



Mastering Multifocals: the Evolution and Future of the Multifocal IOL

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- Multifocal IOLs have evolved tremendously
- Earlier models had significant side effects and did not meet patient's visual needs
- Patient dissatisfaction resulted in increased amount of chair time, causing some of you to have a negative outlook on multifocal lenses.

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Evolution of Multifocal Lenses

- Zonal Refractive
- Diffractive
- Depth of Focus
- Trifocal / Quadrifocal

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Array / Rezoom



- Alternating zones of refractive power (Near and distance)
- Each zone acts primarily as an independent annular refractive lens
- Centration and axial alignment are important
- Pupil size dependent

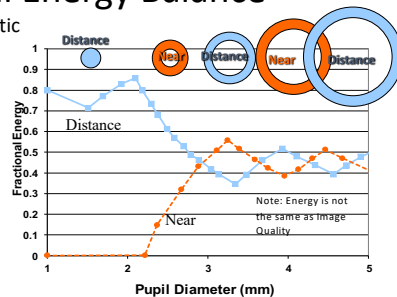


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Theoretical Energy Balance

Zonal Refractive Optic

Results are pupil dependent as well as centration dependent



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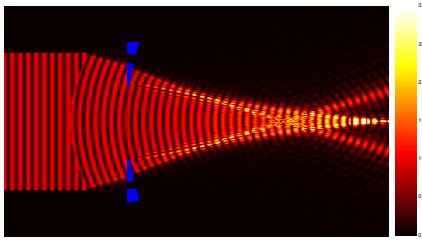
From Array to ReZoom

Zone Size Changes

	Array	ReZoom	Change (mm)
Zone 1 (Distance)	0 – 2.1mm	0 – 2.1mm	—0—
Zone 2 (Near)	2.1 – 3.4	2.1 – 3.45	+0.05
Zone 3 (Distance)	3.4 – 3.9	3.45 – 4.3	+0.35
Zone 4 (Near)	3.9 – 4.43	4.3 – 4.6	-0.23
Zone 5 (Distance)	4.43 – 6.0	4.6 – 6.0	-0.17

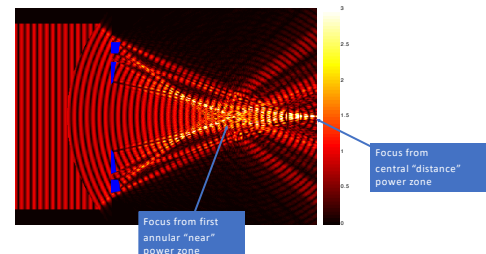
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Zonal Refractive Lens, 3 mm pupil distant object



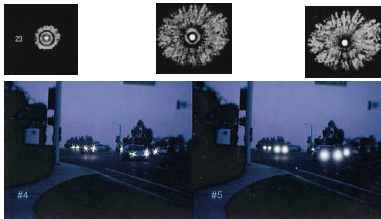
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Zonal Refractive Lens, 5 mm pupil distant object



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Rings Around Lights at Night with Zonal Lens



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ZONAL REFRACTIVE LENSES

These zonal refractive platform lenses provide:

- Limited spectacle freedom
 - 41% Array / ReZoom
- Visual disturbances
- Pupil dependency
- Inferior material platform (silicone)

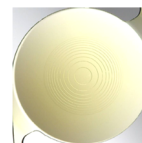
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Diffraction IOLs

