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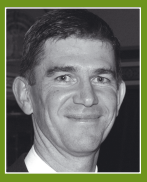
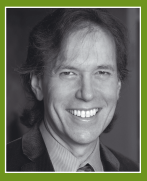




# The Toric Solution: Exceeding Expectations in Patients with Astigmatism

Saturday 5 October

XXXI Congress of the ESCRS
Amsterdam, The Netherlands

# Introduction

With advances in technology and techniques continuing to erode the boundaries between refractive and cataract surgery, emmetropia has gone from an exceptional result to an expected outcome for both the patient and the surgeon. Patients today are better informed and have come to expect excellent uncorrected visual acuity and spectacle independence after their lens surgery.

In order to meet these expectations, surgeons need to be able to correct more than just the spherical equivalent of a patient's refractive error. Uncorrected corneal astigmatism can result in a poor visual outcome, so surgeons need to adopt a strategy for managing astigmatism that is safe, precise, accurate and convenient and which yields consistently excellent results.

Until relatively recently, patients with clinically significant pre-existing astigmatism were either left uncorrected or required corneal curvature-altering procedures to correct this condition.

Fortunately, cataract surgeons today have more options to offer their patients with significant pre-existing corneal astigmatism. The Rayner T-flex® Aspheric Toric IOL and M-flex® T Multifocal Toric IOL both offer excellent visual outcomes at all distances and deliver first-class rotational stability in the capsular bag. Both IOLs come in an exceptionally wide range of cylinder and sphere combinations, making accurate and predictable visual outcomes possible for astigmatic patients.

At an educational symposium organised by Rayner held at the XXXI Congress of the ESCRS in Amsterdam, a select panel of cataract surgeons gathered to discuss toric IOL technology and important considerations for the treatment of astigmatism during cataract surgery. They explained the rationale behind using toric lenses, shared their clinical experience and outcomes with the Rayner range of toric lenses and offered surgical pearls to enable their fellow practitioners to get the most from this proven technology.

Thomas Kohnen

# Why use the T-flex IOL? A comparison of outcomes, rotational stability and ease of use

The epidemiological data for corneal astigmatism in the cataract population shows that an estimated 36 per cent of patients present with corneal astigmatism greater than +1.0 D and 20 per cent greater than +1.5 D. Toric IOLs are an effective means of correcting astigmatism in such patients. Yet, if we look at the number of toric lenses being implanted worldwide, it is clear that we are underutilising our abilities to correct astigmatism in cataract and lens surgery.

The choice of toric lenses on the market is growing all the time, with some key differences between the various lenses available. We have different materials – hydrophobic acrylic, hydrophilic acrylic, silicone, and even hydrophilic acrylic lenses with a hydrophobic surface. There are various haptic types: loop, plate and bag-in-the-lens. There are also varying IOL sizes and some differences in the range of spherical and cylindrical powers offered by the different manufacturers. Incision sizes also differ depending on the type of toric IOL selected.

In my practice, being able to select a lens that offers the widest possible range of spherical and cylindrical powers is very important. The Rayner T-flex® Aspheric toric IOL enables me to offer individual preparation and customised treatment options for my astigmatic patients.

The T-flex® is an aspheric, hydrophilic acrylic toric IOL which comes in two models: 623T and 573T. The 623T has an overall length of 12.50mm, with a 6.25mm optic body diameter, compared to an overall length of 12.00mm for the 573T, with a 5.75mm optic diameter. The estimated SRK/T A-constant of 118.9 and the theoretical anterior chamber depth of 4.97mm is the same for both IOL models.

I like to use the T-flex® primarily because it offers versatility to the surgeon. With such a wide range of spherical and cylindrical powers available, the lens can treat a large patient population and, more importantly, it offers a customised treatment.

