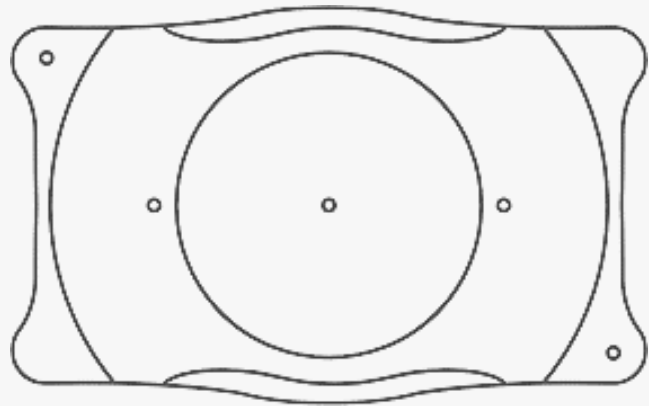


# Rotational stability of two different piggyback toric intraocular lenses for correction of high post-keratoplasty pseudophakic ametropia

Papadopoulos Konstantinos<sup>1,2</sup>, Matsou Artemis<sup>1</sup>

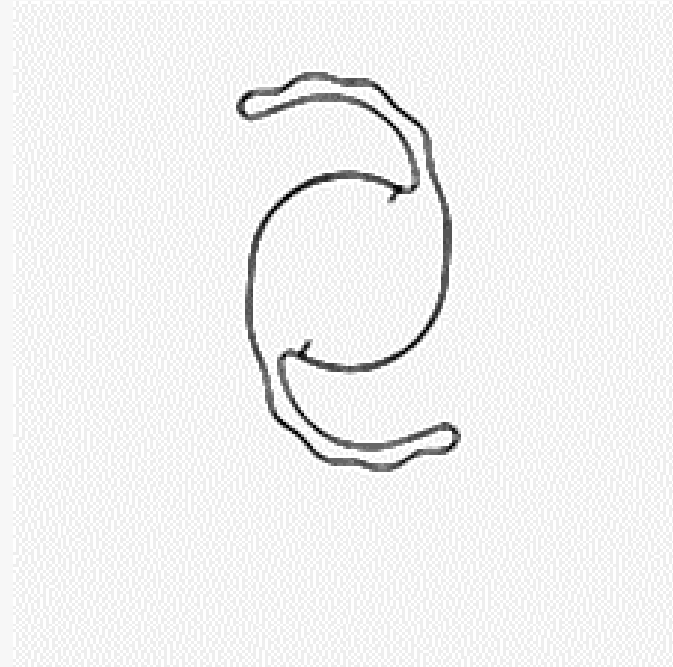
<sup>1</sup> Queen Victoria Hospital, NHS Foundation Trust, East Grinstead, UK

<sup>2</sup> General Hospital of Imathia (Unit of Veroia), Veroia, Greece



**VS**

vault = 1658  $\mu$ m



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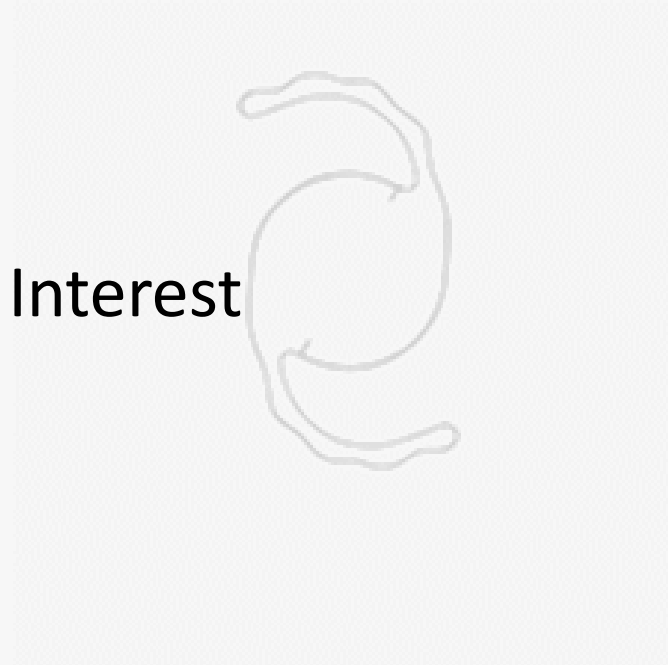
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There is no Conflict of Interest



