

# AN INSIDE LOOK AT INNOVATIONS IN OPHTHALMOLOGY



*Innovation Journal Club* explores recently published and presented data around innovations in eye care with a focus on how they might shape real-world practice.



In the *Innovation Journal Club* series on Eyetube.net, host I. Paul Singh, MD, of The Eye Centers of Racine & Kenosha in Wisconsin, interviews leading experts from across eye care subspecialties about emerging innovations and technologies that may prove influential to the real-world practice of ophthalmology. The series is editorially independent (supported by advertising from multiple companies), which allows the discussions to be broad in scope and candid in presentation.

The following is a summary of three episodes in which Dr. Singh sat down with thought leaders: Cathleen M. McCabe, MD, to talk about patient expectations around astigmatism; with J. Morgan Micheletti, MD, to discuss innovations in cataract surgical techniques; and with Ranya Habash, MD, to look ahead to the use of artificial intelligence (AI) in ophthalmology.

## CORRECTING ASTIGMATISM WITH CATARACT SURGERY

WITH CATHLEEN M. MCCABE, MD



According to Cathleen M. McCabe, MD, correcting astigmatism at the time of cataract surgery is more than a mere convenience—it may be morphing into a patient expectation.

“Astigmatism now has become a fundamental part of how we take care of patients with cataract surgery,” Dr. McCabe said in a recent episode of *Innovation Journal Club*.

A significant number of cataract patients, as many as 1/3 if not more, have visually impactful amounts of astigmatism. Left uncorrected, even the tiniest amount of astigmatism may result in postoperative refractive surprise. In essence, why take a chance on not correcting astigmatism at the time of cataract surgery in order to deliver the best possibility for a good visual result?

“I think that we have this perception that correcting astigmatism is some mysterious thing, where you have to have all kinds of different preoperative technologies and diagnostics to do a good job in delivering for those patients,” Dr. McCabe said. She pointed out that today’s biometers excel at identifying an eye’s axis and magnitude of astigmatism, and that the technology for IOL calculations has likewise advanced to provide durable image quality.

### DON'T AVOID TORICS FOR FEAR OF ROTATION

Astigmatism correction can take many forms, including the use of toric IOLs. Historically, torics have tended to induce anxiety among surgeons, as the lenses demand precise placement and carry a risk of rotating postoperatively. However, according

to a recent study by Kramer et al, rates of repositioning surgery in the first 12 months after cataract surgery with toric IOLs are low, which suggests that the two toric models in the study exhibited good rotational stability.<sup>1</sup>

The first notable thing about the study, Dr. McCabe said, was use of the IRIS Registry Data, resulting in a study population of over 17,000 eyes. Second, although the rate of repositioning surgery in the first 12 postoperative months varied among the two toric IOL models (Figure 1), overall the rate was 1.3%, suggesting excellent rotational stability.<sup>1</sup>

In cases where she does detect postoperative IOL rotation, Dr. McCabe proceeds with a stepwise approach. She begins by determining the refraction, which she admits can be challenging in the early postoperative period because of surface dryness. “I want at least two consistent refractions that say, ‘This is where the refractive astigmatism is.’” Then, she uses the Toric Check on the iTrace aberrometer (Tracey Technologies) to find the location of the lens’ axis and power.

Dr. Singh also employs the iTrace, because it can be used without dilating the eye, and it

