Optical Connection, Inc. and Ophthonix, Inc.

Partners in the delivery of nonsurgical vision optimization

> www.opticonnection.com www.ophthonix.com

The human eye has optical imperfections that can not be measured by conventional means, and are not correctable with today's lenses

- Current examination technology leaves up to 20% of refractive error unmeasured
- To optimize vision, we need to correct 100% of refractive error, including higher order aberrations

Wavefront Technology

- Thorough analysis of the optics of the visual system – from cornea to retina.
- Low order aberrations of sphere and cylinder
- Unique combination of low and high order aberrations in each individual
- The goal: to produce an individually customized refractive correction

Optical Aberrations

- Low order aberrations
 - Tilt (prism)
 - Defocus (sphere)
 - Astigmatism (cylinder)
- High order aberrations
 - Spherical
 - Coma
 - Trefoil
 - Secondary Astigmatism

High order aberrations

 Irregular astigmatism: A complex shape that, due to its asymmetry, cannot be measured using conventional refractive methods

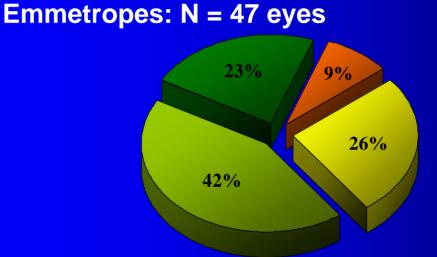
• The only option for correcting "irregular astigmatism" has been an RGP

Refractive correction

 Today we correct a rotationally asymmetric eye with a perfectly symmetric contact or spectacle lens

 Result: Up to 20% of refractive error may be left uncorrected

Subjects With High-Order Aberrations



Myopes: N = 26 eyes 4% 42% 31% Amount of highorder aberrations

>0.3 microns
 0.2 - 0.3 microns
 0.1 - 0.2 microns
 <0.1 microns

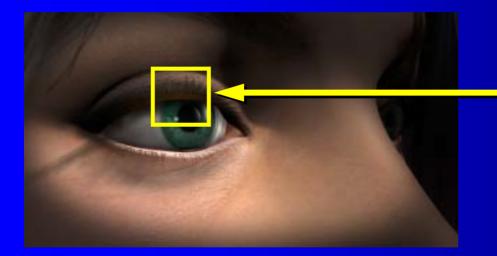
Amount of highorder aberrations

0.5-1.0 microns
 0.3-0.5 microns
 0.2 - 0.3 microns
 0.1 - 0.2 microns
 <0.1 microns

Signs of non-optimized (normal) vision

- Double images
- Low contrast, lack of crispness
- Reduced color sensitivity
- Glare sensitivity
- Night driving problems
- "Halos," "star burst patterns," "comet's tails" around lights at night
- Compromised far and near vision

Human Eye...An Imperfect Instrument





Many localized aberrations

"Optical fingerprint"

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The Wavefront Solution

- A more precise, objective vision examination
 The Ophthonix Z-ViewTM Aberrometer
- A fundamentally new form of refractive correction:
 - The individually customized iZonTM and iZon by DefinitionTM Contact Lens
 - Wavefront-guided
 - Fully customized
 - Fully optimized

Vision Examination

Today

Ophthonix Z-View[™]



Subjective, manual, discrete steps, 15 minutes



Objective, accurate results. Measures low and high order aberrations in one minute

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The Z-View aberrometer creates a customized match for the "optical fingerprint" of the eye

Result: 100% Refractive Error Measured

Current Lenses

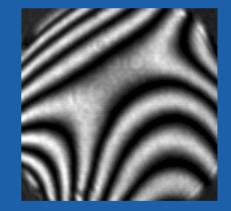




Sphere



Ophthonix iZon™ Lens



Perfect Match

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Z-View[™] Aberrometer Features



Proprietary wavefront technology 11,300 points over 6mm pupil Pupil diameter measurement Pupillary distance measurement Designed for ease of use Binocular viewing Through-the-lens Internal fixation Internal reading target High correlation with manifest refraction $(R^2=0.988)$ Efficient (Less than one minute)

iZon[™] by Definition[™] Wavefront-guided contact lens

A new category of contact lens correction

iZon[™] by Definition[™]