# Case Presentation

## Prior Ocular History

Keratoconus  
 Right Eye (RE) x 2 PK grafts (1990, 2013)  
 Left Eye (LE) x 2 PK grafts (1992, 2014)  
 Rigid Gas Permeable Contact Lens (CL) wearer

## Presentation

RE Uncorrected Distance Visual Acuity (UDVA) 6/60 Best Corrected VA (BCVA) 6/24  
 LE UDVA 3/60 BCVA 6/38  
 RE Nuclear Sclerosis (NS)++, Posterior Subcapsular Cataract (PSC) +  
 LE NS+++, PSC++

## Treatment (2019)

LE cataract surgery via scleral incision  
 Monofocal non-toric +12,50 D IOL  
 Post-phaco LE UDVA 6/24, BCVA 6/9.5

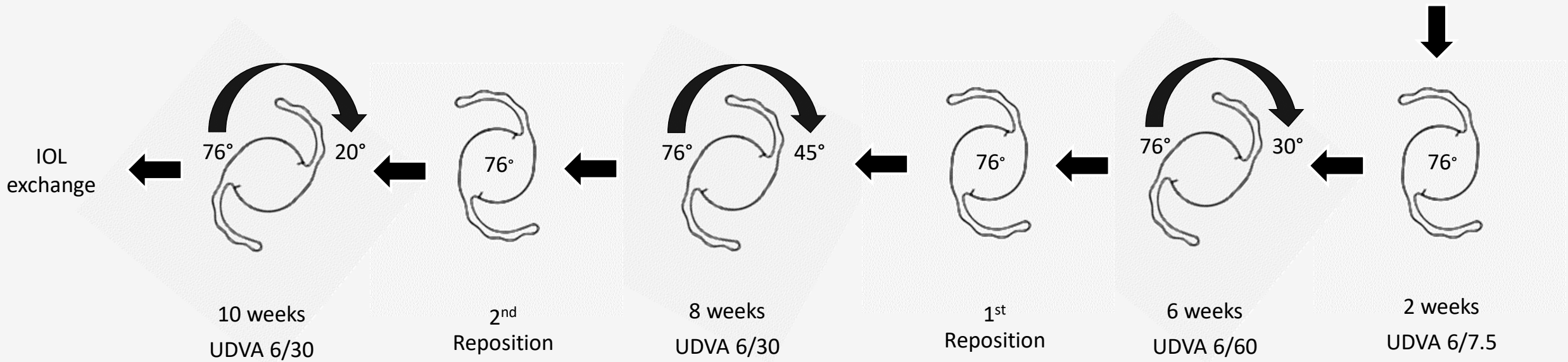


## 6 months post-phaco

LE: stable refraction  
 Manifest Refraction: +1,50/-4.50 x 167° 6/9.5  
 Post-PK pseudophakic astigmatism  
 Meanwhile RE VA 2/60, CL intolerant and cannot drive

## Piggyback Toric Sulcoflex (Rayner)

MR: +1.50/ -4.50 x 167° 6/9.5  
 AL 25.39mm  
 K1 43.66 x 176°  
 K2 51.92 x 66°  
 ACD 3.51  
 Axis of implantation: 76°



Exchange Sulcoflex with toric Implantable Collamer Lens  
(Visian ICL, STAAR Surgical)  
Standard OCOS formula used



**4 years later:**

LE 6/7.5 UDVA  
MR -0.50/ -1.00 X 138°  
ICL stable & aligned at intended axis 175°  
ECC 1850/mm<sup>2</sup>

## Lens Power Calculation

Version 5.01 - BSS

### PATIENT INFORMATION

Surgeon	Patient ID	Patient Name	Date of Birth	Gender	Operative Eye
[Redacted]					OS

