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Breakthroughs in Lens Designs

The TECNIS Eyhance and Synergy IOLs surpass the quality of vision afforded by standard monofocal and trifocal IOL designs.

BY JEFFREY WHITMAN, MD



The presbyopia-correcting IOL market is exploding. These IOLs help our patients achieve greater opportunity for spectacle

independence, at least for most tasks. Finding an IOL that can deliver high-quality vision across distance and near, day and night, is more important today than ever before given the exponential increase in patient expectations for perfect vision after cataract surgery.

Meeting patient demands begins with education. Before we can educate our patients, however, we must educate ourselves on how the available IOL technologies work and understand the advantages and disadvantages of certain lens designs. In return, we can confidently recommend the right IOL technology for each patient.

In my practice, two of the key IOLs we offer are the TECNIS Eyhance and the TECNIS Synergy IOLs (both by Johnson & Johnson Vision). This article presents an overview of each lens and provides some of my real-world experience with them.

TECNIS EYHANCE

Background. The TECNIS Eyhance and Eyhance Toric II IOLs were approved by the FDA for use in the United States in December 2020. These lenses are the first in a new class of monofocal IOLs that provide additional depth of focus without sacrificing the modulation transfer function. Further, in my experience, patients are less likely to experience dysphotopsias with the TECNIS Eyhance and Eyhance Toric II compared with multifocal and extended depth of focus IOLs.



Figure 1. Side-by-side comparison of the TECNIS Eyhance and TECNIS 1-Piece IOLs.

In my practice, we refer to the Eyhance IOL as a monofocal plus lens because it redefines and surpasses what's been done with standard monofocal IOLs. This IOL represents a true breakthrough in lens design as the first monofocal lens intended to slightly extend the depth of focus^{1,2} and strengthen image contrast in low light. Compared to a standard monofocal IOL (TECNIS ZCB00, Johnson & Johnson Vision), at 5 mm, the TECNIS Eyhance provides a 30% improvement in image contrast in low light (data on file with Johnson & Johnson Vision).

Design. Another benefit of the Eyhance IOL is that it leverages the proven refractive aspheric design of the TECNIS platform. The Eyhance has the same base geometry as all other TECNIS 1-Piece IOLs and is visually indistinguishable from the TECNIS ZCB00 1-Piece IOL (Figure 1). Eighty-five percent of its lens surface is identical to the

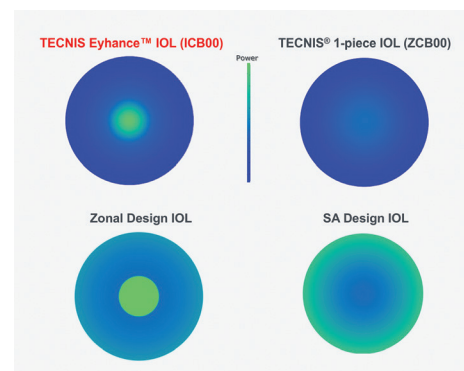


Figure 2. The proprietary aspheric optic of the TECNIS Eyhance IOL creates a continuous power profile to slightly extend depth of focus.

TECNIS 1-Piece IOL³

Rather than being based on a zonal design that causes abrupt change in power or a spherical aberration design, the Eyhance is based on a higher-order asphere (Figure 2). This design provides a continuous change in power from the periphery to the center of the lens to slightly extend depth of focus and improve intermediate vision while maintaining distance image quality. The modified anterior surface of the IOL creates a small continuous increase in central lens power and provides comparable distance image quality to the TECNIS 1-Piece IOL.³ The design of the Eyhance also reduces spherical aberration to near zero (Figure 3).

Lastly, the squared and frosted haptics of the TECNIS Eyhance Toric II IOL are designed to increase friction in the capsular bag. This, in my experience, improves rotational stability and promotes quicker unfolding in the capsular bag.