- ReSTOR 4.0
- ReSTOR 3.0
- Tecnis Multifocals

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AcrySof® IQ ReSTOR® IOL



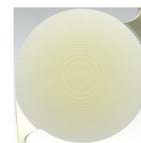
SN6AD3

Add Power: ~~+4.0 D~~

Spectacle Plane: +3.2 D

Range: +10.0 D to +34.0 D

A-Constant: 118.9



SN6AD1

Add Power: ~~+3.0 D~~

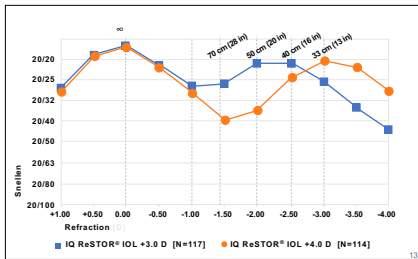
Spectacle Plane: +2.5 D

Range: +10.0 D to +34.0 D

A-Constant: 118.9

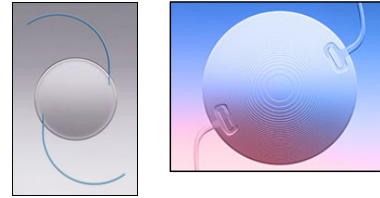
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Binocular Defocus Curve



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Tecnis Multifocal IOL



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Evaluation of Patient Lifestyle

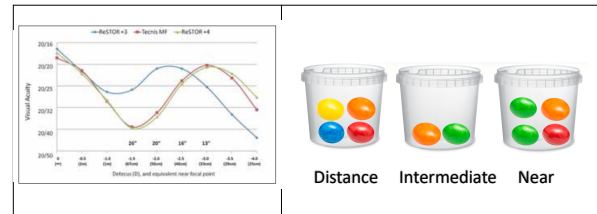
Discuss with each patient the concept of a limited amount of M&M candies being distributed between 3 buckets.



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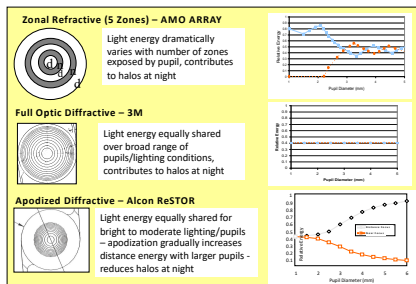
Diffraction IOLS

ReSTOR 4.0 / RESTOR 3.0 / Tecnis Multifocal



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Refractive MF and Diffractive IOLs

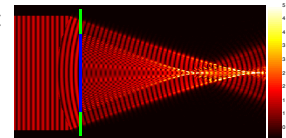


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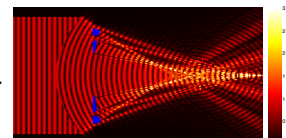
ReSTOR and Zonal Refractive - 5mm Pupil

Distant Object

Apodized
Diffractive
ReSTOR

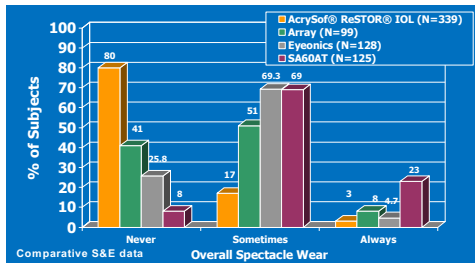


Zonal
Refractive
Array / Mod.
Array



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Spectacle Freedom Overall Vision



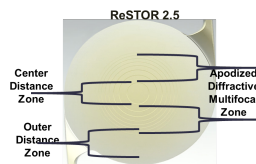
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Depth of Focus Lenses

- ReSTOR 2.5
- Symphony

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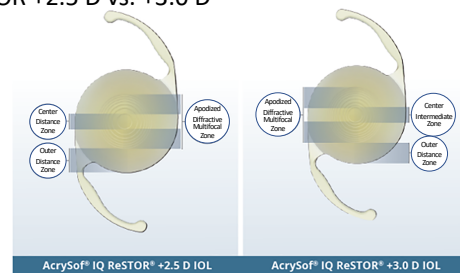
ReSTOR 2.5 Lens



- A 0.9 mm refractive monofocal central zone
- 7 diffractive rings

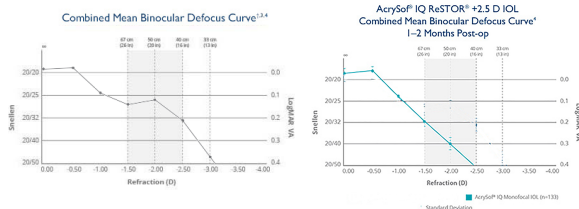
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OPTIC DESIGN DIFFERENCES: ReSTOR +2.5 D vs. +3.0 D