The T-flex® comes in a spherical power range of +6.0 D to +30.0 D for the standard lens and cylinders of +1.0 D to +6.0 D in 0.5 D increments. A made-to-order model is also available to correct spheres from -10.0 D to +35.0 D (spherical equivalent) and is also available in 0.5 increments. This latter choice is particularly important for many of our refractive lens patients who frequently have high myopia or hyperopia. Cylinder correction for the made-to-order lenses is available within the

**UDVA**

| Toric IOL | Number of studies | Number of eyes | ≤20/20 | ≤20/25 | ≤20/40 |
|---|---|---|---|---|---|
| T-Flex | Entabi et al., 2011 & Stewart et al., 2010 | 47 | 36 | 23 | 77 |
| | Alberdi et al., 2012 | 27 | - | 52 | 96 |
| AcrySof | 22 | 1277 | 33 | 63 | 90 |
| Staar | 3 | 252 | 7 | 29 | 75 |
| Light adjustable lens | 2 | 15 | 33 | 80 | 100 |
| Acri.comfort | 2 | 73 | 54 | 75 | 92 |
| Microsil | 2 | 89 | 12 | 33 | 72 |

Adapted from Visser et al., JCRS, 2013

range of +1.0 D to +11.0 D in 0.5 increments and this kind of lens is very useful for special indications such as post-penetrating keratoplasty.

## Robust performance at all distances

When we look at the published data in the scientific literature, and based on our own clinical experience, it is clear that the T-flex® compares very favourably with other toric IOLs on the market in terms of key criteria such as uncorrected distance visual acuity, residual astigmatism, misalignment and ease of use. Visual outcomes are excellent with this IOL, with around 36 per cent of patients attaining 20/20 uncorrected distance visual acuity, 23 per cent reaching 20/25 and 77 per cent 20/40.

In terms of residual astigmatism, the published data show that around 87 per cent of patients have less than +0.5 D and 100 per cent less than +1.0 D of residual astigmatism with this implant. IOL misalignment rates are also similarly positive, with one study reporting a mean misalignment of 4-degrees or less for the T-flex® and no patient experienced more than 12-degrees postoperative rotation.

For ease of use, the T-flex® IOL is very straightforward to use both in terms of calculating lens power and implantation. To calculate the IOL power, Rayner has provided the Raytrace® online IOL toric calculator and ordering system. Using a simple step-by-step approach, the system allows the surgeon to input all of the relevant parameters such as preoperative refraction, patient data, the estimated induced astigmatism from the incisions and the desired postoperative outcome. Based on this data, Raytrace® will then help to select the lens that best matches the patient's needs. The IOL selection can also be changed and the estimated postoperative refraction updated if required.

### Residual astigmatism

| Toric IOL | Number of studies | Number of eyes | ≤ 0.5 D (%) | ≤ 1.0 D (%) |
|---|---|---|---|---|
| T-Flex | Entabi et al., 2011 & Stewart et al., 2010 | 47 | - | -- |
| | Alberdi et al., 2012 | 27 | 87 | 100 |
| AcrySof | 12 | 991 | 71 | 92 |
| Staar | 2 | 137 | 48 | 76 |
| Light adjustable lens | 2 | 15 | 100 | 100 |
| Microsil | 1 | 68 | 25 | 50 |

Adapted from Visser et al., JCRS, 2013

In summary, there are many positive aspects to the Rayner T-flex® Aspheric toric IOL. It is easy to use and can be implanted with the injector technology provided by Rayner. The lens unfolds in a controlled fashion in the capsular bag and the haptic configuration enables the surgeon to easily reposition the lens or for particular cases where the IOL may need to be implanted in accordance with the requirements of vitreoretinal surgery.

Overall, the T-flex® shows equal and superior visual outcomes compared to other IOLs on the market. It is effective at correcting a wide range of astigmatism, shows high rotational stability, is easy to implant and the IOL power calculations are simplified by using the Raytrace online calculator.

"The choice of toric lenses on the market is growing all the time, with some key differences between the various lenses available"

# Clinical experience with the Rayner Toric IOL platform

David Kent

The aim of any cataract procedure is to restore and improve vision, so the key question is what we can do as surgeons to address the astigmatic component of this goal.