Simulated studies. The effects of Eyhance IOL's optical design on quality of

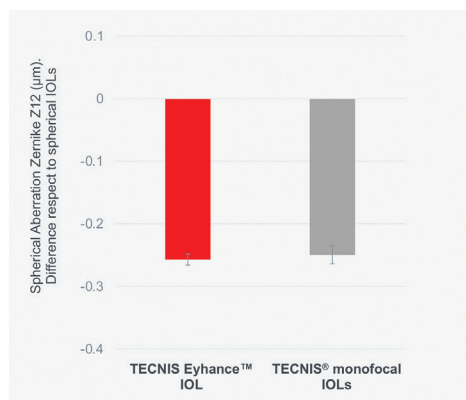


Figure 3. The TECNIS Eyhance reduces spherical aberration to near zero.

vision, contrast sensitivity, and subjective visual disturbances; the safety and effectiveness; and clinically meaningful extension of depth of focus have not been evaluated or substantiated in clinical trials. Simulated binocular visual acuity from optical bench testing has, however, indicated that the IOL does extend depth of focus compared to the TECNIS 1-Piece IOL (Figure 4).^{4,5}

Simulated studies have also shown that the Eyhance delivers pupil-independent performance; the difference in simulated visual acuity at far (0.00 D) and intermediate (-1.50 D) distance at various pupil sizes is shown in Figure 5. These results indicate that the pupil-independent performance of the TECNIS Eyhance IOL compares favorably to that provided by the TECNIS 1-Piece IOL (data on file with Johnson & Johnson Vision).

Real-world experience. I believe there are patients undergoing cataract surgery who can benefit from the design of the Eyhance IOL because it provides them with a slight increase to their depth of focus. It's a great option for patients who may not be able to afford a presbyopia-correcting IOL and for those who are not candidates for these lenses because of ocular pathologies. Most of my patients who have received the Eyhance notice a slight increase in their depth of focus when working at the computer and viewing the dashboard while driving their car. The Eyhance has quickly become one of my favorite IOLs to implant because it gives my patients a greater depth of focus than

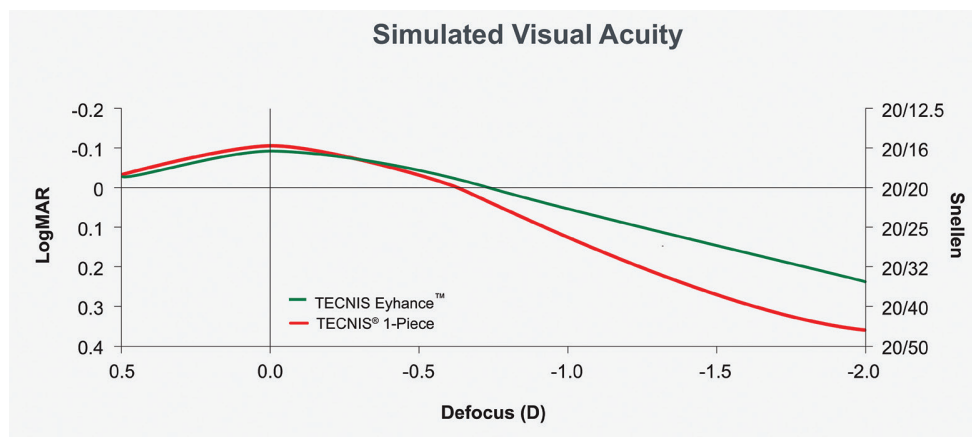


Figure 4. The TECNIS Eyhance is the first monofocal IOL designed to slightly extend the depth of focus.

