

Benefits of extended range of vision optics for presbyopia correction

Suhas Haldipurkar, MD



Suhas Haldipurkar, MD,
Laxmi Eye Institute, Mumbai, India

Presbyopia-correcting IOLs have been around for almost two decades, but use still hovers around 4.5% globally. This is due to a combination of issues with quality, overcautious doctors, a too-high qualifying bar for finding the “Mr. Right” patient, and too many expectations from patients.

Entering this landscape, could extended range of vision optics be the magic pill surgeons have been waiting for?

The Tecnis Symphony IOL (Abbott Medical Optics, Abbott Park, Illinois) combines two complementary enabling technologies: the proprietary diffractive echelette design that introduces a novel pattern of light diffraction that elongates the focus resulting in an extended range of vision of about 1.5 D—sufficient to provide good vision—and achromat technology that reduces chromatic aberration to boost

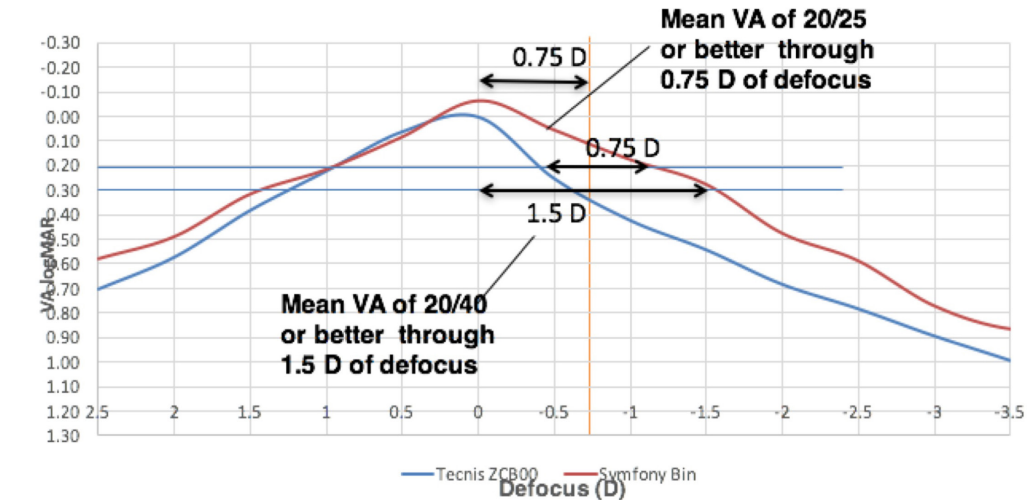


Figure 1. Binocular defocus curve (Symphony vs. Tecnis monofocal)

Source: Suhas Haldipurkar, MD

image quality. In terms of glare and halos, the achromat technology makes the extended range of vision IOL comparable to monofocal IOLs.

Compared to standard multifocal IOLs, the extended range of vision IOL increases depth of focus to provide better intermediate and near vision without affecting distance vision. Negative aberrations combined with tightly controlled chromatic aberrations also help in achieving extended range of vision. Meanwhile, glare and halos are decreased.

Admittedly, visual performance at near is modest compared to multifocals and reading add may be needed for fine print, but the absence of multiple images simultaneously cast on the retina makes

a huge difference, putting the lens in a different class.

Why extended range of vision IOL

The Symphony extended range of vision IOL uses the time-tested Tecnis lens platform that provides visual satisfaction, not just “numbers.” The platform is an excellent product for monovision and mix-and-match IOLs if needed. It is an ideal IOL exchange option for patients unhappy with their multifocal implants.

The extended range of vision IOL provides seamless range of vision from near to far and scores better on contrast and photic phenomenon than multifocal IOLs. In further contrast to multifocals, this IOL has

universal eligibility criteria, and is the ideal implant for a wider range of presbyopic cataract surgery patients.

Way to success

To successfully incorporate the extended range of vision IOL into their practice, surgeons must first believe in the product, putting their faith in the results of the first few cases. Once they have accepted the IOL, they need to change their counseling style. They need to widen the scope for this product, positioning it as a product for one and all—take the exclusivity out of the product.

As with multifocal IOLs, good surgery with a well-centered IOL remains mandatory,

continued on page 3

A lunch symposium at the 2016 Asia-Pacific Association of Cataract and Refractive Surgeons (APACRS) annual meeting held in Bali, Indonesia, brought forth several new developments that allow cataract and refractive surgeons to provide their patients with more optimal results.

