Actualizing and Understanding EDoF IOLs

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Comparing to traditional Multifocal IOLs, EDoF IOLs DO NOT HAVE a DISCRETE number of foci, but a CONTINUUM of foci and provide for continuous vision over an extended range of distances.

- No loss of contrast sensitivity
- No compromises in distance vision
- Excellent intermediate vision
- Good near vision
- Glare, Halos, night driving issues no worse than monofocal IOLs
- No loss of light Long-term stability of optical properties and function
Actualizing and Understanding EDoF IOLs

- Monofocal
- Diffractive
- Aberrational
- Polyfocal
- Refractive

Monofocal EDoF

Enhancing depth of focus by inducing total positive spherical aberration in the eye

In cornea with positive aberration implanting aberrational neutral, asphericIOLs
Monofocal EDoF
Spherical Aberration

Influence of Spherical Aberration on Depth of Field

Diffractive EDoF
Correction of chromatic aberration (LCA)

AT LARA 829 Carl Zeiss Meditech
TECNIS Symfony ZXR--, Johnson & Johnson
Diffractive EDoF
EDoF AT LARA- TECNIS Symfony

Optimized optical design:
• Diffractive optic with reduced chromatic aberration and enhanced contrast sensitivity
• Extended focal area instead of multiple focal points Not “multifocal”
AT LARA 829MP – Aspheric optics

**Contrast Sensitivity Optimization**

- **Advanced Chromatic Aberration Correction**
  - The diffractive design is balanced such that material-based chromatic aberrations are to a large degree neutralizing by the chromatic aberration from the diffractive grating

- **Aspheric designs in IOLs:**
  
  - *AT LARA 829MP*: 0.0 μm
    - Use residual corneal asphericity for focus extension
    - Better performance if tilted
    - Neutral to corneal ‘abnormalities’ (post-LASIK)
  
  - *AT LISA tri 839MP*: -0.18 μm
    - Reduce residual asphericity
    - Maximize image quality and contrast

**AT LARA 829MP**

**NEXT GENERATION**
Extended Depth of Focus (EDoF) IOL

- **Widest range of focus** within EDoF segment
- **Less visual side effects** than multifocal IOLs

Cataract and refractive surgeons can now **grow their premium IOL business** with more choice for different patient needs:

- **AT LARA** offers a **perfect balance** for patients seeking spectacle independence for an active lifestyle with less side effects
- **AT LISA tri** is the unsurpassed market leader in trifocal IOLs and gold standard for patients seeking **maximum spectacle independence**
AT LARA 829MP

- AT LARA 829MP is based on AT LISA platform:
  - Hydrophilic acrylic (25%) with hydrophobic surface properties
  - 4 point-haptic design
  - MICS (1.8 mm)
  - Pre-loaded BLUEMIXS injection system
  - 360° anti-PCO ring and sharp edges

A design that has been successful in the market for more than 15 years

The next generation EDoF IOL:

AT LARA 829

- LIGHT BRIDGE Optical design
  Diffractive optical design with far dominant light distribution and 2 power additions creating an optical bridge effect to extend the range of focus

- Smooth Micro Phase (SMP) Technology
  Patented design and manufacturing technology, minimizing light scattering and glare by including the manufacturing process into optical design optimization
AT LARA 829 IOL

Defocus Curve

AT LARA shows better VA in a wider focus range compared to AMO Symfony
AT LARA 829 IOL

Favorable ratings on visual side effects

Subjective ranking of visual experience (random blind comparison): n=48

Defocus Curve

AT LARA produces **less visual side effects** compared to a trifocal and AMO Symfony

AT LARA 829 IOL

AT LARA produces **excellent Contrast Sensitivity** for most of the spatial frequencies
AT LARA toric 929MP/M

- Toric EDoF IOL with wide range of focus and reduced visual side effects, as AT LARA 829MP
- Precise astigmatism correction
- Proven rotation stability
- Available range:
  - **AT LARA toric 929MP**:  
    - SE: -8.0 D to +32.0 D  
    - CYL: +1.0 D to +4.0 D
  - **AT LARA toric 929M**:  
    - SE: -4.0 D to +32.0 D  
    - CYL: +4.5 D to +12.0 D
  - in 0.5 D increments, respectively

* Further preselected SE/cylinder combinations are available above and below the stated SE range.