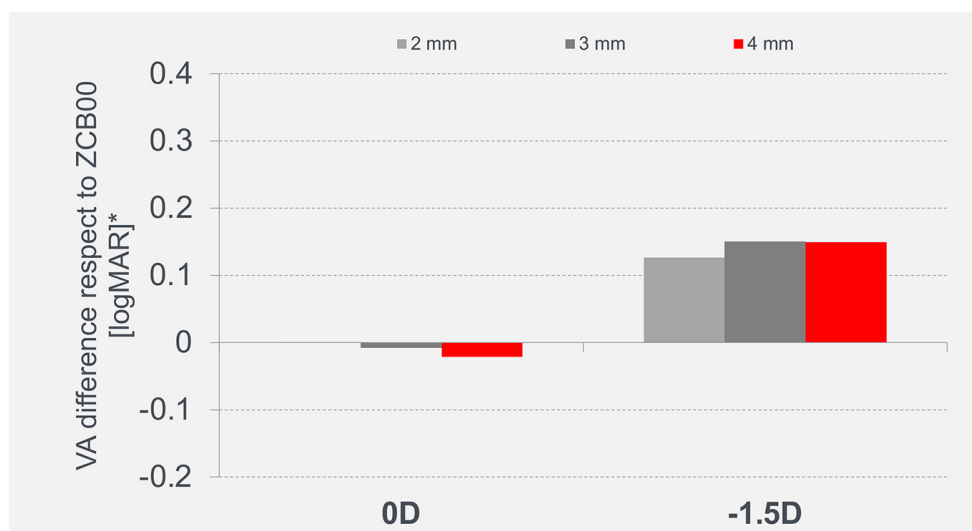


Figure 5. The difference in simulated visual acuity at far (0.00 D) and intermediate (-1.50 D) distance between the TECNIS 1-Piece IOL (model ZCB00) and TECNIS Eyhance IOL (model DIB00) at various pupil sizes.

standard monofocal IOLs. It helps patients achieve great distance vision and some usable intermediate vision as well.

I typically prefer to target plano in the dominant eye and often will target -0.50 to -0.75 D in the nondominant eye to enhance near focus if the patient so desires.

The preloaded injector system, the TECNIS Simplicity Delivery System (Johnson & Johnson Vision; Figure 6), is second to none I've used. The enhanced ergonomic design and optimized features are designed to result in efficient delivery of the IOL into the capsular bag. It has an enlarged knob that enhances control and a beveled tip that can be delivered through a 2.2-mm incision.

TECNIS SYNERGY

Background. More recently, in April 2021, the TECNIS Synergy and the TECNIS Synergy Toric II (both from Johnson & Johnson Vision) IOLs were approved by the FDA for use in the United States. Both IOLs are considered hybrid EDOF/multifocal lenses. I believe this family of IOLs is one of the best to give patients a full range of high-quality vision across all distances and in all lighting conditions, even in low light. This is especially important today given the more widespread adoption of LED lighting. This is creating a challenge for good vision quality in low-light conditions because LED lighting produces a higher level of scatter due to the emission of shorter violet

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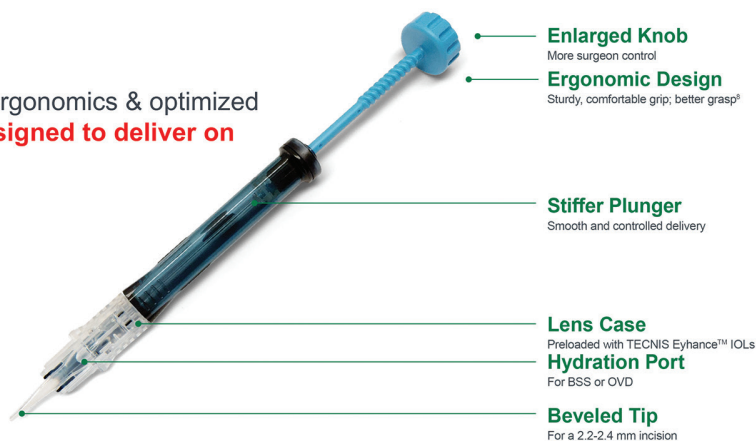


Figure 6. The TECNIS Simplicity Delivery System.

wavelengths.^{6,7} The advanced optic of the Synergy IOLs helps to enhance contrast and reduce dysphotopsias.⁸ This breakthrough innovation in presbyopia-correcting lens design delivers a wide range of continuous vision and excellent near vision so that patients can enjoy the moments that matter the most.

