

Extended Depth of Focus Lens Design With Pinhole Optics

For our eyes to see an image clearly, light rays must fall on the fovea, but aberrant light rays fall on the retina outside the fovea. These rays are not clear, and they can cause blur. However, a pinhole limits aberrant light rays inside the eye. The pinhole, whether an occluder type or an optical/power pinhole, also limits the aberrant rays that hit other parts of the retina so that only the light rays coming straight through and directly hitting the fovea enter the eye. This creates a clear image at near, intermediate, and distance. The clarity of the image is not dependent upon the distance away from the eye.

Principle of Pinhole Optics

The NaturalVue® Multifocal uses the principle of pinhole optics in its design, and the distance power is focused in

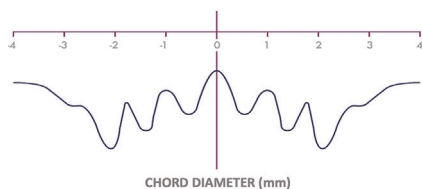


Figure 1. SynergEyes ID lens design representation.¹

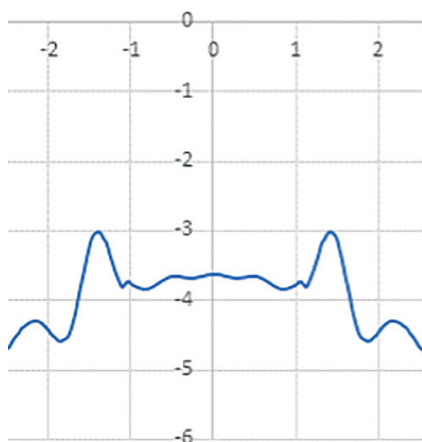


Figure 2. SEED One Day Pure design representation.²

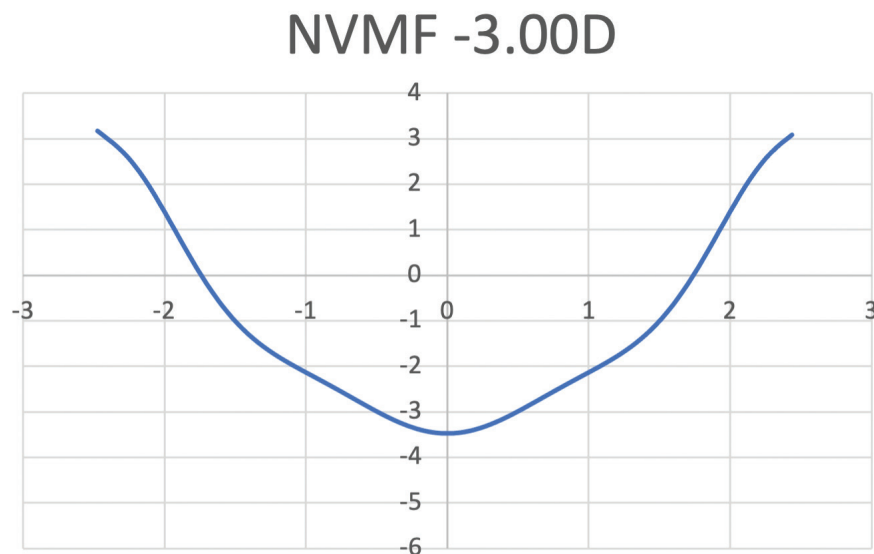


Figure 3. NaturalVue Multifocal design representation.²

the center of the lens. The plus power increases in a rapid, smooth, continuous, and uninterrupted fashion out from the center. The brain and the visual cortex suppress any unneeded power.^{3,4} These high amounts of plus are enough to induce the ‘peripheral blur,’ which creates a virtual aperture or ‘pinhole’ effect, resulting in an extended depth of focus (EDOF), a wider range of clear vision, and is pupil independent. The Neurofocus Optics® technology makes this EDOF lens very different from most multifocal designs on the market today. The NaturalVue Multifocal EDOF design allows us to fit this lens on any age patient, for any near ADD power requirement.

Other EDOF designs exist. The major lenses currently on the market are based on a design from the Brien Holden Vision Institute. They vary slightly due to proprietary design changes unique to each lens/manufacturer. None of the available designs have a smooth, continuous, uninterrupted progression of plus power

as you move away from the center, which is the hallmark of NaturalVue Multifocal. ●

References:

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2. SEED 1dayPure EDOF. Available at: www.seed-uk.com/products-1-day-pure-edof/. Last accessed May, 11 2021.
3. Chima AS, Formankiewicz MA, Waugh SJ. Investigation of interocular blur suppression using luminance-modulated and contrast-modulated noise stimuli. *J Vis.* 2015;15(3):22.
4. Maiello G, Walker L, Bex PJ, Vera-Diaz FA. Blur perception throughout the visual field in myopia and emmetropia. *J Vis.* 2017;17(5):3.

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