The symposium, sponsored by Abbott Medical Optics (Abbott Park, Illinois), featured some of the world’s top experts discussing the latest IOL, phaco, and refractive technologies, including extended range of vision and toric IOLs, hybrid pump systems, and wavefront-guided laser refractive procedures.

Which toric IOL should I use?

Daniel Black, MBBS, FRANZCO



Daniel Black, MBBS, FRANZCO, Sunshine Eye Clinic, Sunshine Coast, Queensland, Australia

Almost half (40%) of patients who present with cataracts will benefit from astigmatism correction, particularly as patients these days tend to expect spectacle independence after cataract surgery. Toric IOLs may cost more upfront, but surgical options such as manual astigmatic keratotomy carry the risk of inducing aberrations. In addition, toric IOLs provide more predictable and more stable refraction than manual incision surgery and ultimately may reduce dependence on spectacles and contact lenses over a patient's lifetime.^{1,2}

In the details

There is quite a selection for surgeons to work through, so choosing a toric IOL is almost like asking which new car you should buy. When buying a new car, you might find yourself confronted with a barrage of tiny little details—this car might be 5% lighter, or 1.5 inches wider; one might have a design that offers a 5% reduction in drag, an engine that reduces emissions by 13%, with a selection of compression ratios ranging from 1:15.5 to 1:16.2;

and should you go with a car with that extra overdrive gear? The point is, there are a lot of little differences that when put together can have a significant impact on the outcome; this is so, too, with toric IOLs. The game has changed: It is no longer good enough to only correct sphere and cylinder; these days, we are also expected to correct higher order aberrations.

This is why the Tecnis Toric IOL (Abbott Medical Optics, Abbott Park, Illinois) is an ideal choice of toric. In addition to spherical aberration correction, the Tecnis Toric also corrects chromatic aberration. This works in synergy with the IOL's high quality optic, which has a low refractive index to minimize dysphotopsias, is completely glistening-free, and provides full light transmission.

Validating optical synergy

A retrospective analysis of 927 cases of patients undergoing surgery from September 2011 to May 2016 was conducted to validate the effectiveness of the Tecnis Toric IOL in correcting astigmatism. A single surgeon conducted the operation using a single technique. Cases were followed up a minimum of 1 month.

Before going into the details, one thing to remember is that when we measure keratometry, we are not measuring the curvature of the cornea. Instead we are measuring a reflection from the tear film; as such, it is imperative to conduct biometry on virgin tear film.

In this study, patients had corneal astigmatism of 0.6 D or greater. The study included patients with astigmatism from

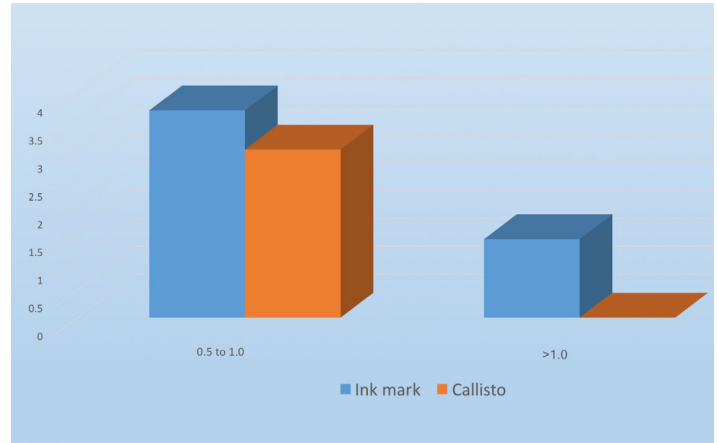


Figure 1. Digital marking resulted in significantly less postop astigmatism than ink marking ($p=0.02$).

Source: Daniel Black, MBBS, FRANZCO

primary and secondary causes, including post-surgery and pterygium patients.

The study used the Holladay IOL Consultant (Bellaire, Texas), which uses the Holladay II formula to calculate the toric correction required. Data was imported electronically to avoid transcription errors. IOLMaster keratometry (Carl Zeiss Meditec, Jena, Germany) was used for astigmatism axis and power, and A-constant was optimized/personalized.

Initially, the steep axis was marked with ink, but the procedure later progressed to using the Callisto digital marking system (Carl Zeiss Meditec), which improved results.

From the perspective of surgical technique, it is important to have very consistent sizing of the capsulorhexis. This ensures rotational stability and consistency with regard to effective lens position (ELP). In the study, surgeons used a 2.2-mm incision to minimize induced astigmatism. The IOL was implanted in the bag, aligned to the marked steep axis, and implantation was

followed by thorough OVD removal.

In terms of complications, two patients had radial tear in the capsulorhexis, but the IOL was implanted in the bag with no problems; five patients had cystoid macular edema that resolved with topical steroid and ketorolac.