Apart from toric IOLs, other conventional options are available for correcting astigmatism: on-axis surgery is sometimes a good option for small cylinders. In my experience, however, limbal relaxing incisions tend to be unpredictable, unreliable and unsatisfactory. They can damage the cornea and lead to or further exacerbate problems of dry eye.

My lens of choice is the T-flex®, a hydrophilic acrylic injectable lens with the toricity on the anterior surface and incorporating square-edge technology. I like the fact that it is an acrylic lens, as it promotes rapid and robust adhesion between the capsule and the lens. The overall length of the lens is also important in helping to ensure stability in the capsular bag and the T-flex® IOL certainly achieves that goal.

## Explaining astigmatism to patients

In terms of explaining the advantages of the toric lens to patients, my own personal approach is to explain astigmatism in simple, straightforward terms. With the toric lens, I tell them that we have an opportunity with cataract surgery not only of improving vision but at the same time neutralising their astigmatism which should enhance their final uncorrected vision postoperatively.

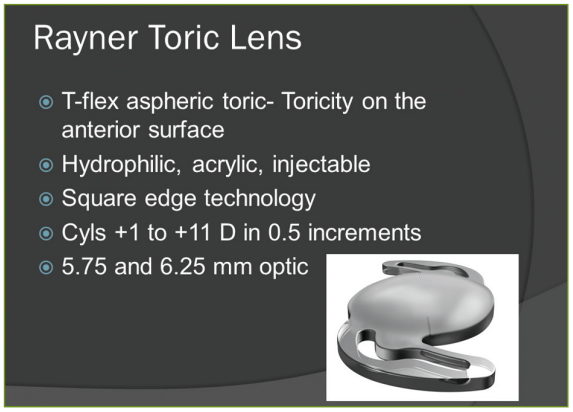
I advise them that their surgical outcome should be better if we use this new toric lens technology compared to using a standard non-toric aspheric IOL. I tell them that the risks of the surgery are no different to conventional cataract surgery, with the only difference being that the lens has to be positioned optimally to ensure the best possible visual outcome. I also warn them about the possibility of postoperative lens rotation with a toric lens.

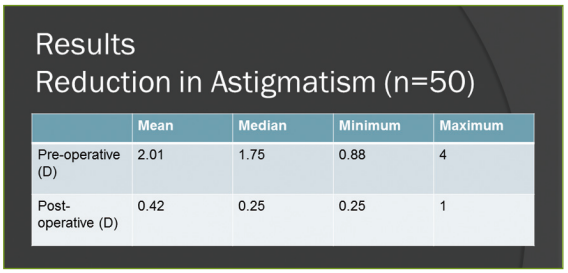
The quality of the T-flex® lens is borne out by the clinical results published to date. In my own case series, the mean preoperative astigmatism of the last 50 patients was about +2.01 D and this was reduced to +0.42 D postoperatively. The maximum astigmatism preoperatively was +4.0 D and +1.0 D postoperatively. All patients implanted with a toric lens had less than +1.0 D of astigmatism postoperatively.

## Pearls and pitfalls

First of all, accurate biometry is the key to excellent outcomes. Beware of unreliable keratometry values and a poor tear film. Lubricate the eye if necessary with normal saline to ensure accurate K readings.

"For high astigmatic values, make sure to repeat the readings several times to ensure their accuracy"




| | Mean | Median | Minimum | Maximum |
|---|---|---|---|---|
| Pre-operative (D) | 2.01 | 1.75 | 0.88 | 4 |
| Post-operative (D) | 0.42 | 0.25 | 0.25 | 1 |

Do not instil topical anaesthetic into the eye before performing K reading measurements because this will dry out the cornea and cause a chemical disruption of the corneal epithelium. Likewise, applanation tonometry causes a physical disruption to the cornea and jeopardises the accuracy of the keratometry readings.

For high astigmatic values, make sure to repeat the readings several times to ensure their accuracy. Be wary also of marked differences in K readings between a patient's eyes unless there is an obvious reason such as trauma or amblyopia.