### PREOPERATIVE DATA

BVD	12
Sphere	+1.50
Cylinder	-4.50
Axis	167
K1	42.88 @ 170
K2	48.08 @ 80
ACD	4.40
Corneal Thickness	0.484
White to White	11.6
CL Sphere	0

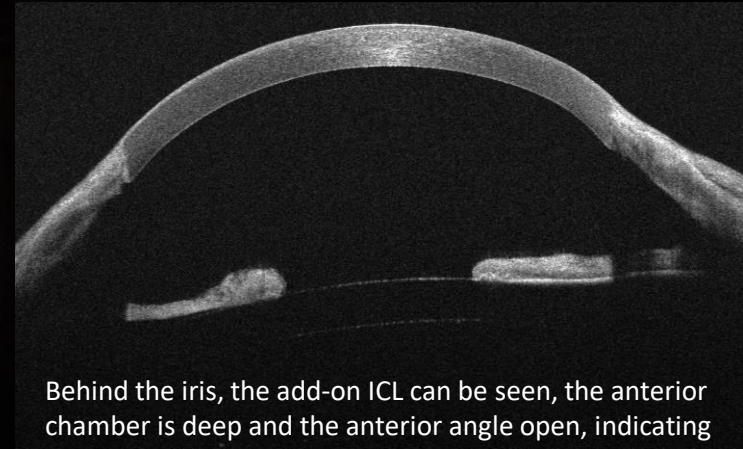
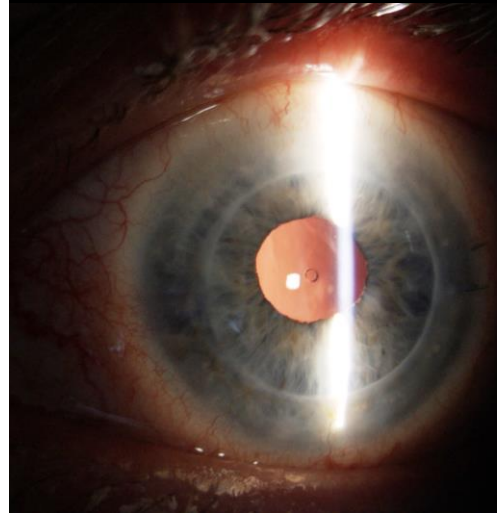
### SUMMARY REPORT

Target Lens	Expected			
	Sphere	Cylinder	Axis	SEQ
Toric Myopic 13.2mm -4.00/+6.0/X077	-00.07	+00.15	078	+00.01
Lens Ordered	Expected			
	Sphere	Cylinder	Axis	SEQ
VTICM5_13.2 -4.00/+6.0/X079	-00.07	+00.15	078	+00.01
Serial Number	<b>T250459</b>			

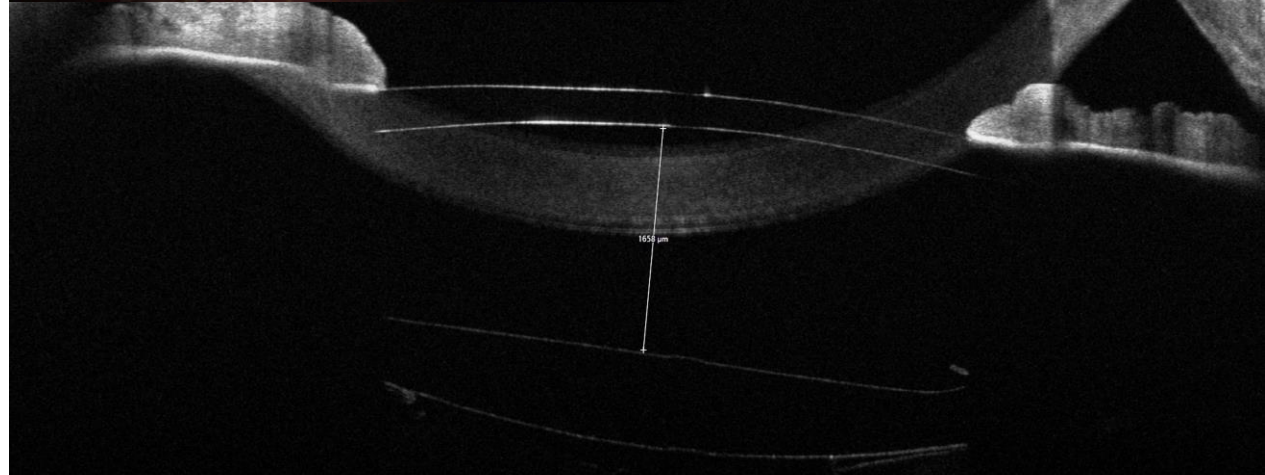
The age of this patient may be outside of the indications for use. Please contact Customer Support at customerservice.ag@staar.com to verify the indicated age range for your region.