Design. The TECNIS Synergy IOL combines technology from the TECNIS multifocal and TECNIS Symphony IOLs to deliver a range of vision from distance to intermediate to near (Figure 7).⁹ The multifocal IOL technology provides good distance and near visual acuity and a pupil-independent design,¹⁰ and the TECNIS Symphony IOL technology provides continuous vision across the entire range,¹¹ chromatic aberration technology that corrects chromatic aberration to optimize contrast vision,^{11,12} and a pupil-independent design.¹³



Figure 8. The echelette surface design of the TECNIS Synergy IOL.

The Synergy also uses IntelliLight technology to enhance the quality and clarity of vision and the contrast sensitivity. It has an echelette design that is created by a high-resolution lathing process to reduce light scatter and the intensity of halos (Figure 8).¹⁴ Additionally, the achromatic technology of the TECNIS Synergy IOL corrects chromatic aberration for enhanced image contrast in different lighting conditions (Figure 9).¹³ Lastly, the IOL's violet light filter is designed to mitigate halo, glare, and starbursts (Figure 10).¹³

Interim studies. Based on interim data collected at 3 months postoperative, patients on average maintained 20/25 or better visual acuity from -3.00 D to infinity. Also, at 3 months postoperative, 80%

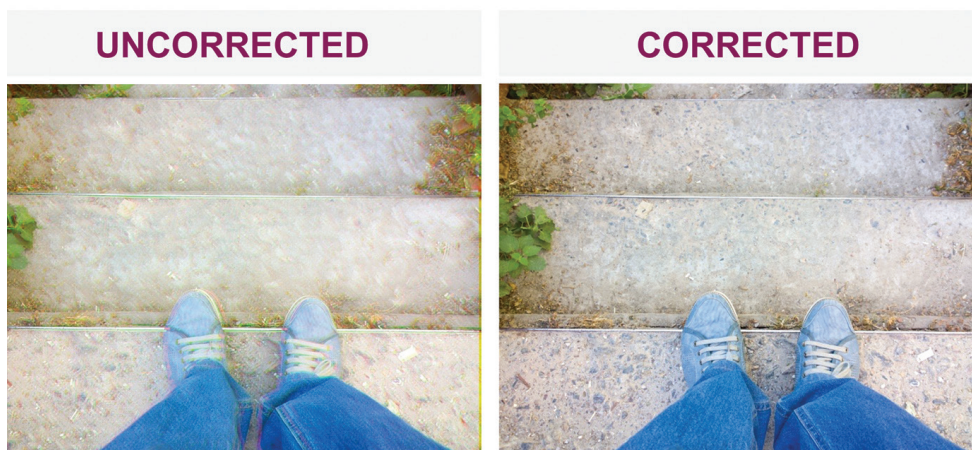


Figure 9. Depiction of the achromatic technology of the TECNIS Synergy IOL.

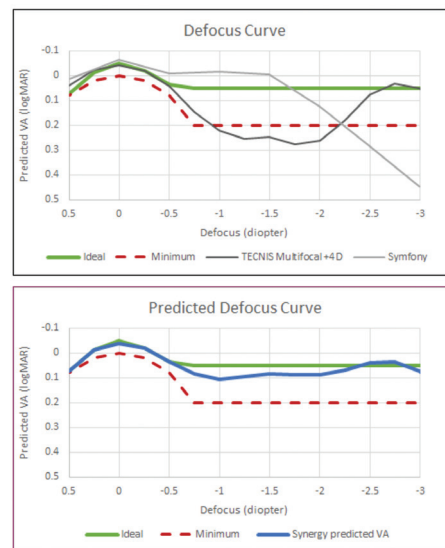
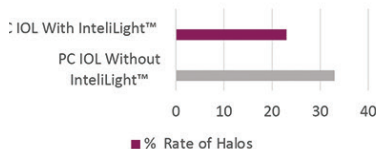


Figure 7. The defocus curve and the predicted defocus curve for the TECNIS Synergy IOL.