Some surgical pitfalls: Mark the 3 and 9 O' Clock positions with a fine tipped marker with the patient sitting up to eliminate cyclotorsion. On the operating table either mark the axis of alignment before surgery or after removal of cataract and stabilisation of the chamber with OVD. Make sure the patient is looking at the operating microscope light to remove effects of parallax. Remember to mark both ends of the axis of alignment. This is important if pupillary constriction during the procedure or exuberant corneal hydration when sealing the section at the end of the procedure impedes the view of the lens markings. In these situations a second reference point can be important.

Remember it is a toric lens and ask the nurse or assistant to remind you of the fact. This might sound obvious, but after performing a series of standard IOL implantations it is easy to slip into autopilot mode and forget that one is implanting a toric lens.

Make sure your surgical incision is in the correct location as per your audited results.

Most surgeons will fill the bag and chamber with OVD. This means that it will be necessary and imperative to remove all OVD from behind the IOL following insertion. A good tip to ensure complete removal is to drop the bottle and use a low vacuum when the tip of the I/A is behind the IOL. Another useful tip is to employ the Arshinoff Soft Shell technique. Partially fill the bag with OVD whilst completely filling the rest of the chamber prior to lens insertion. Then fill the remainder of the bag with BSS beneath the OVD. Then inject the IOL. With this technique virtually all the OVD is anterior to the IOL and removal is rapid and complete with I/A.

Following removal of OVD ensure the IOL is in correct axis. Redial into correct position if necessary. Next ensure adequate chamber stabilisation with stromal hydration of the corneal section. In my opinion it is the combination of complete OVD removal and chamber stabilisation that ensures rotational stability of the IOL. Remember to try and not mask the lens markings with your stromal hydration when sealing the section. Also be cautious with small pupils. Finally inject intracameral cefuroxime via the paracentesis and make a final check that the lens is 'on axis'.

In summary, toric lenses in 2013 should be the standard first option in dealing with preoperative astigmatism. My lens of choice is the T-flex® and this lens, together with the Raytrace® online calculator and ordering system, provides the ideal platform in dealing with significant preoperative corneal astigmatism.

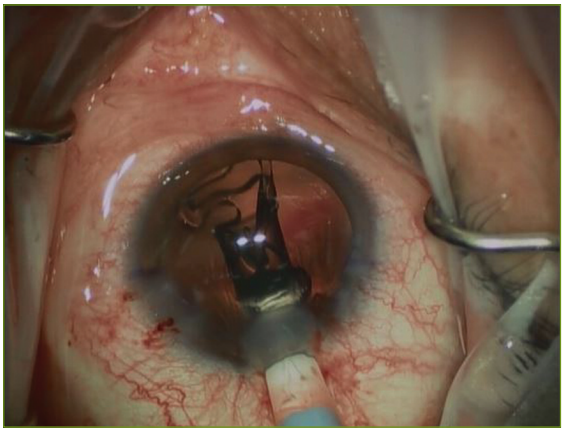
Daniel A Black

# Long-term performance of toric IOLs in the management of astigmatism

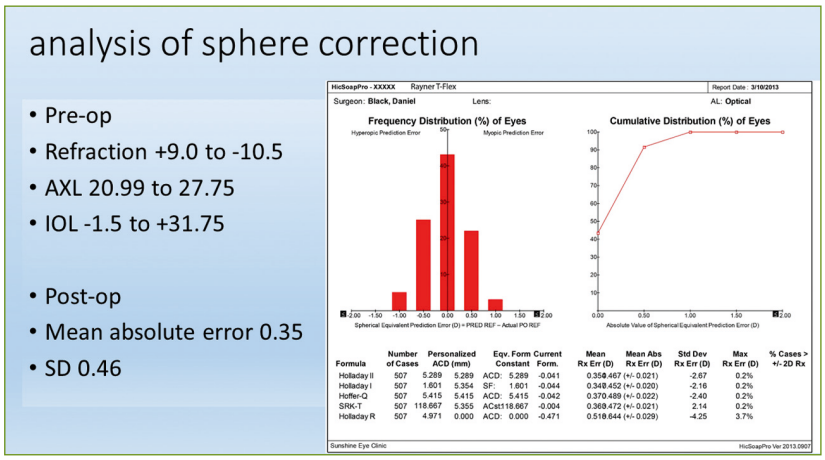
Our patients today expect spectacle independence after their cataract surgery and we know from a number of large population-based studies that about 40 per cent of patients presenting for surgery have significant astigmatism. We also know that a toric lens implant is more predictable and more stable than corneal incision surgery and will not induce the higher-order aberrations that go with corneal incisions.

