Sulcoflex® trifocal:
An adaptive solution towards DIVA
(Distance Independent Visual Ability)

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Chair: Sigmund Freud University; Vienna
Financial disclosure

Alcon
Bausch & Lomb
Geuder
Johnson & Johnson
Morcher
Rayner
Zeiss Meditec
Initial Trial

Duet-implantation: 20 eyes
Implantation in pseudophakic eye: 20 eyes

binocular implantation
follow-up: 1 month
single surgeon
postop refraction: 0

Worlds first implantation:
30. 7. 2018
Material and Design
Surgery
Preliminary Results
Conclusion
Material and Design: The History of Sulcoflex®
Uveal and Capsular Biocompatibility of Intraocular Implants

Hydrophilic Rayacryl: HEMA-MMA copolymer long term experience (>20 a)

Superb uveal biocompatibility


Additive IOLs available

Cristalens Reverso®

Rayner Sulcoflex®

1st Q®
Results: Rayner Sulcoflex®

- n: 200 eyes/ 10 years
- refr. mf, toric, mf/t, monofocal
- LFCM: < than after phaco
- iristrauma: 0
- pigmentdispersion: 0
- interlenticular opacification: 0

Kahraman G, Amon M "Sulcoflex: A new supplementary intraocular lens for pseudophakic refractive errors
Results: Rayner Sulcoflex®

- positive iris-distance: 100%
- positive central optic-distance: 100%
- optic capture: 0
- pupil ovalisation: 0
- UCVA: 0.9
- refraction: +/- 0.25dpt
Cadaver Eye Study:

- appropriate sulcus fixation
- appropriate centration
- minimal interaction with uveal tissue
- minimal interaction with in-the-bag IOL

Effect of interface refelecion in pseudophakic eyes with an additional refractive intraocular lens
Optical bench study:

- same reflections from additional interfaces
- two IOLs similar optical quality to single IOL

Jens Schrecker, Katja Zoric, Arthur Messner, Timo Eppig
J Cat Refract Surg; 38/8; 1650-1656
Decentration compared to the **center of the pupil** in mm
max. decentration capsular bag: 1,05 mm
max. decentration sulcus: 0,6 mm
**Statistically significant better centration** of ciliary sulcus fixated IOLs

Conclusion after over 10 years

Supplementary IOLs are effective for secondary enhancement of the surgical result and for primary “Duet implantation”

They represent a reversible or exchangeable technology for the future
Next step: create first diffractive trifocal add-on IOL

RayOne® Trifocal has fewer rings on the IOL optic surface for reduced potential visual disturbances and improved night vision.

Features:
- 16 diffractive steps / rings
- 4.5 mm diffractive zone
- > 4.5 mm monofocal, distance

Benefits:
- Reduces visual disturbances
- Developed to be less dependent on pupil size or lighting conditions
- Improves distance vision in mesopic condition
# Comparison of Trifocal Technology

<table>
<thead>
<tr>
<th></th>
<th>PhysIOl FineVision</th>
<th>Zeiss AT LISA Tri</th>
<th>Alcon PanOptix</th>
<th>Rayner Trifocal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diffractive Technology</strong></td>
<td>Diffractive Apodized Trifocal across full optic surface</td>
<td>Diffractive Trifocal up to 4.34 mm thereafter bifocal</td>
<td>Diffractive Trifocal up to 4.5 mm thereafter monofocal</td>
<td>Diffractive Trifocal up to 4.5 mm thereafter monofocal</td>
</tr>
<tr>
<td><strong>Diffractive Steps</strong></td>
<td>26 diffractive steps</td>
<td>29 diffractive steps 0.0 D</td>
<td>15 diffractive steps</td>
<td>16 diffractive steps</td>
</tr>
<tr>
<td><strong>Diffractive Orders</strong></td>
<td>0, 1, 2</td>
<td>0, 1, 2</td>
<td>0, 2, 3 (non-sequential)</td>
<td>-1, 0, 1</td>
</tr>
<tr>
<td><strong>Light Loss 3.0 mm pupil</strong></td>
<td>14%</td>
<td>14.3% (Ave.)</td>
<td>12%</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Light Energy Split 3.0 mm pupil</strong></td>
<td>49% D / 18% I / 34% N</td>
<td>50% D / 20% I / 30% N</td>
<td>42% D / 24% I / 22% N (includes 12% light loss)</td>
<td>52% D / 22% I / 26% N</td>
</tr>
<tr>
<td><strong>Reading Distance</strong></td>
<td>37.5 cm 75.0 cm</td>
<td>40.0 cm 80.0 cm</td>
<td>42.0 cm 60.0 cm</td>
<td>37.5 cm 75.0 cm</td>
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</table>
Comparison of optical performance and patient satisfaction with an Extended Range of Vision IOL and a trifocal IOL: A randomized prospective study

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Clemens Bernhart
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Visual Acuity

Decimal visual acuity (mean ± SD)

- CDVA pre
- CDVA
- UDVA
- UIVA
- UNVA

RayOne trifocal

Tecnis Symfony
AT LISA tri
Binocular Defocus Curve
Surgery
Preliminary Results
Defocus curve
Photopic contrast sensitivity

Contrast sensitivity vs. Spatial frequency, cycles per degree
Mesopic contrast sensitivity

Contrast sensitivity

Spatial frequency, cycles per degree
Binocular defocus curve

Decimal visual acuity (mean ± SD)

Level of defocus (dpt)

DEFOCUS- SULCOFLEX TRI
Secondary enhancement
Female: U. P.; 72a

Oktober 2015: uneventful IOL implantation in both eyes

September 2018: uneventful, bilateral secondary enhancement

VA right eye: 0.7 (secondary cataract); Jg 1; YAG scheduled

VA left eye: 1.0; Jg 1
Conclusion

• Excellent visual acuity results across all distances
• All patients were satisfied with their distance, intermediate and near vision
• No surgical and postop-complications
• Results are comparable to trifocal “in the bag“ IOLs

But:

• Supplementary IOLs offer an adaptive option
Conclusion

Main indications today:

In phakic patients:
Multifocal Duet-implantation

In pseudophakic patients:
Multifocal enhancement
Biometrical surprise
Sophisticated
Adjustable
Flexible
Effective