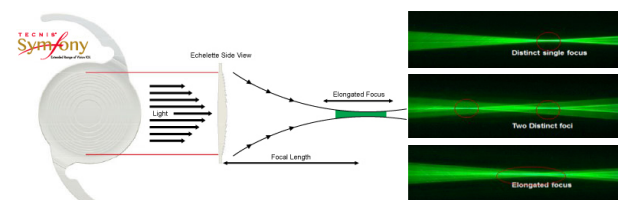
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ReSTOR 2.5



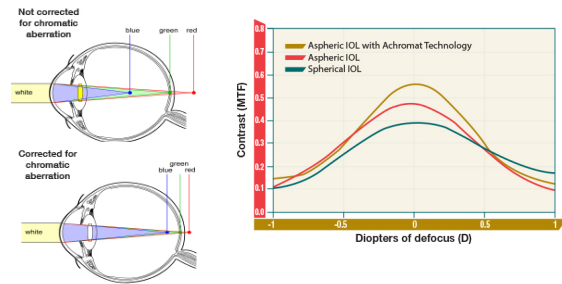
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Symphony



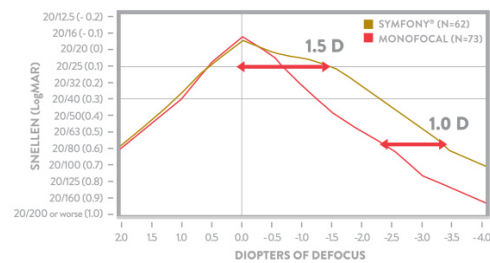
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Symphony Continued



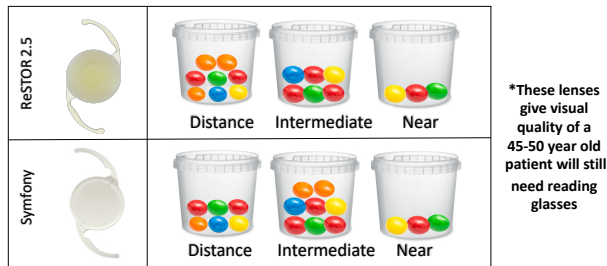
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Symphony Continued



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Current Intraocular Lenses Depth-of-Focus Lenses – ReSTOR 2.5* & Symphony *



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Matching Technology with Lifestyle

- Example:
 - Patient very active in distance and middle buckets
 - Active outdoors on weekends and summers (golf, boating, hunting)
 - Busy on a computer and desk work during weekdays
- Recommended Technology:
 - Dominant eye - ReSTOR 2.5 Lens
 - Non-dominant eye – Symphony Lens
 - "Mix and Match" > happiest group of patients for that time period
 - Patient still needed reading glasses (+1.25 D > +1.5 D)

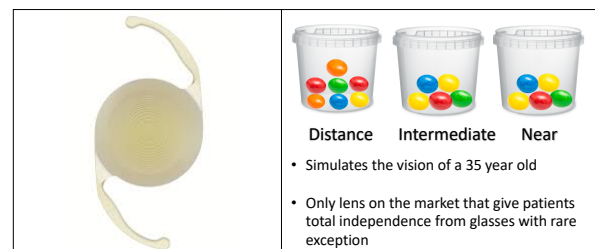
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TRIFOCAL / QUADRIFOCAI

- PanOptix

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Trifocal Lenses – PanOptix



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PanOptix vs. Symfony

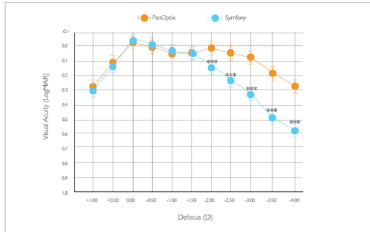
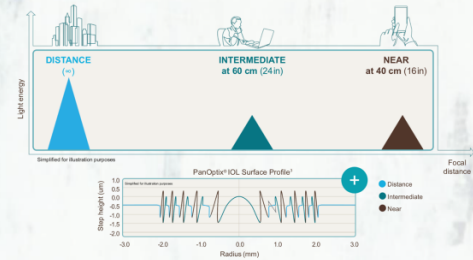