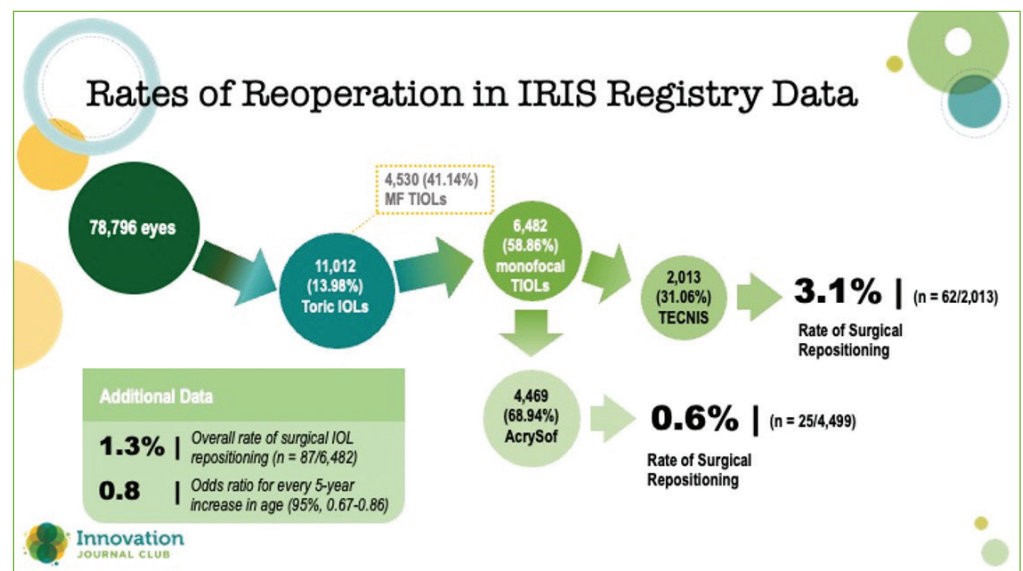


Figure 1. The rate of repositioning surgery in the first 12 postoperative months.<sup>1</sup>

indicates whether the issue with the IOL is its position or power. Both surgeons also use the device to educate patients about how much their vision will improve by correcting it. “It’s all about the value-add,” said Dr. Singh. “We want to do our best to help educate, so the patient can make an informed decision.”

### STUDY: FSAK VS. TORIC IOLS

Another method of astigmatism correction, femtosecond laser-assisted arcuate keratotomy (FSAK), has recently come into clinical use, although where it fits in the treatment algorithm is not formally established. One question with FSAK is how it might compare to toric IOLs in the correction of moderate amounts of astigmatism.

A recent study by Hernandez and colleagues provides some data.<sup>2</sup> The single-center clinical research study enrolled 67 patients with age-related cataracts and preoperative corneal astigmatism of 1.25 to 3.00 D to either a toric IOL (n = 38) or FSAK (n = 37). At 3 months, patients’ mean residual refractive astigmatism was -0.63 D in the toric IOL group and -0.90 D in the FSAK group. In the toric group, 84% (32 eyes) achieved  $\leq 1.00$  D, versus 64% (25 eyes) in the FSAK group.

Dr. McCabe felt that the outcomes of this study confirmed what many surgeons already think: a number of factors affect the healing response with limbal relaxing incisions, and results vary.

“I think this study showed conclusively that the outcomes were better with toric lenses in those moderate amounts of astigmatism,” she said. “It’s exactly what I would’ve expected.”

Despite her preference for torics, Dr. McCabe said still uses FSAK, such as for low amounts of astigmatism for which lens options do not exist, in combination with toric IOLs in patients with  $\geq 4.00$  D of astigmatism.

More important than modality, though, is to adopt a mindset where astigmatism correction is a first priority, and then to work within the options to find the right method for each patient. Considerations for premium lenses and other add-ons are a nice value for cataract patients, Dr. McCabe said, but surgeons should really think about starting every patient with a focus on correcting

the cylinder that may impact the final visual outcome.

“You can add to it if you want, but fundamentally, let’s correct your astigmatism,” she said.

### CATHLEEN M. MCCABE, MD

- Cataract and refractive surgery specialist and Medical Director, The Eye Associates, Bradenton and Sarasota, Florida
- Chief Medical Editor, *CRST*
- cmccabe13@hotmail.com; Twitter @cathyeey
- Financial disclosure: Consultant (Alcon, Bausch + Lomb, Carl Zeiss Meditec); Research support (Alcon); Speakers bureau (Alcon, Bausch + Lomb)

## INNOVATION IN CATARACT SURGICAL TECHNIQUES

### WITH J. MORGAN MICHELETTI, MD



J. Morgan Micheletti, MD, admits he has found his calling in ophthalmology, but perhaps for an unexpected reason: it provides

his curious mind an outlet with which to tinker.

In a recent episode, Dr. Micheletti recalled being a kid who liked to take apart and

put back together household appliances—sometimes with a few leftover screws. Now, he’s applied that inquisitiveness to the practice of ophthalmology. “Every step that I do, from cataract surgery to pterygium surgery, or anything we do in clinic or elsewhere, I say, ‘Why am I doing this? Can this be done in a more efficient manner? How can we take what we have and improve upon it?’”