No patients had to return to the operating theater.

In terms of spherical correction, with refractions ranging from +8.0 to -12.5 preop, surgeons achieved a mean absolute error of 0.30, median absolute error of 0.29, with a standard deviation (SD) of 0.36.

In terms of cylinder correction, over a broad range of preop refraction from 0 to -4.5, keratometric astigmatism of 0.60 to 4.33 requiring IOL toricity of 1.0 to 4.0, no patients had more than 1.0 D of residual astigmatism using digital marking, and 98.6% had ≤ 0.5 D of residual astigmatism.

Stratifying results showed a little bit of difference between with-the-rule (mean 0.14 D, SD 0.24, 98% with 0.5 D or less of residual astigmatism postop)

Mean rotation	Follow-up period	Reference
2.74 degrees	6 months	Data on file (Abbott Medical Optics)
<3 degrees	2 years	Findl, presented at ESCRS 2012
3.15 degrees	2 months	Ferreira TB, Alemeida A, JRS, 2012;28(8):551–555
3.4 degrees	2 months	Sheppard et al, JCRS, 2013; 39:41–7
2.1 degrees	2 weeks	Assaf A, presented at ESCRS 2012, Milan, Italy
2.6 degrees	2 months	Assaf A, presented at ESCRS 2012, Milan, Italy

Figure 2. Rotational stability according to Tecnis Toric studies

Source: Daniel Black, MBBS, FRANZCO

and against-the-rule (0.19 D, SD 0.30, 97.5% with 0.5 D or less of residual postop), probably due to the nomogram.

The use of digital marking resulted in significantly less postop astigmatism than ink marking ($p=0.02$, Figure 1) and ensured that none of the patients had more than 1.0 D of residual astigmatism. The digital marking system effectively reduces the outliers, improving results.

Rotational stability

Alignment is notoriously important for toric correction, with every 10 degrees of misalignment equating to a 6% loss of toric correction. Rotational stability is thus a particularly important factor in IOL selection.

In terms of rotational stability, these study results with the Tecnis Toric match those of other published Tecnis Toric studies, which show a mean rotation ranging from 2.1 degrees after 2 weeks of follow-up to 3.4 degrees after 2 months of

follow-up; meanwhile, a mean rotation of less than 3 degrees was reported by the study with the longest follow-up of 2 years (Figure 2).

It is possible for each and every surgeon to achieve the same results, but you have to pay attention to detail. Biometry on virgin tear film is the single most important factor, and you have to be consistent and accurate with your capsulorhexis, be careful with the alignment of the IOL, and ensure thorough OVD removal.

The success of the Tecnis Toric is the result of its optical synergy: Tecnis has been proven to provide long-term correction of both lower order aberrations of sphere and cylinder; we know that for patient satisfaction we have to correct more higher order aberrations, and Tecnis is the only lens that corrects both chromatic and spherical aberration; and the lens maximizes visual quality through an acrylic material with a low refractive index to minimize dysphotopsias that is glistering-free and allows full light transmission.

References

1. Mingo-Botin D, et al. Comparison of toric intraocular lenses and peripheral corneal relaxing incisions to treat astigmatism during cataract surgery. *J Cataract Refract Surg.* 2010;36:1700–8.
2. Hirschall N, et al. Correction of moderate corneal astigmatism during cataract surgery: Toric intraocular lens versus peripheral corneal relaxing incisions. *J Cataract Refract Surg.* 2014;40:354–61.

continued from page 1

though programming the aspirations of the patient are at least as important.

Detailed ocular surface examination pre- and postop are a must, and managing residual refractive error is of paramount importance.

Nevertheless, unlike multifocal IOLs, the extended range of vision IOL is more forgiving in terms of residual

error. Should postoperative refractive surprises occur, the flat defocus curve leaves a margin for some error, and surface ablation to treat residual error is more possible with the extended range of vision IOL than with multifocal IOLs. Moreover, neural adaptation is less of an issue.

Personal experience with extended range of vision lenses

At Laxmi Eye Institute, surgeons implanted the Symphony extended range of vision IOL bilaterally in 24 patients, aiming for micro-monovision. Patients' best corrected visual acuity (BCVA) for distance was 20/20 with spherical equivalents between -0.25 and -0.50 D. Uncorrected near visual acuity

was N6 and uncorrected intermediate visual acuity N8.

Compared to a Tecnis monofocal, Symphony provided a mean visual acuity of 20/25 or better through 0.75 D of defocus and 20/40 or better through 1.5 D of defocus (Figure 1).