Figure 5. Binocular defocus curves for the PanOptix™ and Symfony IOLs (13). ***, $p < 0.001$.
Rosa-Pérez, R., Alvarado, A., Rosa-Santos, H. A comparative study of the visual outcomes between a new trifocal and an extended depth of focus intraocular lens. European Journal of Ophthalmology, published online ahead of print. Copyright © 2017 by the authors. Downloaded by University of Arizona Libraries on 05/10/17.

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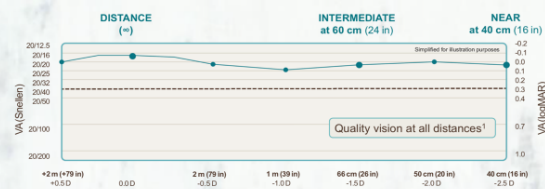
REIMAGINE MULTIFOCAL PERFORMANCE

RESULT ENLIGHTEN® Optical Technology optimizes intermediate without compromising near and distance vision.



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20/20 NEAR, INTERMEDIATE AND DISTANCE VISION IS NOW POSSIBLE^{1,†}



¹Based on mean value of binocular defocus curve at near, intermediate and distance at 6 months ($n=127$).
[†]Snellen VA was converted from logMAR VA. A Snellen vision of 20/20† or better indicates a logMAR VA of 0.04 or better, which means 3 or more of the 5 ETDRS chart letters in the line were identified correctly.

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PanOptix Defocus Curves

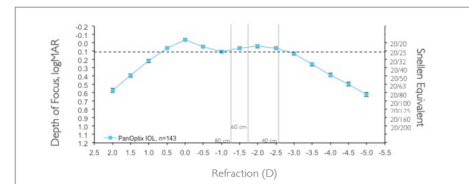


Figure 2. Binocular defocus curve for PanOptix™ at 6 months (4). Binocular defocus testing was performed under photopic conditions (~85 cd/m²) using a 100% ETDRS chart at 4 m. Subjects were defocused from manifest refraction using a -5.00 D and +2.00 D spherical correction in 0.5 D increments. Data reflect mean and 90% confidence intervals.

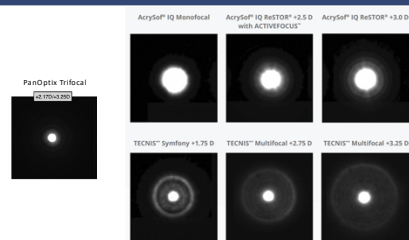
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PanOptix

Box 1. IOL Characteristics

- | | |
|---|---|
| <p>AcrySof® IQ PanOptix™ trifocal multifocal IOL (Alcon) (6)</p> <ul style="list-style-type: none"> Hydrophobic acrylate/methacrylate copolymer Optic 6.0 mm, overall diameter 13.0 mm Non-apodized near trifocal design Redirects light from the 3rd step height to distance Intermediate +2.17 D add Near +3.25 D add Spherical range 6 to +34.0 D Light distribution less dependent on pupil size | <p>AT-LISA tri 839RP trifocal multifocal IOL (Zeiss) (8)</p> <ul style="list-style-type: none"> Hydrophobic acrylate with hydrophobic surface properties Optic 6.0 mm, overall diameter 13.0 mm Trifocal over 4.34 mm, bifocal from 4.34–6.0 mm Diffraction profile using "smooth steps" Intermediate +1.66 D add Near +3.33 D add Spherical range 5.0 to +32.0 D Multistep pupil independent design |
| <p>FreeVision Microf trifocal multifocal IOL (PhysIQ) (7)</p> <ul style="list-style-type: none"> Hydrophobic acrylate Optic 6.5 mm, overall diameter 10.75 mm Combination of 2 apodized diffractive profiles Intermediate +1.75 D add Near +3.5 D add Spherical range +10.0 to +35.0 D Light distribution dependent on pupil size | <p>TECNIS Symfony EDOF IOL (Johnson & Johnson Vision) (9)</p> <ul style="list-style-type: none"> Hydrophobic acrylate Optic 6.0 mm, overall diameter 13.0 mm Posterior aspheric, diffractive surface and extendable feature Intermediate +1.75 D add Spherical range +5.0 to +34.0 D Pupil independent |