- New contact lens that can be individualized to nanometer level of optical path difference (OPD)
- Can correct sphere and cylinder to 0.01D
- Is customized to individual on-eye lens movement and centration characteristics
- Corrects low and high order aberrations and distortions, including those aberrations induced by the lens itself

The ultimate custom contact lens

- Each eye is individually measured
- Each lens is individually designed and manufactured
- Each prescription is treated the same: sphere, toric, keratoconus, post-LASIK

The ultimate custom contact lens

- WaveTouchtm manufacturing assures absolute reproducibility
- Manufacturing process allows great flexibility in polymer selection and lens fit characteristics

On-eye lens stability requirement

Simulated Optical Performance of Custom Wavefront Soft Contact Lenses for Keratoconus

Opt. Vis. Sci., Vol. 80, No. 9, September, 2003. de Brabander, Chateau, Marin, Lopez-Gil, van der Worp, Benito

On-eye lens stability

- Translation (movement and centration) should not exceed 0.5mm
- Rotation should not exceed +/- 10 deg

• Any of today's **soft torics** meet these criteria de Brabander, et. al.

Soft lenses will work?!

A wavefront contact lens must be well centered, stable and provide little movement. Soft lenses meet those criteria.

The Wavefront Process

Wavefront Process

Step 1

Wavefront Data Acquisition

Wavefront over refraction through trial lens Step 2 Wavefront Contact Lens Production

Conversion of wavefront data into production code Step 3 Wavefront Contact Lens Delivery

Direct delivery of custom lens – no inventory required

WavefrontProcess[™] Pat. Pending (Serial#60/407,316)