The surgeons concluded that Symphony is an excellent alternative for a larger section of the cataract population who have no issues wearing reading glasses for small print.

Improving outcomes, safety, and efficiency with phacoemulsification

Steven Dewey, MD



Steven Dewey, MD,
Colorado Springs Eye Clinic,
Colorado Springs, Colorado

A surgical technique is an amalgam of habits, available technology, and instrument familiarity. With this in mind, how does one advance his or her own surgical performance? The first step is to set your ego aside as you take inventory of your existing technique. We all have assumptions that we make about our surgery, and those assumptions may or may not stand up to review.

The next step is to establish a measurable goal. Reducing the number of unplanned vitrectomies or reducing case times are relatively simple but highly worthwhile goals. To do this, achieving certain other goals may become necessary, such as improving chamber stability.

While metrics alone can be helpful in establishing the success of a particular change, video recording of these cases will speed the progress. Video can reinforce the improvements, but will also unmask all of the flaws. As changes are intro-

duced into the technique, video is critical to separate those problems due to the change in technique from those that are coincidental but unrelated.

Underlying the opportunity for improvement is a deeper understanding of the available options. Differences in vacuum pump technology, for example, can be utilized to improve various stages of surgery. Understanding these subtleties may help provide that breakthrough.

Breaking down flow vs. vacuum

The effect of vacuum is the force created to pull fluid into the lumen of the phaco needle. The type of pump used to create vacuum doesn't determine the magnitude of the vacuum, but rather how flow is controlled in its relationship to vacuum. The pump is controlled by software, driven by a computer, and ultimately controlled by your foot pedal.

So what is the difference between flow and vacuum? Fluid going from one place to another is flow. Flow is a rate—how fast the fluid goes from here to there. We are all familiar with flow, whether it is a slow drip from a garden hose or an explosive jet from a fire hose. The difference between the flow we observe daily and the flow rate in phaco is that the flow we generally observe is not directed. Flow in phacoemulsification is directed into the lumen of the phaco needle, hence the alternative term aspiration, or aspiration rate.

“Underlying the opportunity for improvement is a deeper understanding of available options. Differences in vacuum pump technology, for example, can be utilized to improve various stages of surgery.”

—Steven Dewey, MD

Vacuum is a force, the effort that is generated to pull the fluid from here to there. When the needle is unoccluded, flow tells us how quickly the fluid is moving from point to point. When the needle is occluded, vacuum is the force necessary to restore that flow. Flow is the action of material in the anterior chamber before the material reaches the needle, everything you see happening as the material moves to the needle is flow. Once the needle is occluded—when the material is at the tip—that's vacuum.

These two things are always happening at the same time and do not occur in isolation from each other; rather, they are synergistic.

Flow will bring material to the tip—the higher the flow, the faster the draw. In other words,

the “reach” of the needle—its range of attraction—is greater with higher flow rates. Higher levels of flow also overcome turbulence in the anterior chamber.

Vacuum, on the other hand, establishes hold on material to the tip of the needle—the higher the vacuum, the more efficient the hold. This hold then allows power to be transferred from the tip to the fragment. Higher levels of vacuum overcome repulsion and reduce chatter.

Vacuum is also useful for removing nuclear and cortical material. Softer material can be removed in some cases without phaco power. The higher the vacuum, the more effectively this force can remove material. Denser material requires more power to remodel or remove the material.

Breaking down peristaltic vs. venturi

Bearing in mind the differences and synergism between flow and vacuum, peristaltic and venturi pumps are just different styles of pump.

The peristaltic pump is generally considered to be safer because the nature of the pump dictates that flow and vacuum are separate parameters—they are measured separately and can be controlled separately. Flow occurs when the needle is unoccluded; vacuum occurs when the needle is occluded and there is resistance to flow.

Meanwhile, with the venturi pump, the vacuum is always active; it is the parameter that you control with your foot pedal. The pull on the fluid is the same whether the needle is occluded or whether flow is occurring. While flow is a consequence of using the venturi vacuum, there is no way of measuring flow when using a venturi pump.

So which is better? They are both good for different situations during surgery.

At occlusion, the vacuum created by each system is the same—the vacuum force created at the tip of the needle during occlusion is the same whether it is created by a peristaltic or venturi pump. The difference is in how flow is generated (venturi) versus how flow is measured (peristaltic). With the flow generated using the venturi pump, the only flow regulation is mechanical—i.e., the lumen size of the needle. The peristaltic pump, on the other hand, regulates the flow directly.