Calculation entered in Version 4.06

The patient received a 13.2mm diameter toric V4c ICL of -4.00 D / +6.00 / 77°, aimed to be implanted at 175 degrees axis, at the same time as Sulcoflex removal



Behind the iris, the add-on ICL can be seen, the anterior chamber is deep and the anterior angle open, indicating proper sizing of the add-on ICL.



Vault = 1658µm → high for phakic eyes BUT clinically acceptable in pseudophakic eyes, because of deep AC (Kamiya et al.)

Previous Intervention  
Endothelial cells count (ECC) was 2234/mm<sup>2</sup> in the left eye before surgery.

Yes:  
Non- refractive corneal surgery  
IOL for CLE or cataract

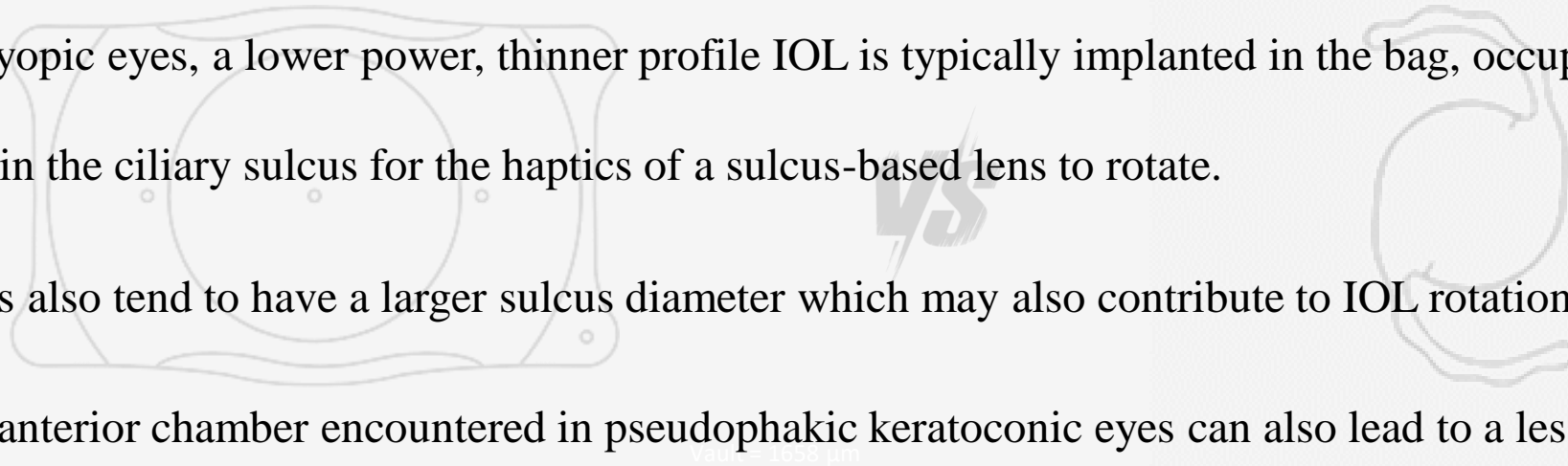
# Discussion

<p>Alfonso et al. (ICL)</p>	<p>49 pseudophakic eyes (6 virgin cornea, 12 LASIK or PRK, 8 RK, 5 ICRS, 11 PK, 7 DALK).</p> <hr/> <p>The virgin cornea, excimer laser, and RK groups demonstrated 96.2% spherical equivalent within <math>\pm 1.00</math> D</p> <hr/> <p>The ICRS, PK, DALK groups showed 50% spherical equivalent within <math>\pm 1.00</math> D with good rotational stability.</p>	<p>McLintock et al. (Sulcoflex)</p>	<p>51 pseudophakic eyes (19 graft)</p> <hr/> <p>62% required repositioning</p> <hr/> <p>Mean times of repositioning: 2.3</p>
<p>Kamiya et al. (ICL)</p>	<p>35 pseudophakic eyes</p> <hr/> <p>No significant intraocular pressure rise, pupillary block, iritis, cystoid macular oedema occurred.</p> <hr/> <p>Anteriorly vaulting shape prevents attachment of the 2 IOLs → less risk of interface opacities</p> <hr/> <p>Thinner than other add-on IOLs → less iris chaffing</p>	<p>Meyer et al. (Sulcoflex)</p>	<p>7 pseudophakic eyes (2 grafts) with postoperative IOL rotation in keratoconus patients.</p> <hr/> <p>Suture fixation was required for 2 cases.</p>



# Contributing factors of rotational instability of sulcus placed IOLs in keratoconic eyes.

- Keratoconic eyes are usually highly myopic, with longer axial lengths, which has been reported to associate with toric in-the-bag IOL rotation.