We carried out a study to validate the effectiveness of a toric IOL in correcting astigmatism in cataract patients. The Rayner T-flex® lens was selected for this study because of its wide range of potential toric corrections. We took full advantage of this range and used from -1.5 D to +32.0 D for sphere and all the way from +1.0 D to +11.0 D in the cylinder range. Once we cross over the +1.5 D threshold, a lot of other toric lenses on the market start to come in 0.75 D or 1.0 D steps for toricity. The Rayner lens is special, however, because it comes in 0.50 D steps and therefore gives us much more flexibility in treating our astigmatic patients.

Our retrospective analysis encompassed 507 eyes that underwent cataract surgery over a five-year period from August 2007 to August 2012. It was a single-surgeon, single-centre study and the same cataract removal and IOL insertion technique was used for all patients. Our threshold for treatment is corneal astigmatism of +0.7 D or greater at the corneal plane which is about +1.0 D at the IOL plane. For the purposes of this study we treated all-comers, including those with both primary and secondary astigmatism, post-refractive surgery,



Implantation




penetrating keratoplasty, keratoconus and corneal scarring patients.

Biometry is the cornerstone of good results with a toric lens. The single biggest source of error in toric lens implantation is corrupted biometry. So remember when we are measuring keratometry, we are not measuring the curvature of the cornea but the reflection from the tear film. We screen all patients coming for surgery and the first test we perform is keratometry.

I use Dr Jack Holladay's programme for the calculation because I can import the data electronically from IOLMaster® (Carl Zeiss Meditec) and there are no transcription errors. I use the IOLMaster® keratometry both for calculating the axis of astigmatism and the power of correction needed for the lens. My advice is to continually optimise the A-constant values. In my case, the value is 118.7. Dr Holladay helpfully provides a chart that gives the degree of toricity recommended for any given spherical power.

The steps of my surgical technique are straightforward: topical anaesthesia, temporal clear corneal incision and bimanual surgery with vertical phaco chop to remove the nucleus. The toric lenses were implanted using the company-provided injector, initially through a 2.8mm incision and later a new injector which made a 2.4mm incision possible. The lenses all went into the capsular bag and were aligned with the marked steep axis followed by thorough removal of the viscoelastic.

## Very low rate of complications

Looking at our complication rate, two patients had radial tears in the continuous curvilinear capsulorhexis (CCC) but we still succeeded in implanting the lens in the capsular bag with no problems. We experienced about a one per cent cystoid macular oedema rate (five patients) but they all resolved with topical steroid and ketorolac treatment and there were no returns to theatre for IOL misalignment.

Looking at the results in terms of sphere correction, we had a wide preoperative range from -10.5 D to +9.0 D, and an axial length range of 20.99mm to 27.75mm. However the postoperative mean absolute error was one-third of a dioptre (0.35 D) and the standard deviation was 0.46 D. For cylinder correction, we treated a very wide range of refractive astigmatism from 0 to 7.25 D, keratometric astigmatism from 0.67 D to +7.86 D, keratometric value range from 33.35 to 59.00 and IOL toricity from +1.0 D to +11.0 D.

The mean postoperative cylinder from all these cases was 0.26 D with a standard deviation of 0.35 D and with 90 per cent of patients having 0.5 D or less of astigmatism. If we stratify the results looking at with-the-rule and against-the-rule astigmatism, we observed that with-the-rule cases generally did better than those patients with against-the-rule astigmatism.