However, the venturi pump is generally regarded as more efficient as it creates more attraction—higher flow—at low levels of vacuum. The creation of this vacuum is furthermore not dependent on the state of occlusion. This style of pump is therefore efficient for any size material, and is exceptionally efficient for material that cannot form an occlusion—wispy cortex and viscoelastic.

Still, the peristaltic pump has the advantage over venturi in terms of emulsification. When the needle is occluded, whether partially or completely, the hold of the vacuum establishes the transfer of power from the needle to the material.

Now, as power is applied, material is removed and the occlusion is broken. Flow then reattracts the material to reestablish occlusion while vacuum holds the material to subject it to the forces of power.

The Signature Pro (Abbott Medical Optics, Abbott Park, Illinois) has both vacuum systems available for on-demand, middle-of-the-case switching. This allows surgeons to optimize their surgery by making use of each system's advantages over the other whenever appropriate.

Dealing with occlusion break surge

In addition to having two styles of pump in one system, the Signature Pro has automatic occlusion sensing technology.

When complete occlusion takes place with a dense fragment, flow stops and vacuum builds—this is the system working to restore flow. With vacuum at its highest level, the

occlusion breaks and flow is immediately restored.

Given the tiny volume of the anterior chamber, at the point of an occlusion break, the chamber evacuates, creating a post-occlusion surge.

This is a bigger problem for the venturi vacuum, in which the blunting of the surge is dependent on reaction time and the speed of the surgeon's foot on the pedal. On the other hand, because the peristaltic pump allows measurement of flow, the reduction of flow is detected and the vacuum reduced appropriately.

The Signature Pro's automatic occlusion sensing technology replaces the surgeon's reaction time and foot speed with the speed of a modern computer. The system automatically cuts the vacuum, resulting in a significantly less precipitous drop in intraocular pressure, from a drop of around 60 mm Hg without the automatic sensing technology to a drop of just around 25 mm Hg. This essentially reduces post-occlusion surge to zero.

CASA

After examining our assumptions, setting aside ego and given a thorough understanding of flow and vacuum, how then do we proceed to advance our surgery? We always want to move our surgery forward and take it to the next step, but how do we do that?

In order to do better with our surgery, we have to be able to measure something, then we have to monitor what we are measuring; we have to have a basis for comparison.

For years the only option was to keep a paper log and digital video recordings of all your cases. All the information gathered would then have to be converted, tabulated, and encoded into a spreadsheet—a cumbersome process to say the least.

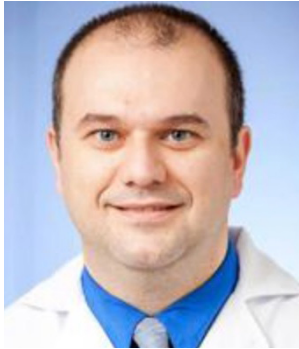
Now, with the Signature Pro, we have the Cataract Analysis and Settings App (CASA), the first mobile analytics tool in phaco. CASA wirelessly connects to your Apple operating system device and allows you to download all the performance metrics and parameters you could want or need to analyze your surgical performance, including phaco time, case time, and turnover time. With all the metrics the app allows you to analyze, in addition to the performance of the surgery, you can also measure the efficiency of the system and workflow in place in your surgery center.

It is a fantastic tool for keeping track of what you are actually doing as opposed to what you only think you are doing. When something happens during surgery, emotions can dictate what you think just happened, and it is only when you review the video—which you can watch in slow motion—that you can see what actually happened, what you actually did, and how you can do better.

This should become an essential part of the cataract surgeon's evolution.

Future of corneal refractive surgery: Meta-analysis of custom LVC vs. SMILE

David Piñero, PhD



David Piñero, PhD, University of Alicante, Alicante, Spain

LASIK remains the most common surgical refractive procedure, and wavefront-guided LASIK (WFG-LASIK) has become the gold standard of LASIK. WFG-LASIK aims to avoid inducing higher order aberrations postoperatively while reducing preoperative ocular aberrations, thus preserving visual quality to achieve patient satisfaction. The procedure is based on the patient's entire individual optical system.

Some years ago, small incision lenticule extraction (SMILE) technology was developed for correcting refractive errors based on the use of the femtosecond laser technology. This femtosecond laser-based technique corrects refractive errors without creating a flap—potentially reducing complications associated with LASIK. As such, it has the potential to be a replacement for the older procedure.

But does it offer real benefit over WFG-LASIK?

Published data

As we know, WFG-LASIK can correct myopia, hyperopia, and mixed astigmatism; to date, the only scientific evidence for SMILE as a safe and effective technique is for the correction of myopia.