Dysphotopsias



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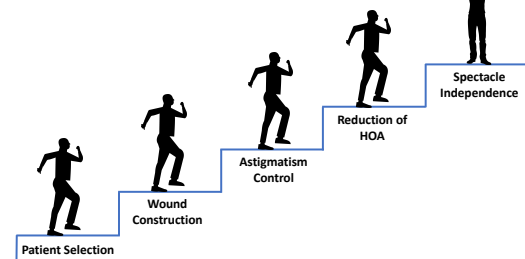
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Results of clinical study

- 14 random patients selected with bilateral PanOptix / PanOptix Toric
- Surgery performed December 2019 (P.H.E)
- Evaluation done February 17, 2020 with Dr. Patil
- All 14 patients 20/20 uncorrected at 16 inches
- 13 of 14 patients 20/20 at 24 inches, 1 patient 20/25
- 10 of 14 patients 20/20 at distance, 4 patients 20/25
- All patients were spectacle independent and thrilled with their visual results

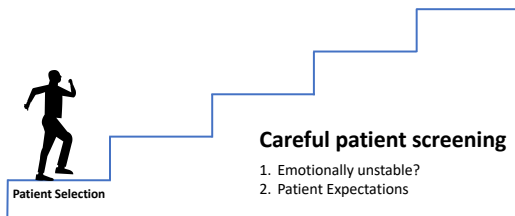
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Steps to the Successful use of the PanOptix Lens



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Steps to the Successful use of the PanOptix Lens



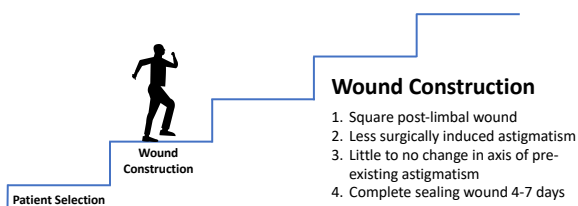
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Patient Expectation

- What is discussed pre-op
 - Every patient is told they have an excellent change of being free of glasses post-op but not perfect 20/20.
 - Patients write this statement out to confirm they understand
 - The purpose of going through expectations is to reduce post-op chair time for you.
- Most expectation issues occur post operatively
 - Patient Examples
 - Dominant eye -0.25D sphere, Non-dominant eye plano
 - Complaining that the dominant eye is not as good as the non-dominant eye
 - Pre-op refractive error -5.0 D OU
 - Post-op plano -0.25 D x 90°
 - Patient can't read at 8-10 inches
- Suggestions on how to manage such a patient
 - Ask the patient what was their expectation based on what we talked about pre-op?
 - Re-review pre-op expectation discussion
 - Encourage the patient to focus on what they can do not what they can't do
 - The golf analogy of hole in 1 vs. a par on a par 3
 - Let the patient know they have less correction than I have
 - If all else fails, give the patient the prescription and they will most likely not be wearing it in 6 months.