### LENS EXCHANGES WITH PREMIUM IOLS

Take, for example, Dr. Micheletti’s proposed modification on the *twist and out* technique, which was introduced in 2020 by Chapman et al.<sup>3</sup> He told Dr. Singh that during one particular case where he was performing the technique, he had placed paracentesis incisions 180° apart, as is his practice. Just before he was about to ask for the spatula for his left hand, he changed his mind and asked for a 25-gauge cannula instead, just to try it. With the cannula threaded from the sideport to the secondary incision, he had bridged the gap and thereby provided structural support.

“Now I have a cannula bridging going across the anterior chamber, protecting the endothelium, providing that mechanism to roll the IOL against,” he said.

Using the cannula for counter-traction, Dr. Micheletti could now use two hands to rotate the forceps and wrap the IOL before retracting it (Figure 2). He added that the

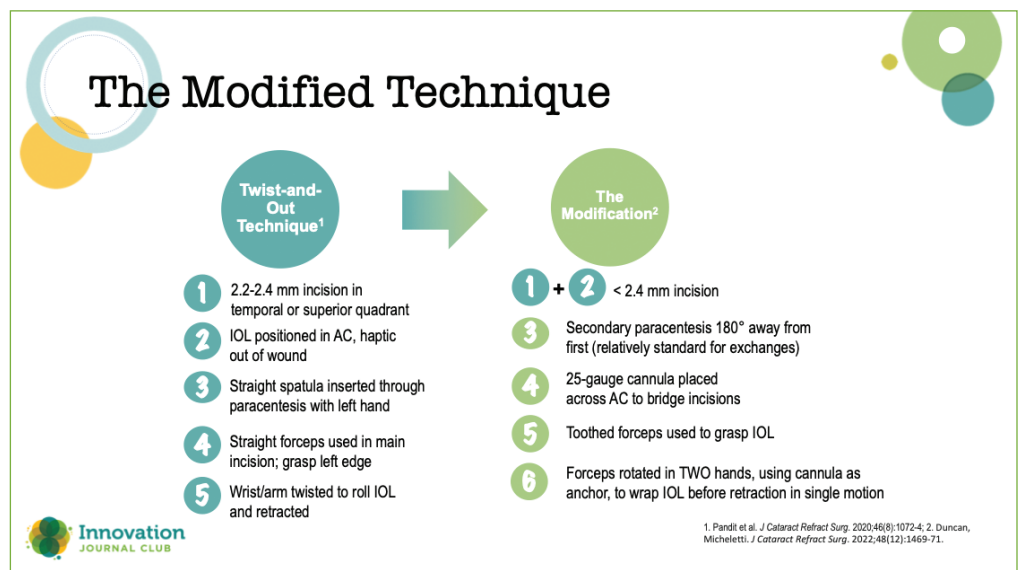


Figure 2. Dr. Micheletti’s modified technique.



technique was titratable, and that he performed it through a 2.4-mm incision or smaller. He also likes that the technique does not require extra

instrumentation. During the episode, Drs. Micheletti and Singh reviewed a case video in which Dr. Micheletti demonstrated the modification (scan the QR code to view).

### THE PUNCH TECHNIQUE

When an IOL is dislocated within the capsular bag, the standard of care is to extract it and implant a 3-piece IOL with scleral fixation. Often, premium IOL recipients don't want the lens explanted. They've paid more for it, and they like the vision the IOL gives them. In these cases, Dr. Micheletti will present the patient the option of fixating the IOL. "If it's still floating on the interior hyaloid face, or just at least high enough up in the anterior chamber that I as an anterior segment surgeon can get to it, then I think it's worth the discussion with the patient."

The particular technique Dr. Micheletti uses for these cases is a good example of inspiration striking when least expected (Figure 3). During the COVID lockdown, Dr. Micheletti was watching surgical videos on Eyetube, when he came across a video of Sergio Canabrava, MD, performing an *external punch*. A couple of days later, he was watching his kids use a hole puncher in paper cups. "And I was like, what if we took Dr. Canabrava's punch, and miniaturized it, and could use it in the eye?"

He contacted his local ophthalmic company, Diamatrix, Ltd., in Houston, about his idea, and they developed a prototype within 2 weeks.

