular bag was inflated with dispersive viscoelastic. The anterior and posterior capsular leaflets appeared to be adherent in the inferonasal quadrant, and these were separated using the viscoelastic. Using a Sinskey hook, the IOL was moved centrally along the 100° axis in a radial fashion. A capsular tension ring (CTR 11 Reform capsular tension ring, Alcon, Fort Worth, TX) was implanted.

On postoperative day 1, the patient's UCVA was 20/30. On postoperative day 7, it was 20/25 as it was on postoperative day 30, when

he was discovered to have mild cystoid macular edema, for which he began ketorolac 0.5% QID. On dilation, the IOL and bag remained in proper position. The lens remained in proper position, axis 101°, with stable UCVA on postoperative day 50. BSCVA was 20/20 with a manifest refraction of −1.25 + 1.75 × 055 in the presence of 2+ posterior capsular opacification, which he did not feel was visually significant.

## 2. Conclusions

Rotational stability has been a major endpoint in analysis of toric IOL outcomes.[7,8] A larger than normal capsular bag was noted intraoperatively in the 3 of 263 (1.1%) of Acrysof toric IOL (Alcon, Ft. Worth, TX)] cases by one surgeon requiring repositioning by rotation.[9] Longer axial length has also been correlated with toric IOL rotation.[10] This patient's WTW qualify as megalocornea; his findings seem to indicate simple megalocornea with increased anterior chamber depth, not megalophthalmos anterior. The latter is associated with iris stromal hypoplasia, early cataract formation, and pigmentary glaucoma. One report describes suturing a toric IOL to a capsular tension ring in a patient with known megalocornea (WTW of 15.0 mm),[11] but the description of the anterior segment abnormalities indicates the patient had megalophthalmos anterior instead. The current patient's findings—large cornea, normal width ciliary body band by gonioscopic examination, age-appropriate cataract, lack of phacodonesis or iridodonesis, lack of iris defects, increased anterior chamber depth, long axial length—did not fit the description of megalophthalmos anterior. Megalocornea (MCG1) is known to be a genetic disorder with over 90% of cases being X-linked recessive (Xq23; phenotype MIM number 309300).[12,13]

A positive correlation between WTW and capsular bag size has been presumed by many. The practice of selecting CTR size based WTW, as done in this case, is based on this presumption. One study found a correlation between corneal diameter and lens diameter in cadaver eyes,[14] whereas another study found the opposite in cadaver eyes.[15] Reports about a correlation between axial length and crystalline lens equatorial diameter are also conflicting. In one report, only axial length and corneal power (not horizontal or vertical WTW) were statistically significantly correlated with capsular bag diameter, which was back-calculated by considering the size of the CTR implanted in all 70 eyes[16]; even so, the r-squared correlation was weak, only holding for eyes with axial lengths under 25 mm. This finding was in contrast with those in another study in cadaver eyes.[17] Although a clear-cut correlation between WTW and lens diameter or capsular bag size is not evident from the literature, one may assume that this patient's simple megalocornea was correlated with a larger than average capsular bag. This anatomical property may have allowed the IOL to migrate radially and to be “shrink-wrapped” by excess capsule in a decentered position, thus causing decreased UCVA weeks after cataract extraction.

Accurate capsular bag sizing is important not just for selection of the proper size of CTR, but also important for centration, stability, and function of accommodating IOLs[15] and in this case, toric IOLs. Capsular bag sizing can be important for selection of the proper size/type of IOL, as in the case of a plate haptic design toric IOL that decentered and rotated, requiring exchange with a larger single piece IOL.[18] The use of IOLs that attach to the iris confers stable IOL positioning without having to rely on abnormal anatomy.[19] Innovations in imaging may help with capsular bag sizing.

In summary, when implanting a toric IOLs in patients with megalocornea or otherwise much larger than normal WTW, one might consider concomitant implantation of a CTR. The WTW might escape notice if there is no known ocular history or suggestion of megalophthalmos such as early cataract presentation, iris defects, pigmentary glaucoma, or gonioscopic abnormalities. Although small studies show conflicting results regarding a correlation between WTW and capsular bag size, in a patient with whose WTW is significantly larger than normal and whose axial length is also longer than average, one may assume a larger than normal capsular bag and may need to be prepared for additional measures to stabilize a toric IOL.

## Patient consent

As no identifying information is disclosed, patient consent was not obtained.

## Authorship

The author attests that she meets the current ICMJE criteria for Authorship.

## Declaration of competing interest

None.

## Acknowledgements

None.

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