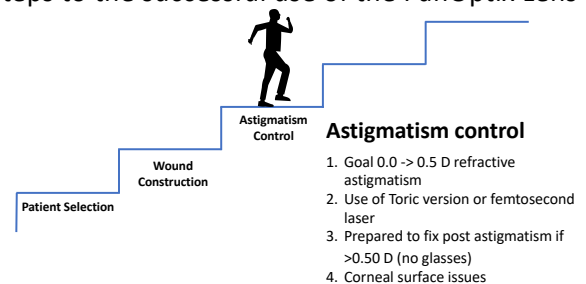
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Steps to the Successful use of the PanOptix Lens



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Steps to the successful use of the PanOptix Lens



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Corneal Surface Issues

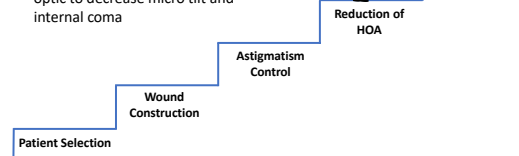
- #1 reason for post-op astigmatism is surface issues
- Causes
 - Betadine prep
 - Post-op drops
 - Wearing a mask
- Treatment
 - All of my PanOptix patients are advised to use artificial tears every 2 hours or at least 6 times a day post-op for 30 days
 - Compare K readings versus refractive readings for diagnosis
 - Once a patient develops a surface issue post-op it could take 2-3 months to recover
 - We would be happy to follow a patient with this problem

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Steps to the Successful use of the PanOptix Lens

Reduction of HOA

1. Pre-op evaluation of corneal coma
2. Femtosecond laser gives symmetrical overlap of anterior capsule on lens optic to decrease micro tilt and internal coma



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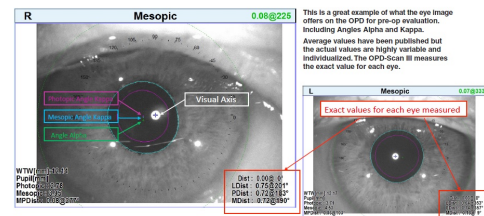
Pre-Op Evaluation

- Thorough ocular evaluation to detect conditions other than cataracts (ERM, ION, Glaucoma, Fuchs' Corneal Dystrophy, ABMD, ARMD, DES)
- Refractive error and corneal astigmatism
- OPD Wavescan III
 - Confirms corneal astigmatism
 - Corneal coma
 - Red Flag -> 0.32 microns – contraindication for multifocal lenses
 - Placido disc – dry eye
 - Mesopic pupil size
 - Yellow Flag – pupils > 6 mm will have more side effects from multifocal lenses



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Visual Axis, Angle Kappa and Alpha



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Multifocals, Angle Kappa, Angle Alpha

	Lens	ADD	Center Diameter	Angle Kappa Max	Waves	SA	Pupil Size	Pupil Size
AMO - Senilis	ZMR00	4	1.0 mm	0.5	22	-0.27	2.0-2.2	5.8
	ZBR00	3.25	1.2 mm	0.6	18	-0.27	2.0-2.2	5.8
	ZBR00	2.75	1.3 mm	0.65	15	-0.27	2.0-2.2	5.8
	Symfony [®] aspheric	1.6 mm	0.80	9	-0.27	2.0-2.2	5.8	
Alcon	AcrySof [®] IQ	2.5	0.88 mm	0.47	7	-0.2	2.0-2.2	5.5
	AcrySof [®] IQ	3	.88 mm	0.43	9	-0.1	2.0-2.2	5.5
	AcrySof [®] IQ	2.5	0.88 mm	0.47	7	-0.2	2.0-2.2	5.5
	PanOptix [®] IOL	3.25	1.164mm	0.58	15	-0.1	2.0-2.2	5.5
	PanOptix [®] IOL Toric	3.25	1.164mm	0.58	15	-0.1	2.0-2.2	5.5

Angle Alpha $\leq 0.3mm$ = good candidate and patient should be looking through center of the central optic zone.

Angle Alpha 0.31 to 0.5mm = within tolerance but need to be cautious of different IOL central optical zones.

Angle Alpha $\geq 0.5mm$ = may not be a candidate for multifocal.

