

SCIENCE IN FOCUS

Engineering Vision Across Distances: The Science Behind the 3-Zone Progressive™ Multifocal Contact Lens Design

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KEY TAKEAWAYS

- The 3-Zone Progressive™ design distributes optical power across near, intermediate and distance zones to support continuous vision.
- Eye modeling and power-profile analyses support the design rationale and its consistency across biometric and lens-parameter variation.
- In a 3-week multicenter study, mean logMAR acuity was -0.012 at distance, 0.046 at intermediate and 0.115 at near, with stable performance across the observed pupil-size range.
- The two-add system supports a simplified initial fitting approach, with refinement guided by patient needs and clinical judgment.

Presbyopia Is a Through-Focus Design Challenge

Presbyopic patients shift constantly among road signs, dashboards, screens, mobile devices and print - often under changing luminance and contrast. A multifocal lens must therefore balance simultaneous retinal images and maintain usable vision across distance, intermediate and near tasks. Multifocal designs vary in how power is positioned and transitioned across the pupil. These differences influence how light is allocated and help explain variation in visual performance.

In this Science in Focus article, we discuss the 3-Zone Progressive™ design in INFUSE® One-Day Multifocal (kalifilcon A), which was developed specifically for this through-focus challenge.^{1,2} The article reviews the design rationale, supporting eye-modeling and power-profile evidence, clinical performance across pupil sizes and practical implications for lens selection.

Three Zones, One Continuous Visual Objective

The center-near 3-Zone Progressive design controls zone diameter, add power and power transitions across three functional regions:

- Central near zone
- Surrounding intermediate zone
- Outer distance zone

These zones do not create three isolated focal points. They work together as a simultaneous-vision system, distributing multiple powers across the pupil to support a continuous through-focus response. This is especially relevant at intermediate distances, where many everyday tasks occur.^{1, 4}

From Population Averages to Individualized Eye Models

In a published eye-modeling study, Kingston and Cox developed individualized computer eye models using measurements across nine object distances. Inputs included:

- Ocular aberrations and pupil diameter
- Visual acuity and accommodative response
- Corneal characteristics, anterior chamber depth and axial length

The modeling approach also incorporated a novel image-quality metric that converted modeled retinal letter quality into predicted logMAR acuity.⁴ The model closely matched clinical measurements:

- Predicted and measured baseline through-focus acuity in mature presbyopic eyes: $R^2 = 0.85$
- Across five multifocal designs, predicted and clinical mean normalized acuity differed by less than one line at all tested distances
- Correlations across tested designs: $R^2 = 0.90\text{--}0.97^4$

The validated platform was then used to evaluate thousands of optical iterations across varied eyes and viewing distances. The final 3-Zone Progressive design was selected for both modeled performance and robustness across biometric variability.⁵

Power-Profile Consistency as an Engineering Attribute

Optical intent must remain consistent across sphere powers and add levels. Comparative studies show that commercial multifocal lenses can differ substantially in profile shape, add amplitude and spherical-aberration behavior - even within the same labeled add category.²

A 2026 in vitro analysis compared eight daily disposable multifocal designs across a broad labeled power range. After alignment to an intermediate-zone reference:

- Kalifilcon A had low overall variation in normalized power values, with a standard deviation of 0.037 D.
- Its normalized power-profile variation was lower than that of most tested comparators
- The intended zone-specific profile was maintained across the evaluated powers and adds⁶

Clinical Vision Across a Wide Range of Pupil Sizes

A prospective, single-arm, open-label study at 20 U.S. sites evaluated 294 habitual multifocal soft contact lens wearers over approximately 3 weeks. Pupil sizes ranged from 2.0 to 7.0 mm. Outcomes included binocular high-contrast logMAR acuity and participant-rated vision at distance, intermediate and near.⁵

At 3 weeks:

- Mean logMAR acuity was -0.012 at distance, 0.046 at intermediate and 0.115 at near
- Mean subjective ratings on a 0–100 scale were 84.6, 89.3 and 84.2, respectively
- Favorable ratings were reported by 94.0%, 98.6% and 95.7%, respectively
- Pupil size was not significantly correlated with objective acuity at any distance or with subjective ratings at either follow-up⁵

Together, these findings suggest that visual performance with the optimized design remained stable across the observed 2.0-to-7.0 mm pupil-size range. The results should be considered alongside relevant limitations, including the open-label, single-arm design and non-standardized pupil measurement.⁵

Simplifying the Translation From Design to Chairside Use

The kalifilcon A multifocal system simplifies initial selection with two add categories:

- Low: spectacle adds of +0.75 D to +1.50 D
- High: spectacle adds of +1.75 D to +2.50 D

In the evaluated study population, fitting outcomes were consistent with a simplified initial selection process:

- 87.4% of participants were successfully fitted in one visit; 99.0% in two visits
- 85.9% of eyes required no refinement across visits^{5,7}

These fitting outcomes support the role of the two-add system as a standardized starting point for initial lens selection. Subsequent refinement should continue to follow the fitting guide and reflect each patient's distance, intermediate and near priorities, without replacing individualized assessment or over-refraction.

Clinical Perspective

The 3-Zone Progressive design combines three elements to support balanced vision across everyday distances:

- Near, intermediate and distance zones
- Individualized through-focus modeling using multiple biometric inputs
- A simplified two-add fitting strategy

In habitual multifocal wearers, the design demonstrated favorable objective and subjective vision at all three distances, stable performance across the observed pupil-size range at 3 weeks, and high fitting success. Lens selection should continue to reflect ocular health, refractive findings, visual demands and patient expectations.^{5,7}

For readers interested in exploring the evidence in more detail, recently published resources cited in this article including the Phatak, Montani and Holland publications are available on the publications section of the Bausch + Lomb ECP website.

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Author disclosures

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