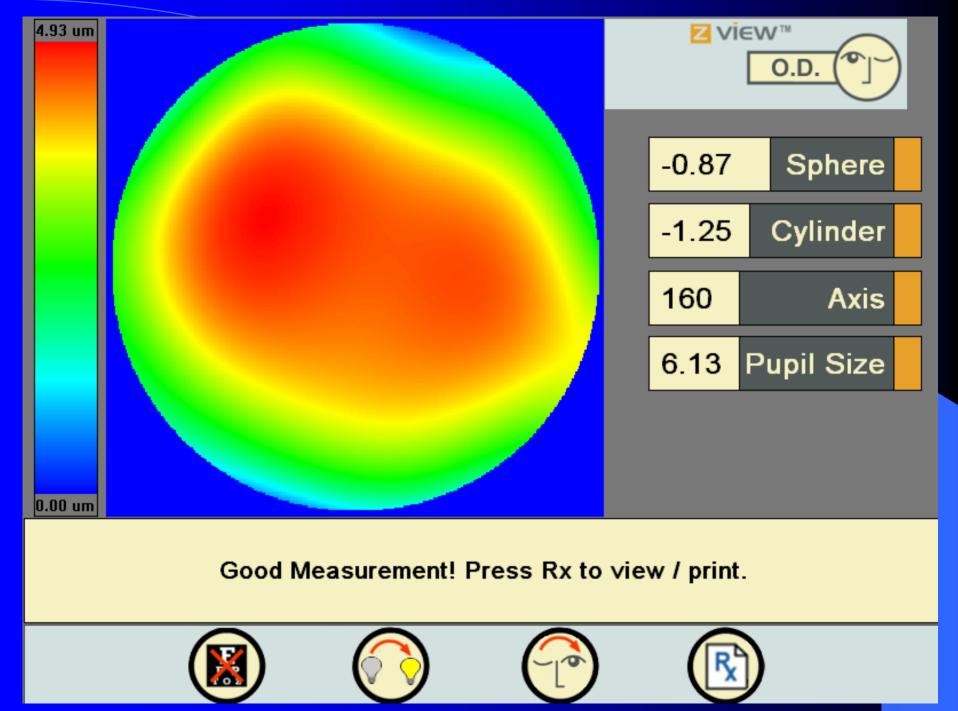
Step 1: Wavefront Data Acquisition

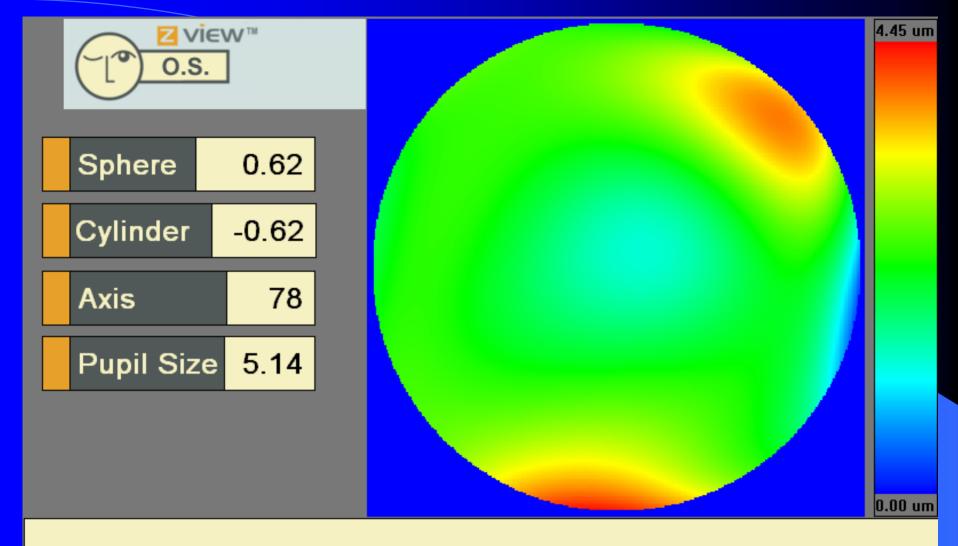
A "predicate" trial lens is placed on the eye; wavefront analysis is performed through the predicate lens.



Predicate Lens with Alignment Markings

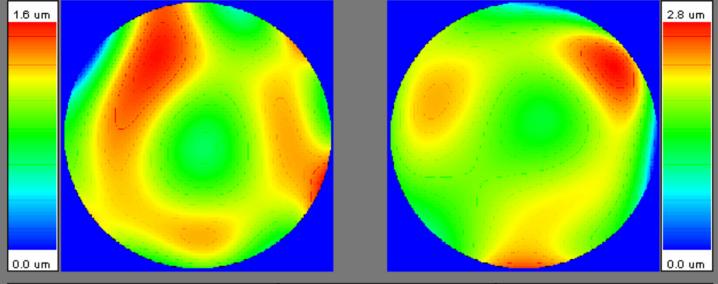
Wavefront Over Refraction US Patent 6,086,204





Good Measurement, press advance to next eye button.





	0.D.		0.S.		
	ZView Rx	Refraction	ZView Rx	Refraction	
Sphere	-0.87 D		0.62 D		
Cylinder	-1.25 D		-0.62 D		
Axis	160 Deg		78 Deg		
Pupil Dia., Zernike Dia.	6.1 mm, 4.0 mm		5.1 mm, 4.0 mm		
Total High-Order	0.41 D		0.62 D		
Trefoil	0.14 D		0.42 D		
Coma	0.15 D		0.05 D		
Spherical Aberration	0.25 D		0.35 D		
Pupil Distance	35.3 mm		32.8 mm		
		(HL)		¥,	