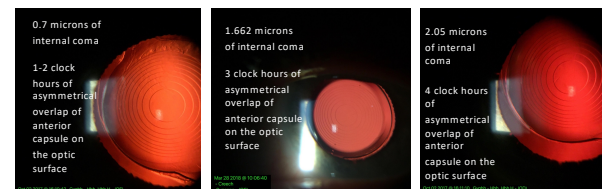
≥ 0.6 Toric may have issues rotating

≥ 0.7 even an aspheric IOL (use a zero SA IOL, SofPort, enVista, Softec HD).

When Angle Alpha > 0.3 mm the interaction with Angle Kappa should be considered. Angle Alpha relates to the position of the IOL in the eye and Angle Kappa relates to the pupil position in front of the IOL. The combination of those 2 conditions should be considered for their potential effect on optical performance.

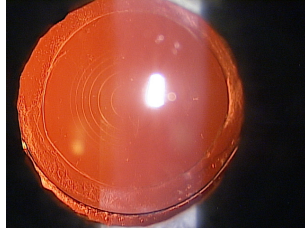
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Patients with Manual Rhexus and Asymmetrical Overlap of the Anterior Capsule on the Lens Optic



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Femtosecond Rhexus



0.023 microns of internal coma

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Study Findings Patient Satisfaction Survey Scores

- Patients were asked 30 questions from 10 categories with responses ranging from 0-3
 - 0 Not a problem
 - 1 Mild
 - 2 Moderate
 - 3 Severe
- 10 Categories Include
 - Glare
 - Halos
 - Starburst
 - Hazy Vision
 - Blurred Vision
 - Distortion
 - Multiple Images
 - Fluctuation in vision
 - Focusing difficulties
 - Depth perception

Quinn M. Williams, L.J. Knecht, P. Prasad, J. and Jonathan L. Mann, J.A. "The Development of an Instrument to Measure Quality of Vision: The Quality of Vision (QoV) Questionnaire" (2016, November 2016), Vol. 15, No. 10

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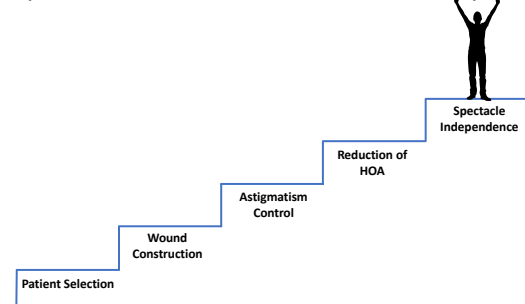
Comparison of satisfaction score and internal coma less than 0.20 microns

Satisfaction Score	% of People with Internal Coma of 0.20 μ or less
0-10 (n=15)	100%
11-20 (n=29)	93.1%
21-30 (n=30)	60%
>30 (n=15)	46.7%

($p < 0.001$)

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Steps to the Successful use of the PanOptix Lens



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What's Coming

- Synergy J&J's version of PanOptix
- Symphony Plus increases the near add from 1.75 -> 2.25

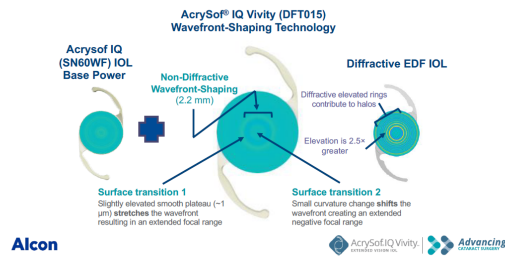
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What's Coming

- Vivity (Alcon) & Eyhance (J&J)
 - Aspheric monofocal lens with extended depth of focus without diffraction segments giving vision in distance and middle bucket activities
 - Maintains a visual disturbance profile comparable to an aspheric monofocal lens

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VIVITY UTILIZES A NON-DIFFRACTIVE WAVEFRONT-SHAPING TECHNOLOGY TO STRETCH AND SHIFT THE WAVEFRONT



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Summary

- Today's multifocal IOLs give more spectacle independence with less dysphotopsias
- Many patients are demanding this type of technology
- Still must pay attention to expectations and surface issues

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Questions?

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