In terms of postoperative residual astigmatism, six per cent of patients had +1.0 D, seven patients had more than +1.0 D and no patient had more than +2.0 D of residual astigmatism. Interestingly the seven patients with more than +1.0 D of residual astigmatism were all cases of primary astigmatism. Fortunately they all had less astigmatism than before surgery, indicating that in a small percentage of patients there are factors other than anterior corneal curvature that were contributing to total ocular astigmatism.

While a lot has been said about misalignment in toric lenses, research from Noel Alpins has shown that if the lens placement is within 10 degrees of intended axis, only about five per cent of toric power is lost. We have been able to validate the published data in our own practice. We found the T-flex® lens to be highly effective over the long term in correcting the widest possible range of both sphere and cylinder corrections.

> "Biometry is the cornerstone of good results with a toric lens"

# Multifocal toric IOL and patient selection in the management of astigmatism

Sérgio Kwitko

We have been using the Rayner M-flex® T multifocal Toric IOL in our clinic for approximately three years now.

We know that 35 per cent to 40 per cent of cataract patients have more than +1.0 D of corneal astigmatism. We need to address this when we are implanting IOLs and especially if we want to correct presbyopia because we are all aware that a small amount of astigmatism may impact on the final outcome of any multifocal IOL.

So there are a variety of options open to us to correct cataract, astigmatism and presbyopia: there are options such as the combination of multifocal IOL and limbal relaxing incisions, with low predictability

"For me, this lens has two main advantages: it is transparent with no blue filter, so the total visible light transmission is maximised and the loss of contrast sensitivity is minimised"

and stability or a multifocal IOL combined with LASIK/PRK surgery. This last option, however, includes two surgeries and an additional cost and burden for the patient.

I personally prefer to correct cataract, astigmatism and presbyopia in one procedure. For these patients, my lens of choice is the Rayner M-flex® T multifocal toric IOL because it is precise, can be easily implanted in one surgery and it offers excellent stability over time.

The Rayner M-flex® T is a refractive multifocal, aspheric, toric lens with either +4.0 D or +3.0 D add options for near vision. I prefer the +4.0 D add as it gives better near distance visual acuity, and as with any refractive IOL it delivers an excellent far and intermediate visual acuity which is usually better than those achieved with a diffractive IOL. The near visual acuity results with this lens are also excellent and are similar to those achieved with diffractive lenses.

The M-flex® T is based on the same tried-and-trusted platform as the T-flex® aspheric toric IOL. It is a one-piece hydrophilic acrylic lens, with anterior neutral asphericity of zero microns and a 360-degree posterior square edge.

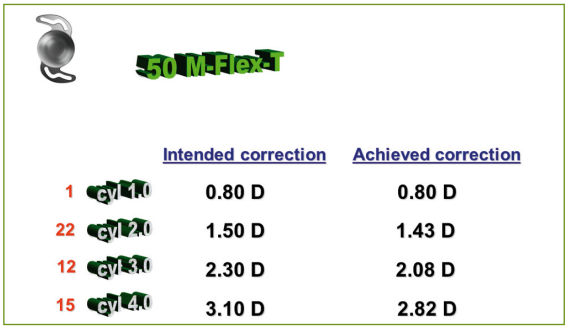
For me, this lens has two main advantages: it is transparent with no blue filter, so the total visible light transmission is maximised and the loss of contrast sensitivity is minimised. Secondly the hydrophilic acrylic material means that we experience no problems with glistenings which have been an issue with some other acrylic IOLs.

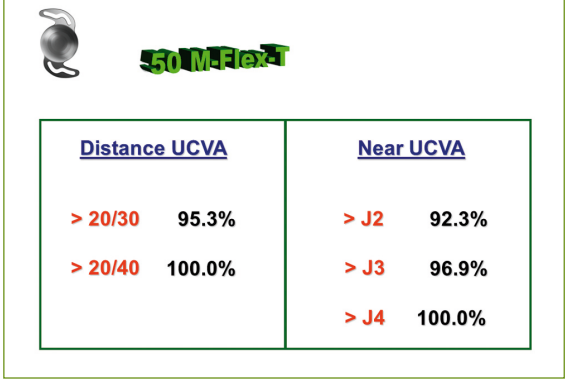
## Patient selection key to successful outcomes

One of the keys to success with this lens is patient selection and, more importantly, patient orientation in terms of what the patient can expect from the M-flex®T. We need to be honest with the patient and explain that every multifocal lens involves some element of compromise. We should tell the patient that we are going to reduce their dependence on glasses, but there is the possibility that they may experience some night-driving problems as with any multifocal IOL.