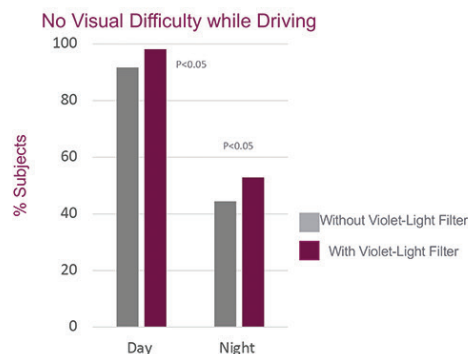
of patients achieved 20/20 visual acuity at near. Ninety percent of patients were able to see objects and read street signs in the evening or at night, 96% were able to read a menu in a dimly lit restaurant, and 97% were able to see steps or curbs in the evening or at night (data on file with Johnson & Johnson Vision).

Additionally, again based on interim data, at 6 months postoperative 92% of patients who received the TECNIS Synergy IOL reported not wearing glasses across all distances (data on file with Johnson & Johnson Vision).

TECNIS Synergy™ violet-light filter reduces the rate of halos³



Patients reported experiencing less visual difficulty while driving day and night with violet-light filter IOLs vs IOLs without the violet-light filter³



Patients reported experiencing less frustration with their vision while driving at night with violet-light filter IOLs vs. without the violet-light filter³

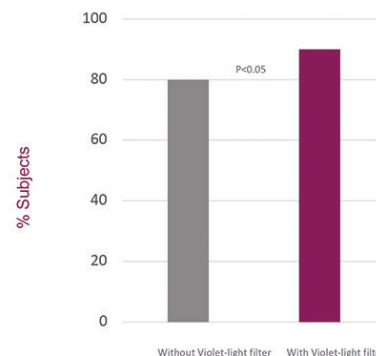


Figure 10. The TECNIS Synergy IOL incorporates violet light filtration.

Real-world experience. In my experience, the TECNIS Synergy IOL provides the best near vision (33 cm) of any presbyopia-correcting lens, and it also provides the best range of vision from distance to intermediate to near. I have found that targeting the first plus from biometry in both eyes gives me the best results.

For me, the Synergy bridges the visual gaps that can be seen by patients who have received trifocal IOLs. Patient satisfaction in my practice is high with the TECNIS Synergy IOL. They report sharp vision in the brightness of the day as well as at nighttime and in other low-light situations.

CONCLUSION

The TECNIS Eyhance and TECNIS Synergy IOLs are based on the proven TECNIS IOL platform, a platform that is not associated with glistenings (data on file with Johnson & Johnson Vision). Three key

features, described below, provide benefits to patients that result in high-quality vision for life.

No. 1: The wavefront-designed optic corrects spherical aberration to near zero, providing sharp quality of vision¹⁵;

No. 2: The lens material induces little chromatic aberrations, providing high image contrast sensitivity under all lighting conditions and creating less blurred images (data on file with Johnson & Johnson Vision); and

No. 3: The lens design induces less capsular phimosis, minimizing the risk for IOL decentration and decreased vision.¹⁶

1. TECNIS Eyhance IOL with TECNIS Simplicity Delivery System. Directions for use.
2. TECNIS Eyhance Toric II IOL with TECNIS Simplicity Delivery System. Directions for use.
3. TECNIS Monofocal IOL with TECNIS Simplicity Delivery System. Directions for use.
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9. TECNIS Synergy IOL with TECNIS Simplicity Delivery System. Directions for use.

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