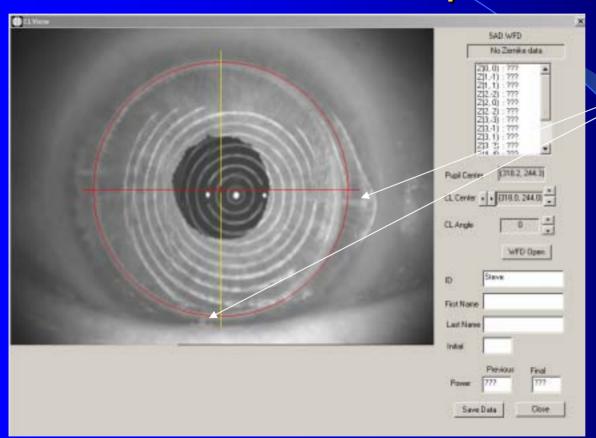
Standard Lens Correction	(O.S.)	Z-Lens Correction	
	20 / 72	Ε	
OPH	20 / 48	ОРН	
THONIX	20 / 36	тноміх	
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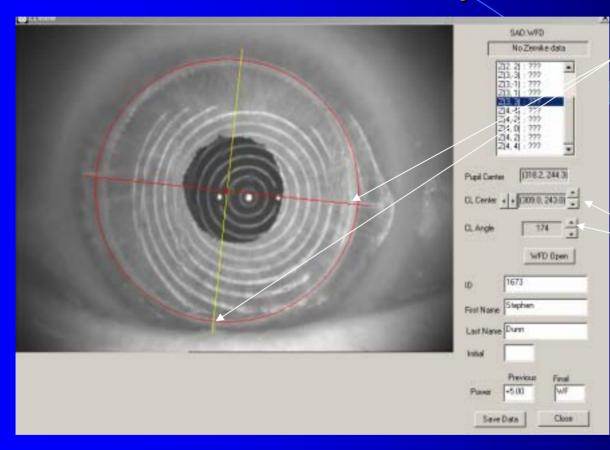
Wavefront Data Acquisition ~ continue



Alignment Markings

View of an eye with a predicate lens on

Wavefront Data Acquisition ~continue



Alignment of the axis and CL center with the markings

> The lens position data acquired

Step 2: Wavefront Contact Lens Production

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-0.00000 -0.00000 -0.00000 -0.000001 -0.000000	014622 -0.014924 -0.014925 -0.0	114926 = 0.014927 = 0.014929 = 1
-0.015095 -0.015092 -0.015094 -0.015095 -0.	015098 =0.015099 =0.015101 =0.0	115103 -0.015105 -0.015108 -1
-0.015340 -0.018342 -0.015344 -0.015347 -0.	0153MB = 0.015352 = 0.015354 = 0.0	115357 =0.015380 =0.015384 =1
-0 015055 -0 015668 -0 015670 -0 015573 -0	.015677 -0.015690 -0.015693 -0.0	15687 -0.015680 -0.015694 -1
-0 010005 -0 016060 -0 016073 -0 016077 -0	.016060 -0.016084 -0.016088 -0.0	116093 -0.016067 -0.016101 -1
-0.03543 -0.016547 -0.016551 -0.016566 -0.	.016560 -0.016565 -0.016570 -0.0	78575 -0.016580 -0.010080 -1
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-0.017726 -0.017731 -0.017736 -0.017742 -0	017748 -0.017754 -0.017761 -0.0	17767 -0.017774 -0.017781 -4
-0.019431 -0.018437 -0.018443 -0.019450 -0	018456-0 018453-0.018471-0.0	18478 -0.018496 -0.019493 -0
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-0.034529 -0.004546 -0.034563 -0.034581 -0	0.034600 -0.034619 -0.034639 -0.0	194050 -0.034581 -0.034703 -1
-0.036302 -0.036319 -0.036337 -0.036356 -0	1,036376 -0.036396 -0.036418 -0.1	135439 -0.035462 -0.035465 -1
-0.038150 -0.038169 -0.038168 -0.036208 -0	1,038229 -0.038250 -0.038273 -0.1	106296 -0.038320 -D.038344 -1
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-0.081325 -0.061362 -0.081402 -0.081443 -	CL Angle	174
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	676	J +
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11 652052

Internet

Production Lab

Wavefront data (purely individual CL Rx in a form of Zernike coefficients) along with the lens positioning data are transmitted to the production lab.