- In highly myopic eyes, a lower power, thinner profile IOL is typically implanted in the bag, occupying less volume, allowing more space in the ciliary sulcus for the haptics of a sulcus-based lens to rotate.
- Myopic eyes also tend to have a larger sulcus diameter which may also contribute to IOL rotation.
- The deeper anterior chamber encountered in pseudophakic keratoconic eyes can also lead to a less crowded anterior segment, and as the ciliary sulcus is often larger it provides more space within the iridociliary angle for IOL rotation.
- Axis of implantation may also play a role, as the ciliary sulcus is larger in the vertical than in the horizontal meridian.



# Points to consider ICL

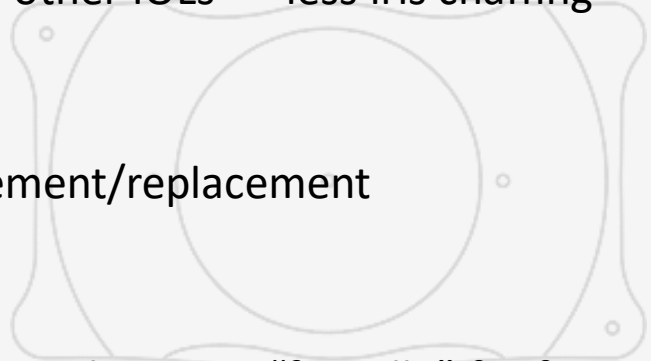
- Anteriorly vaulting shape prevents inter-lenticular issues

- Thinner than other IOLs → less iris chaffing

- Ease of placement/replacement

- Collamer material is more “friendly” for future EK surgery

- Cost: similar cost of 1stQ Addon and ICL, Sulcoflex much lower



VS



Vault = 1658  $\mu$ m

# Take home messages

1. Residual refractive error in pseudophakic patients with previous corneal transplantation is very common and usually significantly high, necessitating additional procedures such as IOL exchange or a supplementary piggyback IOL implantation.

2. The rotational stability of toric piggyback IOLs in pseudophakic post-keratoplasty eyes has not been adequately investigated and no comparative studies between different type of supplementary IOLs exist in this cohort of patients.

3. The anterior segment anatomical particularities of eyes that have undergone corneal graft surgery for keratoconus, have to be considered when planning implantation of supplementary toric IOLs for correction of residual refractive error.

4. Pseudophakic toric ICL use in post-keratoplasty eyes can be superior to other types of piggyback lenses, thanks to better rotational stability.