We also need to correctly identify the type of astigmatism with which we are dealing. While a monofocal toric IOL can be implanted in some patients with irregular and asymmetric astigmatism, a multifocal toric IOL is best implanted only in patients with regular, symmetrical astigmatism. This is because corneal asymmetry will lead to a poor outcome with a multifocal toric IOL.

We also need to address potential night-driving problems. If the patient develops cystoid macular oedema (CME), which is rare but remains a possibility, it is going to be more clinically significant than with a monofocal IOL, the patient will complain, so we need to aggressively treat CME to avoid such problems. We must also eliminate biometric errors as far as possible and warn the patient that he or she may need further corneal surgery or occasional use of glasses if there is a significant biometry error.




## Superior rotational stability

Rotational stability is critical for any toric lens and the M-flex® T is no exception. Each degree of rotation loses three per cent of cylinder correction. This might partly explain why there seems to be a tendency towards slight undercorrection of the astigmatism in the published literature and also in our own clinical experience.

With this in mind, if the online calculator suggests implanting a +2.5 D cylinder lens, I might therefore implant a +3.0 D lens, because this will compensate for any slight rotation there might be with the lens postoperatively.

I would also advise polishing the back surface of the anterior capsule because this may decrease the risk of capsular contraction and IOL dislocation and rotation. Implantation with this IOL into the capsular bag is very easy and straightforward. It is important to remove all of the viscoelastic behind the IOL in order to decrease the risk of postoperative rotation of the lens. I normally do this before the final alignment of the lens with the corneal markings and then dial the lens into its final position.

I have implanted about 50 M-flex® T IOLs to date with excellent results for both sphere and cylinder: the M-flex® T gives the patient excellent near and distance visual acuity and first-rate reduction of astigmatism.

Mark Packer

# Available options for accurate toric IOL positioning: from markers to the latest alignment technology

The recent upsurge in interest in technology to help us better position and align toric lenses in the eye is a welcome development. It means that there is a lot more attention on toric lenses than previously and companies are seriously looking at ways to help us improve our outcomes by developing better systems for measurement of astigmatism, registration of those measurements and intraoperative imaging and tracking systems in the operating room.


There are essentially two different ways in which we can measure preoperative astigmatism. We can do it under natural conditions on a pristine eye as the patient comes in off the street and measure the amount of astigmatism in the cornea. Then if we are going to use that measurement in the operating room we have to estimate what we believe the effect of our surgery will be on that astigmatism.

Not surprisingly, there is typically a large standard deviation in those measurements. When a surgeon states that his or her surgically induced astigmatism (SIA) is 0.4 D or 0.5 D they are referring to the mean SIA. However the standard deviation may be +0.4 D or -0.4 D, which means that one-third of patients have no induced astigmatism and one-third experience twice that amount or perhaps one whole dioptre.

We can also measure astigmatism intraoperatively as well. The advantage of intraoperative measurements during surgery is that we have already made the incisions so we can obtain a direct measure of SIA, or at least SIA as it is on the day of surgery. However, this will change later due to wound healing and other factors over the ensuing weeks, but we can get an estimate.

There are also a lot of variables in the operating room (OR) at the time of surgery including factors such as patient sedation, bright microscope lights, dry corneal epithelium, lid speculum, poor fixation and so forth. All of these factors need to be controlled somehow in order to get precise intraoperative measurements. With this in mind, my conviction is that a combination of preoperative and intraoperative measurements will give the best results.