Initially, he used 5-0 prolene sutures,<sup>4</sup> but now performs the technique with 6-0 or even 7-0 sutures, which he threads through the haptic-optic junction to secure the lens. "Basically, you're creating a rivet; a double flange. You're flanging one side with low-temp cautery, going through that hole that you've created inside the haptic-optic junction inside the eye. And that's what makes this unique: you're creating a hole inside the lens, inside the eye." The surgeon removes the cored piece of the IOL from

## Punch and Rescue Technique

**A new approach to IOL fixation after in-the-bag dislocation**

- 1** 2 paracenteses made w/ 1 mm side-port blade; AC filled with OVD

**2** 2.4 mm keratome entered inferiorly to AC over targeted haptic

**3** IOL punch introduced to AC, centered on the optic-haptic junction around the IOL-bag complex  
(a) activated to create a hole; core removed  
(b) Can be repeated for multiple anchor points

**4** 5-0 (or 6-0) prolene threaded through opening into small-gauge needle inserted 2.5 mm posterior to limbus  
(a) retrieved as needle is retracted
- 5** Both portion flanged with low temp cautery; scleral side is also flanged using cautery as a temporary safety flange

**6** IOL is centered (we use a digital heads-up display + Purkinje reflex)

**7** After centration, scleral side of prolene suture was cut, and a flange was created again using cautery

**8** Anterior vitrectomy to remove residual vitreous, OVD

Innovation  
JOURNAL CLUB

Figure 3. The punch and rescue technique.

the punch device, docks the suture with a 25-gauge needle, and pulls it out, similar to haptic fixation. The step is repeated on the other side of the IOL.

### J. MORGAN MICHELETTI, MD

- Cataract, refractive, and anterior segment surgeon, Berkeley Eye Center, Houston
- Member, CRST Editorial Advisory Board
- [morgan.micheletti@berkeleyeye.com](mailto:morgan.micheletti@berkeleyeye.com)
- Financial disclosure: Consultant (Alcon, Bausch + Lomb, Carl Zeiss Meditec, Johnson & Johnson Vision, RxSight); Research grant (Alcon, Johnson & Johnson Vision); Speaker (Alcon, RxSight)

## THE NEXT FRONTIER IN MEDICINE: ARTIFICIAL INTELLIGENCE

### WITH RANYA HABASH, MD



"We use AI all the time, we just don't realize it," Ranya Habash, MD, a corneal refractive surgeon at Bascom Palmer and the head of AI for AECOS told Dr. Singh in an episode dedicated to understanding the potential role of AI in ophthalmology.

However, she added, it would be best to understand the "A" in AI as *augmented*.

In her view, AI has every potential to add clinical efficiencies that will permit physicians to spend more time on the reason they got into medicine in the first place—and something that is suffering in the current clinical setting: interacting with the human patients in their practices.

### THE FUTURE ROLE OF AI IN OPHTHALMOLOGY

Dr. Habash explained how generative AI differs from the behind-the-scenes digital automations that eye care practitioners have come to rely on (IOL calculations, for example). AI systems that produce content, such as ChatGPT (Chat Generative Pre-Trained Transformer), are not confined by their current level of knowledge. They have to be trained to function as desired, and they continuously improve over time. "Every time someone corrects its output, it learns how to improve its answers," she said. "It generates new data."

Where such a technology might be applicable, for example, is in listening to exam room conversations between a doctor and a patient, and then synthesizing the most important information into clinical notes. Such services would free up physicians' time to do more patient-centric tasks. Dr. Habash added that some doctors are exploring AI's use in writing prior authorizations and denial letters. They are



using it to find the citations they need so that insurance companies “have no wiggle room.”

### LEARNING AS IT GOES

ChatGPT’s learning potential was demonstrated in a study that evaluated whether the generative content functions could provide answers to two 260-question simulated exams used to study for the yearly OKAP exams.<sup>5</sup> The study found 55.8% and 42.7% accuracy in the two trials, which is remarkable, considering the system was used “out of the box” without any training. Dr. Habash said she is aware of a more recent figure of 81% with ChatGPT-4. As well, even within the study, ChatGPT performed better on question sets in some subspecialties than others (75% accuracy in general medicine and retina vs 35% in uveitis). “The more information that you can give it, the more feedback you can give it, the quicker it will learn,” she said.

