



Figure 2. Range of vision at all distances after treatment with PresbyMAX in the dominant and nondominant eyes.

LVC VERSUS INTRAOCULAR SURGERY

Predictability. One advantage of presbyopic LVC is greater predictability compared to intraocular surgery.^{6,12} The predictability of refractive results with LVC may decrease slightly if the amount of preoperative spherical aberrations is high.^{12,13}

Anatomy. Unlike refractive lens exchange (RLE), LVC preserves the ocular anatomy and thus whatever accommodative amplitude a patient had preoperatively. Presbyopic LVC can also be a better option for patients with axial myopia because of their increased risk of retinal detachment after RLE.^{14,15}

Retreatment. As noted earlier, presbyopic LVC reduces binocular distance visual acuity, contrast sensitivity, and stereopsis. Additionally, a second treatment may be required to increase the effect of presbyopia correction as patients age.^{12,16}

IOL dislocation. People who undergo lens surgery when they are 40 to 50 years of age are at greater risk of IOL dislocation than those who undergo lens surgery for age-related cataracts.¹⁷

Cataract. RLE eliminates a patient’s future need for cataract surgery. In contrast, presbyopic LVC may make future IOL power calculation and selection more difficult. Obtaining biometry measurements before LVC or performing presbyopic LASIK with a wavefront-guided excimer laser system may help address these issues.¹⁸⁻²⁰

There are also long-term considerations for patients who have undergone LVC, such as the choice and accuracy of IOL calculations for cataract surgery. Variables such as corneal power, axial length, and the effective lens position of the IOL after cataract surgery affect calculations. In virgin eyes, one can obtain accurate measurements with a high degree of confidence. After refractive surgery, however, it is difficult to measure the cornea exactly, making it harder for surgeons to achieve the desired postoperative target. It should be noted that the improvement of IOL calculation formulas allows surgeons to achieve more accurate results with IOL calculations after LVC.²¹⁻²⁵ Reinstein et al reported in 2019 that the extended focus effect was preserved in

92 eyes that underwent laser blended vision correction with aspheric IOLs. Pajic et al achieved similar results in 28 eyes in 2021.¹³

CUSTOMIZED LVC

Some excimer laser manufacturers offer customized approaches to presbyopic LVC. The optical results targeted for the dominant eye are tailored to the individual’s visual needs. Multifocality is created, and depth of focus is increased through the surgical induction of spherical aberrations and scope for myopic and hyperopic patients. Eyes with myopia and hyperopia, however, receive different amounts of multifocality owing to the nature of the refraction. The treatment approach is also influenced by the intended micro-monovision. Because spherical aberrations reduce contrast sensitivity, modifications must be made carefully.²⁶

$$D.O.F. = \frac{\omega \times 250,000}{NA \times M} + \frac{\lambda}{2 (NA)^2} (\mu m)$$

D.O.F. = Depth of Focus

ω: Resolving power of eyes 0.0014 (when optical angle is 0.5 degrees)

M: Total magnification (objective lens magnification x eyepiece magnification)

λ: Wavelength (550nm)

$$\rightarrow D.O.F. = \frac{350}{NA \times M} + \frac{0.275}{(NA)^2}$$

This indicates that the focal depth becomes smaller as the numerical aperture becomes larger.

Example With MPLFLN100x (NA=0.90), WHN10x:

$$D.O.F. = \frac{350}{0.90 \times 1000} + \frac{0.275}{0.81} = 0.39 + 0.34 = 0.73 \mu m$$

Figure 3. Max Berek’s formula for depth of focus.

During customized presbyopic LVC, a micro-monovision strategy typically aiming for -0.75 to -1.00 D of spherical anisometropia and targeting the nondominant eye for near vision is generally used (Figure 2).^{6,27}

► **Option No. 1:** The dominant eye is targeted for distance vision with a modification of spherical aberration to minimize the impact on quality of vision.

► **Option No. 2:** The depth of focus targeted in the dominant and nondominant eyes differs but is generally greater in the nondominant eye. This is thought to provide good spatial vision.

► **Option No. 3:** The same depth of focus is targeted in both eyes.

Customized presbyopic LVC bears a similarity to the mix-and-match concept used in RLE, where the IOL implanted in the dominant eye provides better distance vision with a shallower depth of focus or multifocality.^{26,27} Any discussion of presbyopia correction should include the pinhole effect with a small-aperture IOL to increase depth of focus (Figure 3).

CONCLUSION

Presbyopic LVC offers customized solutions for patients. The technology and techniques continue to evolve. ■

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