Every degree of IOL misalignment reduces the toric effect by 3.3 per cent so a misalignment of 30-degrees negates the correction of the IOL and the effect is the same as if one has implanted a standard aspheric IOL. More than 30 degrees of misalignment will actually increase the pre-existing astigmatism, and this can be a real problem in cases of high-powered toric correction. Low-powered corrections are much more forgiving.

The problem with ink marking is that it runs, is messy and is not precise. One improvement on this is the Wet-Field Osher Thermodot® (Beaver Visitec), which is essentially a handheld cautery device for making a tiny dot at the limbus.

While the problem of cyclotorsion is often mentioned in association with toric lenses, inaccuracy can also occur because the marks are not perfectly horizontal. A bubble marker is now available to take care of this and is a clear improvement over simply making a dot at 12 o' clock and 6 o' clock positions on the cornea. There is also the Akahoshi Electronic marker® which provides auditory and visual cues to indicate the accurate horizontal marks. These are not the most high-tech solutions available, but they are still better than just estimating where the astigmatism might be.

Another advance is so-called iris fingerprinting which uses landmarks in the iris to guide IOL orientation. The Haag-Streit Osher® toric alignment system and Micron Imaging® systems take a picture of the dilated iris and superimpose a protractor, the keratometric medians and IOL goal line on this image. A hard copy of the image is then used during surgery.

## Towards greater precision with advanced technology

Even more advanced are the latest systems that use limbal registration and eye tracking to help us with our lens placement. For the last five years, in addition to preoperative topography and axis marking, I have been using intraoperative measurements with wavefront technology. I think this is helpful because it takes into account first of all the fact that I have already made the incisions in the eye and the IOL has been introduced. So the incisions are their final size and I have a real handle on my own surgically induced astigmatism rather than a mean and a standard deviation.

But there are a lot of details during surgery that make it a little tricky and there is a definite learning curve to using intraoperative measurements.

I have been using the WaveTec ORA® system which is based on Talbot-Moiré interferometry and allows real-time analysis of refraction, astigmatism and aphakic lens power during procedures. Adjustments can also be made intraoperatively.

I published a paper a few years ago looking at limbal relaxing incisions (LRIs) with this device and came up with some interesting results. In a control group of 37 eyes where I did not use the ORA intraoperative measurement, about eight per cent of patients had one dioptre or more of residual astigmatism. But in the treatment group of 73 eyes, only one per cent had one or more dioptres of residual astigmatism.

That equated to fewer excimer laser enhancements for the treatment group. In the control group, I was taking them back to the laser 16 per cent of the time and just four per cent in the aberrometry group. This is what people mean when they say that LRIs are unpredictable. With toric lenses, we can imagine that the results will be even better because toric IOLs are already more predictable than LRIs.

Another interesting development has been the discussion around posterior corneal astigmatism, following on from Douglas Koch's published study which found that a significant number of patients with against-the-rule astigmatism end up under-corrected after toric lens implantation. Dr Koch concluded that posterior corneal astigmatism was the cause of this under-correction, but taking intraoperative measurements is one way to overcome this issue and obtain better results for our patients.

In conclusion, toric IOLs are a growing part of our practice, but like all new technologies they make an extra demand on the surgeon to get that axis aligned perfectly. What we are seeing right now is a tremendous flowering of technology in this area to give us better measurements preoperatively and registration of those images intraoperatively so we can get away from making a messy dot of ink on the eye, end up with better outcomes, more pristine surgery and happier patients.

"The advantage of intraoperative measurements during surgery is that we have already made the incisions so we can obtain a direct measure of SIA, or at least SIA as it is on the day of surgery"

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## Contacts

Daniel A Black MBBS, FRACO, FRACS
Email: daniel.black@suneye.com.au

David Kent MD, FRCOphth
Email: dkent@liverpool.ac.uk

Thomas Kohnen MD
Email: kohnen@em.uni-frankfurt.de

Sérgio Kwitko MD
Email: sergio@oftalmocentro.com.br

Mark Packer MD, FACS, CPI
Email: mark@markpackerconsulting.com