In terms of astigmatism, there are some papers illustrating that there is a trend toward undercorrection by vector analysis.¹ In terms of hyperopia, the only scientific evidence reported to date that can be related to SMILE is with its flap-creating cousin, the femtosecond lenticule extraction (FLEx) procedure. FLEx has been reported in one study to correct hyperopia (mean preoperative spherical equivalent of the sample: +2.80±1.30 D), but with only 35% of eyes with a spherical equivalent within ±0.50 D postoperatively.²

Predictability between SMILE and WFG-LASIK is not so different (Figure 1). However, there is a minimal but significant trend to more myopic residual spherical error (SE) with SMILE (−0.01 to −0.33 D) compared with WFG-LASIK (−0.02 to −0.17 D), and while the published percentages of eyes within ±1.00 D of target are similar between SMILE and WFG-LASIK, the published percentages of eyes within ±0.50 D range more widely with SMILE (67.60% to 100%) than with WFG-LASIK (80% to 100%).³ It should be said that the trend toward myopic residual SE was seen in the first articles evaluating the outcomes

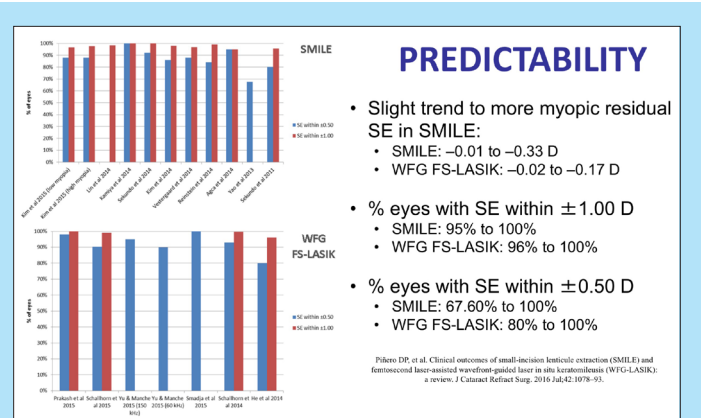


Figure 1. Predictability between SMILE and WFG-LASIK is not so different, but with a slight trend toward more myopic residual SE in SMILE. Source: David Piñero, PhD

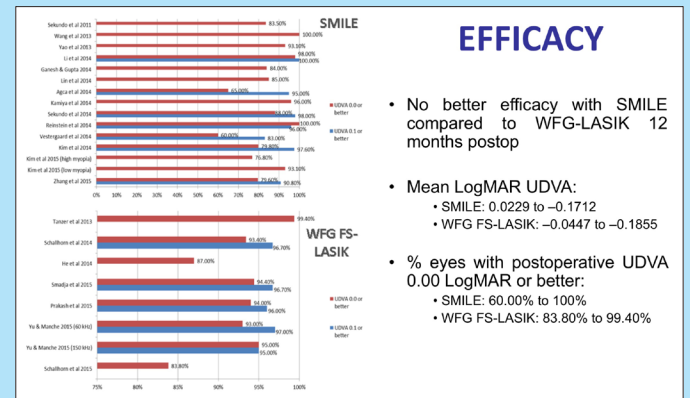


Figure 2. There is no better efficacy with SMILE compared to WFG-LASIK. Source: David Piñero, PhD

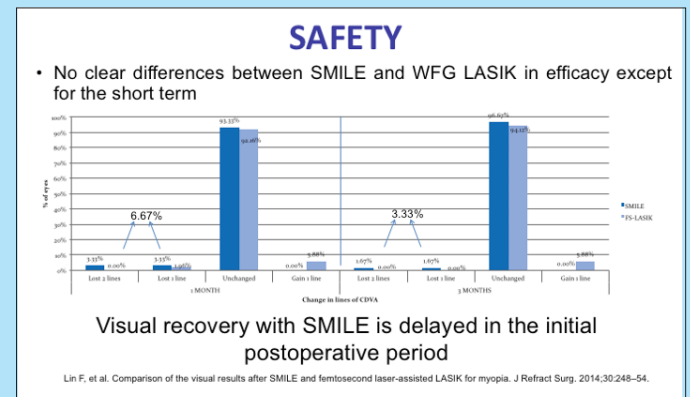


Figure 3. Visual recovery with SMILE is delayed in the initial postop period. Source: David Piñero, PhD

of SMILE and could have been a question of adjustment of the optical configurations of the lenticule.