To many, AI remains an intriguing concept, but one that sometimes engenders concerns that machines will replace humans, and medicine is too important a sector to risk something going wrong. Dr. Habash pointed out that AI, if it is *augmented* intelligence, is meant to improve the capabilities of human actors. A second brain, if you will, that will allow the individual using it to perform more efficiently.

At Bascom Palmer, Dr. Habash and colleagues placed fundus cameras equipped with AI for automatic detection of suspicious findings in primary care offices in an experiment to boost the number of screenings for diabetic retinopathy, which

hovered at around 40%. The team was hopeful for even a slight increase. After the cameras were installed, the rate improved to 82%.

“Then, we found pathology in 50% of the patients who were screened,” Dr. Habash said, adding that her team was able to expedite those patients to retina specialists for intervention instead of waiting 6 months for an appointment.

### THE APPRAISE STUDY

Ultimately, how accepting ophthalmologists are of AI—however it is defined—will hinge on its applications. That certainly seems to be the case based on the results of the Acceptance and Perception of Artificial Intelligence Usability in Eye Care (APPRAISE) for Ophthalmologists survey,<sup>6</sup> which asked 1,176 ophthalmologists from 70 countries to “evaluate the perspectives of ophthalmologists regarding AI in four major eye conditions: diabetic retinopathy, glaucoma, age-related macular degeneration, and cataract.”

Overwhelmingly, and perhaps unsurprisingly, respondents were more willing to use AI in clinical assistance capacities (office tasks, scripting, etc.) than as a diagnostic tool. Dr. Habash interpreted these findings to mean that ophthalmologists welcome AI support for clinical efficiencies, but they are not enthusiastic to let AI generate or be responsible for clinical decisions.

### THE FUTURE WILL BE COLLABORATIVE

Dr. Habash stressed the need for medical practitioners to collaborate with tech industry partners as well as ophthalmic

device manufacturers to develop AI-assisted technologies. In fact, she brought representatives from Microsoft, Inc., to give a panel talk at this year’s ASCRS meeting in which they highlighted ways those in the medical and technology fields can work together to usher in an age of “precision medicine.” ■

1. Kramer BA, Berdahl J, Gu X, Merchea M. Real-world incidence of monofocal toric intraocular lens repositioning: analysis of the American Academy of Ophthalmology IRIS Registry. *J Cataract Refract Surg.* 2022;48(3):298-303. doi: 10.1097/jjcrs.0000000000000748.
2. Hernandez R, Almenara C, Soriano D, et al. Toric intraocular lens implantation vs femtosecond laser-assisted arcuate keratotomy for correction of moderate astigmatism in cataract surgery. *J Cataract Refract Surg.* 2022;48(8):887-893.
3. Pandit RT, Devgan U, Chapman JR Jr. Twist and out intraocular lens removal. *J Cataract Refract Surg.* 2020;46(8):1072-1074. doi: 10.1097/jjcrs.000000000000161.
4. Micheletti JM, Weber N, McCauley MB, et al. Punch and rescue technique for scleral fixation of dislocated single-piece intraocular lenses. *J Cataract Refract Surg.* 2022;48(2):247-250. doi: 10.1097/jjcrs.0000000000000845.
5. Teebagy S, Colwell L, Wood E, Yaghy A. Improved performance of ChatGPT-4 on the OKAP Exam: a comparative study with ChatGPT-3.5. *medRxiv.* April 2023.
6. Gunasekaran DV, Zheng F, Lim GYS, et al. Acceptance and Perception of Artificial Intelligence Usability in Eye Care (APPRAISE) for ophthalmologists: a multinational perspective. *Front Med (Lausanne).* 2022;13(9):875242.

### RANYA HABASH, MD

- Voluntary Assistant Professor of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Florida
- Visionary Innovation Mentor and Mentor, Clinical Informatics Management Program, Stanford University School of Medicine, Palo Alto, California
- Cofounder, MetaMed
- FDA Digital Health Network of Experts
- Cochair, Artificial Intelligence, American-European Congress of Ophthalmic Surgery
- ranya@habash.net
- Financial disclosure: Consultant (AbbVie/Allergan, Alcon, Bausch + Lomb, Carl Zeiss Meditec, Dompé, Doximity, Johnson & Johnson Vision, Tarsus); Equity owner (Doximity, MetaMed)