Wavefront Contact Lens Prescription

11.507987

0.150000 -0.014821 -0.014821 -0.014822 -0.014823 -0.014823 -0.014824 -0.014824 -0.014825 -0.0014825 -0.014918 -0.014919 -0.014620 -0.014621 -0.014622 -0.014624 -0.014825 -0.014825 -0.014827 -0.014627 -0.014529 -1 -0.015091 -0.015092 -0.015094 -0.015096 -0.015098 -0.015099 -0.015101 -0.015103 -0.015105 -0.015108 -0 -0.015340 -0.015342 -0.015344 -0.015347 -0.015349 -0.015352 -0.015354 -0.015357 -0.015360 -0.015363 -0 -0.015665 -0.015668 -0.015670 -0.015673 -0.015677 -0.015680 -0.015687 -0.015687 -0.015687 -0.015687 -0.015684 -0.015687 -0.016065 -0.016069 -0.016073 -0.016077 -0.016080 -0.016084 -0.016088 -0.016083 -0.016087 -0.016101 -0 -0.016543 -0.016547 -0.016551 -0.016566 -0.016560 -0.016565 -0.016570 -0.016575 -0.016580 -0.016586 -1 -0.017096 -0.017101 -0.017106 -0.017111 -0.017116 -0.017122 -0.017127 -0.017133 -0.017139 -0.017145 -0.017726 -0.017731 -0.017736 -0.017742 -0.017748 -0.017754 -0.017761 -0.017767 -0.017774 -0.017781 -0.019431 -0.018437 -0.018443 -0.019450 -0.018456 -0.018453 -0.018471 -0.018478 -0.018486 -0.019483 -0 -0.019212 -0.019219 -0.019226 -0.019233 -0.019241 -0.019249 -0.019257 -0.019265 -0.019273 -0.019282 -0.020070 -0.020077 -0.020085 -0.020093 -0.020101 -0.020110 -0.020119 -0.020128 -0.020137 -0.020147 -0.021003 -0.021012 -0.021030 -0.021039 -0.021038 -0.021048 -0.021057 -0.021067 -0.021078 -0.021088 -4 -0.022013 -0.022022 -0.022031 -0.022041 -0.022051 -0.022061 -0.0220672 -0.022083 -0.022094 -0.022106 -0.022106 -0.023099 -0.023109 -0.023119 -0.023129 -0.023140 -0.023151 -0.023163 -0.023175 -0.023187 -0.023200 --0.024261 -0.024271 -0.024282 -0.024294 -0.024305 -0.024318 -0.024330 -0.024343 -0.024357 -0.024357 -0.025409 -0.025510 -0.025522 -0.025534 -0.025647 -0.025560 -0.025574 -0.025608 -0.025602 -0.025617 --0.026814 -0.025825 -0.025828 -0.025851 -0.025865 -0.026809 -0.026804 -0.025909 -0.025824 -0.025 -0.028204 -0.028217 -0.028230 -0.028244 -0.028250 -0.028274 -0.028290 -0.028305 -0.028323 -0.028340 -1 -0.029671-0.029685-0.029689-0.029714-0.029730-0.029746-0.029763-0.029790-0.029797-0.029816-1 -0.031214 -0.031229 -0.031244 -0.031260 -0.031277 -0.031294 -0.031312 -0.031330 -0.031349 -0.031388 -1 -0.032834 -0.032849 -0.032865 -0.032862 -0.032900 -0.032918 -0.032937 -0.032857 -0.032977 -0.032967 --0.034529 -0.004546 -0.034563 -0.034561 -0.034600 -0.034619 -0.034639 -0.034680 -0.034681 -0.034703 --0.036302 -0.036319 -0.036337 -0.036356 -0.036376 -0.036396 -0.036418 -0.036439 -0.036462 -0.036485 --0.038150 -0.038169 -0.038188 -0.038208 -0.038229 -0.038250 -0.038273 -0.038296 -0.038320 -0.038344 -1 -0.040075 -0.040095 -0.040115 -0.040136 -0.040158 -0.040181 -0.040204 -0.040229 -0.040254 -0.040279 -0.042077 -0.042097 -0.042119 -0.042141 -0.044155 -0.044177 -0.044199 -0.044222 --0.046310 -0.046333 -0.046356 -0.046380 (318.2, 244.3) -0.048542 -0.048565 -0.048590 -0.048615 Pupil Center -0.050850 -0.050875 -0.050900 -0.050927 -0.053225 -0.053261 -0.053288 -0.053316 --0.055697 -0.055724 -0.055752 -0.055781 --0.058236 -0.058254 -0.058293 -0.058324 --0.060852 -0.060881 -0.060911 -0.060943 -(309.0, 243.0) -----CL Center 4 + -0.063545 -0.063575 -0.063607 -0.063640 --0.066315 -0.066346 -0.066379 -0.066414 -0.069152 -0.069195 -0.069229 -0.065265 -0.072087 -0.072121 -0.072156 -0.072193 -0.075089 -0.075124 -0.075161 -0.075199 -0.078158-0.079204-0.078243-0.078282 174-0.081325 -0.061362 -0.081402 -0.081443 CL Angle

The Wavefront contact lens prescription is more than a collection of Zernike Coefficients; it also includes patientspecific lens positioning data. The complete lens design is a file over 130 pages long!