Efficacy was good for both SMILE and WFG-LASIK, and there was no better efficacy with SMILE compared to WFG-LASIK at 12 months postop (Figure 2). From various studies, the mean logMAR UDVA was 0.02339 to -0.1712 for SMILE and -0.0447 to -0.1855 for WFG-LASIK, while the percentages of eyes with post-operative UDVA 0.00 logMAR or better ranged from 60.00% to 100% for SMILE and 83.80% to 99.40% for WFG-LASIK.

Control of higher-order aberrations, however, was better with WFG-LASIK than SMILE, with mean changes of $+0.03 \pm 0.10$ μm HOA RMS and $+0.05 \pm 0.08$ μm primary SA reported after WFG-LASIK in naval aviators⁴ against changes of 0.15 μm HOA RMS, 0.14 μm SA, and 0.33 μm coma RMS reported after SMILE.⁵ High levels of HOAs (0.503 μm SA, 0.706 μm coma RMS, 0.427 μm HOA RMS) were also reported after SMILE.⁶ Studies report no significant levels of HOAs (coma RMS: 0.28 ± 0.14 [150 kHz FS laser], 0.29 ± 0.03 [60 kHz FS laser]; SA: 0.22 ± 0.19 [150 kHz FS laser], 0.21 ± 0.17 [60 kHz FS laser]) after WFG-LASIK.⁷

There was no clear difference between SMILE and WFG-LASIK in terms of safety, although visual recovery with

SMILE seems to be delayed in the initial postoperative period (Figure 3).⁸

Structural changes

The delay in visual recovery with SMILE may be due to the production of microdistortions of Bowman's layer—88.5% with SMILE vs. only 42.1% with WFG-LASIK—which appear to be associated with lenticule thickness.⁹ These microdistortions may explain the increased backscattered light intensity in the anterior stroma as demonstrated through analysis by in vivo confocal microscopy.¹⁰

One of the theoretical advantages of SMILE is a higher total stromal tensile strength compared to LASIK and PRK procedures.¹¹ However, this estimation is based on a mathematical model not validated experimentally, based on the assumption that the anterior stroma is completely intact.

Clinically, however, there is no evidence of better biomechanical behavior with SMILE vs. LASIK, with studies using the ORA system (Alcon, Fort Worth, Texas) and Corvis ST (Oculus, Wetzlar, Germany) showing comparable corneal hysteresis and corneal resistance factor values between the two procedures.^{12,13}

Advantages related to structure touted by SMILE proponents are the reduction of corneal sensitivity and potentially lower incidence of dry eye symptoms as well as the lack

of flap-related complications with the procedure. However, other complications such as diffuse lamellar keratitis,¹⁴ decentrations,¹⁵ and ectasia¹⁶ have been reported after SMILE.

Moreover, when complications do occur, there is to date little scientific evidence about the results of SMILE retreatments and the procedures to do them.

Ocular surface health

One thing true to both SMILE and any LASIK procedure is how the status of the ocular surface affects outcomes. Studies looking at subjective dry eye questionnaires have shown that ocular surface disease index (OSDI) worsens after both SMILE and femto LASIK procedures, returning to preop values after 1 month postop.¹⁷ Meanwhile, the McMonnies questionnaire scores of patients who underwent SMILE and 90- μm flap LASIK recovered to their preop values by 3 months postop.¹⁸

Conclusion

Considering all the evidence thus far, what is the *real* benefit of SMILE over WFG-LASIK? Future controlled randomized comparative studies are necessary to determine whether such a benefit exists, but for now, whether one procedure can replace the other is not something that we can say from a scientific point of view.

References

- Zhang J, et al. Vector analysis of low to moderate astigmatism with small incision lenticule extraction (SMILE): results of a 1-year follow-up. *BMC Ophthalmol.* 2015;15:8.
- Blum M, et al. Femtosecond lenticule extraction (ReLEx) for correction of hyperopia – first results. *Graefes Arch Clin Exp Ophthalmol.* 2013;251:349–55.
- Pinero DP, et al. Clinical outcomes of small-incision lenticule extraction and femtosecond laser-assisted wavefront-guided laser in situ keratomileusis. *J Cataract Refract Surg.* 2016;42:1078–93.
- Tanzer DJ, et al. Laser in situ keratomileusis in United States Naval aviators. *J Cataract Refract Surg.* 2013;39:1047–58.
- Vestergaard AH, et al. Efficacy, safety, predictability, contrast sensitivity, and aberrations after femtosecond laser lenticule extraction. *J Cataract Refract Surg.* 2014;40:403–11.
- Lin F, et al. Comparison of the visual result after SMILE and femtosecond laser-assisted LASIK for myopia. *J Refract Surg.* 2014;30:248–54.
- Yu CQ, et al. Comparison of 2 femtosecond lasers for flap creation in myopic laser in situ keratomileusis: one-year results. *J Cataract Refract Surg.* 2015;41:740–8.
- Lin F, et al. Comparison of the visual results after SMILE and femtosecond laser-assisted LASIK for myopia. *J Refract Surg.* 2014;30:248–54.
- Yao P, et al. Microdistortions in Bowman's layer following femtosecond laser small incision lenticule extraction observed by Fourier-Domain OCT. *J Refract Surg.* 2013;29:668–674.

