Rigid Optics with Soft Lens Comfort

A look at how the technology behind SynergEyes lenses benefits both patients and practitioners.

By Brian Chou, OD, FAAO

The development of SynergEyes (SynergEyes Inc., Carlsbad, CA) exemplifies how technological advances in several areas — material science, manufacturing, lens design and prescribing method — combine such that their sum effect is greater than adding the individual parts, making the trade name appropriately resonate the meaning of "synergy."

My office was one of the 23 sites that participated in the initial FDA clinical studies of SynergEyes lenses. Currently, more than 50 patients in my practice are successfully wearing SynergEyes lenses.

In this article I'll share some of the relevant information about SynergEyes, giving a technological perspective on what differentiates this contact lens from its commodity counterparts.

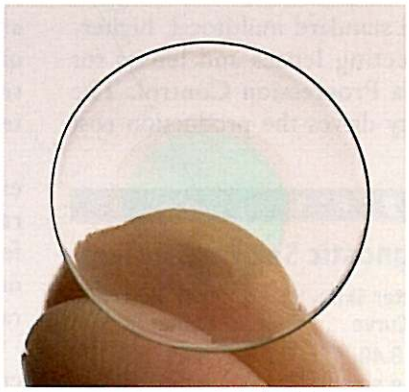

Figure 1. A SynergEyes hybrid lens.

Material Science

Previous hybrid lenses had a Dk of about 14 and the firm center and soft skirt separated relatively easily. Even though some GP materials now exist with Dk values exceeding 150, until now, no manufacturer successfully developed a high-Dk hybrid contact lens because of the difficulty in bonding hydrophilic skirts to high-Dk rigid materials.

The breakthrough in material science is the proprietary Hyperbond technology that allows a strong link between a hydrophilic skirt and a highly oxygen permeable rigid center. The polymer chemists at SynergEyes developed a method to protect the GP material from alteration by the hydrophilic monomers while providing a strong bond. The technology produces intermediate layers that preserve the gas permeability, mechanical properties and index of refraction while producing a multi-zone inter-

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face. Each chemically different layer is nanometers thick. The SynergEyes rigid center has a Dk of 145 with a bond to the soft skirt that is substantially stronger than anything before, approximately 10 times stronger than previous hybrid lenses, according to company data.

Manufacturing

Today, contact lens manufacturers frequently use low-cost cast molding to make lenses. Diamond turning lathes and automation also produce precision lenses at a reasonable cost.

SynergEyes lenses are manufactured with no-polish lathing. The process utilizes vibration-free computer-numerical-controlled lathes driven by proprietary Pro80 design software. Jim Schwiegerling, PhD, Associate Professor of Ophthalmology at the University of Arizona, developed this software to provide versatility for the hybrid platform extending beyond standard lathe mini-files. Spherical, toric, multifocal and rotationally non-symmetrical optical and structural designs are generated for the hybrid platform.

These methods will produce a family of lenses targeted to manage the full continuum of refractive errors. The software-driven polish-free lathed optics are ideal for a platinum standard multifocal, higher-order aberration correcting lenses and lenses for patent-pending Myopia Progression Control. The manufacturing efficiency drives the production cost of the SynergEyes lens to about one-half that of previous hybrid lenses.

The SynergEyes rigid center has a Dk of 145 with a strong bond to the soft skirt.

TABLE 1

SynergEyes A Diagnostic Set Parameters

GP Base Curve	Flatter Skirt Curve	Steeper Skirt Curve
7.1 (47.50)	8.40	8.10
7.2 (46.87)	8.50	8.20
7.3 (46.25)	8.60	8.30
7.4 (45.62)	8.70	8.40
7.5 (45.00)	8.80	8.50
7.6 (44.37)	8.90	8.60
7.7 (43.87)	9.00	8.70
7.8 (43.25)	9.10	8.80
7.9 (42.75)	9.20	8.90
8.0 (42.25)	9.30	9.00
8.1 (41.62)	9.40	9.10
8.2 (41.12)	9.50	9.20

Design

Previous attempts at hybrid lenses experienced limitations besides just hypoxia-related corneal neovascularization and frequent separation at the rigid-soft skirt border. The first hybrid lenses were launched nearly 25 years ago. A second-generation hybrid, SoftPerm (CIBA Vision) is still commercially available. These predecessor lenses have one skirt radius for each base curve.

The clinical research team at SynergEyes discovered a clear relationship between corneal curvature, corneal diameter and the required base curve and skirt radius needed for a successful lens fit. A plurality of skirt radii for a given base curve radius is necessary to accommodate the geometric diversity from the full range of corneal diameters. The SynergEyes lenses have the patent-pending feature of a series of available skirt radii for each rigid center's base curve.

The SynergEyes A and M designs are indicated for correcting hyperopia, myopia, astigmatism and presbyopia, in aphakic and non aphakic eyes free of disease. They are approved for daily wear for correcting up to +20.00D and –20.00D in eyes with astigmatism up to 6.00D; for presbyopia with add requirements from +1.00D to +4.00D. Each design has two available core skirt radii and two available extended range skirt radii.

SynergEyes KC for keratoconus patients and SynergEyes PS for post-surgical patients have three skirt radii for each equivalent base curve. These lenses feature an aspheric base curve that is more forgiving on eyes that have high degrees of circumferential and radial irregularity.

The plurality of skirt radii, the aspheric base curves and the non-rotational platform are all novel for hybrid lenses, allowing the use of front-surface cylinders and de-centered multifocal optics to center the simultaneous vision features over the visual axis.

Methods of Prescribing

Low-cost cast molding yields a host of one-size-fits-all products that require little to no clinical measurement to predict their lens fit. This reduces the amount of needed practitioner expertise and chair time, saving the patients from the associated costs.

The parallel arm of contact lens evolution is to-

ward technology-driven measurements for reducing chair time. This is analogous to the difference between over-the-counter reading glasses and professionally fit progressive addition lenses (PALs).

The HVID allows you to empirically prescribe the SynergEyes hybrid lens with a high degree of success.

Measurements of monocular pupillary distances with pupillometers and segment heights improve the fitting and success of PALs.

Prescribing for SynergEyes parallels that used for PALs. Corneal diameter is a major contributing variable for the fit of contact lenses, yet most clinicians don't routinely measure it. Using the horizontal visible iris diameter (HVID) allows you to empirically prescribe the SynergEyes lens with a high degree of success. Many corneal topographers and slit lamp eyepiece reticules allow for this measurement. SynergEyes has a patent-pending device, the M-Scan, that is useful for measuring corneal diameter with an accompanying lens calculator that determines the empirically recommended SynergEyes hybrid lens from keratometry, manifest refraction and HVID.

The M-Scan also measures pupil size, which enhances the success of the SynergEyes M multifocal contact lens. The SynergEyes multifocal has a center add that uses pupil diameter to determine the anterior add diameter. The device also captures the registration marks on diagnostic lenses to determine whether any optical decentration is required to center the multifocal over the pupil.

Conclusion

SynergEyes lenses are polar opposites to the one-size-fits all, mass-merchandised contact lenses. By embodying advances in material science, manufacturing, design and prescribing methods, SynergEyes lenses are directed toward practitioners who appreciate the intellect and expertise behind prescribing. **CLS**