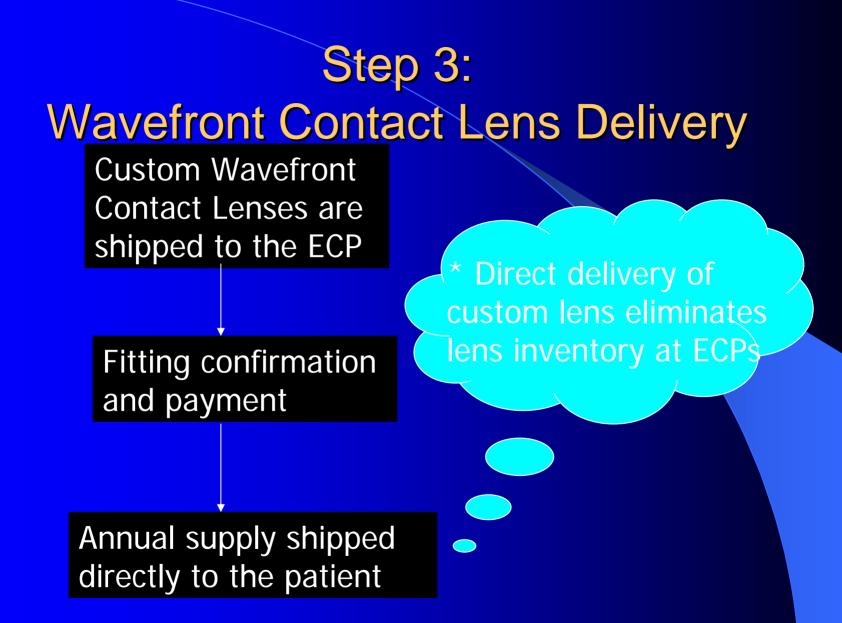
Wavefront Contact Lens Production ~continue

DAC



Semi-mold production

The WaveTouch Process is performed on a blank identical to the predicate lens



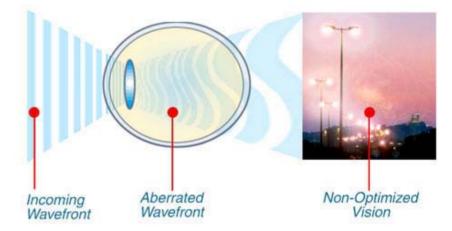
Patient Benefits From iZon[™] by Definition Lenses

Fully optimized, high definition vision

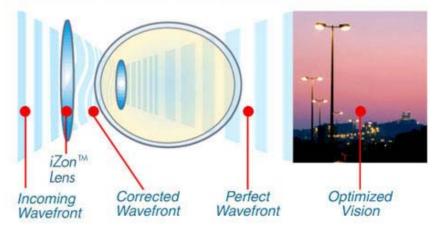
Provides refractive correction near the physiological limits of the human eye – 20/10 or better

- Significantly improved
 - visual acuity
 - Iow contrast visual acuity
 - contrast sensitivity
 - night vision, reduced glare

BEFORE WAVEFRONT-GUIDED LENSES



WITH iZon™ WAVEFRONT-GUIDED LENSES



Target patient population?

- Regular Astigmatism
- Irregular astigmatism
- Surgical corneal irregularities (PK)
- Keratoconus

iZon™ Lens Product Family

Continuous stream of product innovation

- Premium iZon[™] Wavefront-Guided Single Vision Spectacles (Q4 '04)
- iZon[™] by Definition Wavefront-Guided Contact Lenses by Definition[™] (Q1 '05)
- iZon[™] Wavefront-Guided Progressive Addition Lens (Q4 '05)







Thank you...



Optical Connection, Inc. is a proud member of the Shine Optical Group.