Comparing custom LVC with other technologies

Rohit Shetty, MD, PhD



Rohit Shetty, MD, PhD,
Narayana Nethralaya,
Bangalore, India

In my refractive surgery practice, we follow certain “commandments” for good LASIK practice excellence. These commandments begin with robust diagnostics and end with skills transfer; ultimately, it comes down to these two things, and following these commandments we evaluate the custom laser vision correction (LVC) technology from Abbott Medical Optics (Abbott Park, Illinois).

Robust diagnostics are the heart of refractive surgery; they are what drive the laser

machine. For custom LVC, robust diagnostics are provided by the iDesign Advanced WaveScan Studio System (Abbott Medical Optics) using a high-definition Hartman-Shack sensor.

The system is custom LVC’s “thinking machine” and employs Fourier reconstruction algorithms using up to 1,257 micro-refractions over a 7-mm diameter wavefront. The system’s diagnostics are robust because it is able to pick up much finer resolutions compared to other aberrometers.

Custom LVC vs. other technologies

Most of the outcomes evaluated when comparing technologies revolve around quality of vision—every single machine, every single lens must be evaluated on quality of vision. What is most important is how the patient actually sees.

Initially, we compared custom LVC with other technologies to evaluate efficacy, safety, and accuracy in terms of uncor-

“Robust diagnostics are the heart of refractive surgery; they are what drive the laser machine.”

—Rohit Shetty, MD, PhD

rected distance visual acuity achieved (UDVA), following patients up to 6 months.

Comparing custom LVC with conventional LVC, more than 90% of eyes in both groups had 20/20 UDVA; 14% of eyes gained two lines of vision after custom LVC, achieving 20/16 UDVA, compared to only 7% achieving 20/16 UDVA after conventional LVC.

Meanwhile, 85% of both custom and conventional LVC groups were within ± 0.5 D of target refraction.

Comparing custom LVC with flapless LVC, both groups

had more than 90% of eyes achieving 20/20 UDVA with more than 80% within ± 0.5 D of target refraction.

Conclusion

In conclusion, unlike topo-guided ablations that treat only the anterior part of the cornea leading to vision that is not optically clear in eyes with irregular posterior corneal surfaces, wavefront-guided ablations ensure good vision and optical clarity even in eyes with irregular posterior corneal surfaces.

continued from page 7

10. Agca A, et al. Corneal backscatter analysis by in vivo confocal microscopy: fellow eye comparison of small incision lenticule extraction and femtosecond laser-assisted LASIK. *J Ophthalmol.* 2014;2014:265012.
11. Reinstein DZ, et al. Mathematical model to compare the relative tensile strength of the cornea after PRK, LASIK, and small incision lenticule extraction. *J Refract Surg.* 2013;29:454–60.

12. Agca A, et al. Comparison of corneal hysteresis and corneal resistance factor after small incision lenticule extraction and femtosecond laser-assisted LASIK: a prospective fellow eye study. *Cont Lens Anterior Eye.* 2014;37:77–80.
13. Shen Y, et al. Comparison of corneal deformation parameters after SMILE, LASEK, and femtosecond laser-assisted LASIK. *J Refract Surg.* 2014;30:310–8.

14. Zhao J, et al. Diffuse lamellar keratitis after small-incision lenticule extraction. *J Cataract Refract Surg.* 2015;41:400–7.
15. Lazaridis A, et al. Topographic analysis of the centration of the treatment zone after SMILE for myopia and comparison to FS-LASIK: subjective versus objective alignment. *J Refract Surg.* 2014;30:680–6.
16. Wang Y, et al. Corneal ectasia 6.5 months after small-incision lenticule

extraction. *J Cataract Refract Surg.* 2015;41:1100–6.
17. Li M, et al. Confocal comparison of corneal reinnervation after small incision lenticule extraction (SMILE) and femtosecond laser in situ keratomileusis (FS-LASIK). *Plos One.* 2013;8:e81435.
18. Xu Y, et al. Dry eye after small incision lenticule extraction and LASIK for myopia. *J Refract Surg.* 2014;30:186–190.