AT LARA toric 929MP/M

**Excellent Optical Quality - Bitoricity**

- Bitoric designs by default provide an excellent quality image, also in high cylinder values, leading less aberrations

- Its design also enables production of higher cylinder powers

![Monotoric and Bitoric images]
Comparison of Halo & Glare
AT LARA vs Tecnis Symfony

Aberrational EDoF
MINI WELL

**Comparison of Halo & Glare**

**AT LARA vs Tecnis Symfony**

**Minimum** - Halo: (0%, 0%) Glare: (0%)

**Mean** - Halo: (28%, 37%) Glare: (16%, 32%)

**Maximum** - Halo: (58%, 69%) Glare: (70%)

**Minimum** - Halo: (0%, 0%) Glare: (0%, 0%)

**Mean** - Halo: (58%, 65%) Glare: (34%, 48%)

**Maximum** - Halo: (87%, 93%) Glare: (38%, 69%)

**Aberrational EDoF**

**MINI WELL**

**Technical Specifications**

- **Name**
- **Material**
- **Positioning**
- **Total diameter**
- **Diameter of optical surface**
- **Vaulting**
- **Optics shape**
- **Posterior edge**
- **Estimated A constant**
- **Estimated A.C.D.**
- **Dioptic range**
- **Equivalent Additional power**

**MINI WELL READY**

- **Copolymer**
- **Bag**
- **10.75 mm**
- **6 mm**
- **5°**
- **Biconvex progressive multifocal aspherical**
- **Double**
- 118.6
- 5.32 mm
- from 0 to +30 (incr: 0.5 from +18 to +25)
- +3
Polyfocal EDoF WIOL-CF

Different zones of spherical aberration correction to enhance vision in different distances

Polyfocal IOL of bioanalog material (Hydrogel)
Pupil dependant

Similarly to natural human lens, WIOL-CF uses constriction and dilation of the pupil for better close focus.
Polyfocal EDoF WIOL-CF

Postoperative Stability of Visual Acuity

Refractive EDoF
LENTIS COMFORT
Oculentis LENTIS Comfort

• EDOF: Extended Depth Of Focus
  • Novel and modern concept of creating a larger range of functional vision with as little physical focal points as possible

Oculentis LENTIS Comfort

• Very good near and intermediate vision
• Optimized depth of focus
• Spectacle independence
  • most of the time
• Very good contrast Sensitivity
• Very good quality of image
Oculentis LENTIS Comfort

- RMS over 500
- Irregular corneal surface
- Abnormal corneal surface
diopteric power distribution curve
- Borderline Macula

Oculentis LENTIS Comfort

Excellent far and intermediate vision
Oculentis LENTIS Comfort

• LENTIS® Comfort vs. Crystalens HD

![Diagram](image)


Oculentis LENTIS Comfort

• EDOF: Extended Depth Of Focus

- Far vision as good as monofocals
- 50% of the patients can read
- Optical phenomena similar to monofocals
- Contrast sensitivity similar to monofocals
- For tasks in everyday life patients are spectacle free
- No strict patient selection necessary
- Suitable for patients who do not fulfill criteria for implantation of Trifocal IOLs
# Oculentis LENTIS Comfort

**HALO & GLARE**

![Image showing HALO & GLARE effects](image)

## Actualizing and Understanding EDoF IOLs

<table>
<thead>
<tr>
<th>MONOFOCAL</th>
<th>DIFFRACTIVE</th>
<th>ABERRATION</th>
<th>POLYFOCAL</th>
<th>DIFFRACTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monofocal IOL</td>
<td>At LARA (Zeiss)</td>
<td>MI NI WELL (Sifi)</td>
<td>WIOL (Medicem)</td>
<td>Lentis Comfort (Oculentis)</td>
</tr>
<tr>
<td>Positive spherical aberration</td>
<td>Diffractive optic</td>
<td>Different zones of spherical aberration correction to enhance vision in different distance</td>
<td>Polifocal concept that changes its focal power depending on pupillary and ciliary body activity</td>
<td>Near vision segment with low addition and transition zone</td>
</tr>
<tr>
<td>Produces depth of focus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Conclusion

• Monofocal IOLs can be EDoF IOLs depending on corneal spherical aberration
• EDoF IOLs show less dysphotopic phenomena compared to multifocal IOLs
• Range of vision is partly limited compared to modern MIOLs (trifocal)
• Some models are dependant on pupil size and corneal spherical aberration (W-IOL, Miniwell)
• Good overall vision can be achieved with a Mix & Match approach (MF15/MF30)
• Comfort/MF15 shows comparable results for dysphotopsia with enlargement of defocus capacity to monofocal IOLs

CONCLUSION

• EDoF IOLs provide us with an excellent option to improve the quality of vision of our demanding patients, achieving excellent far and intermediate vision usually with improved depth of focus that helps the patient in his daily activities. Compared to multifocal or Trifocal IOLs it is true EDoF IOLs have their limitation for near but on the other hand they provide a natural continuous vision of high quality in the other distances preserving almost normal contrast sensitivity and without suffering the adverse phenomena como dysphotopsias, haloes and glare.
Muchas Gracias