

Evaluation of PSF Imaging After Bilateral Implantation of Accommodating or Multifocal IOLs

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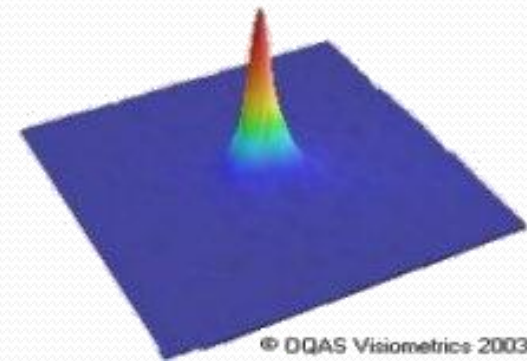
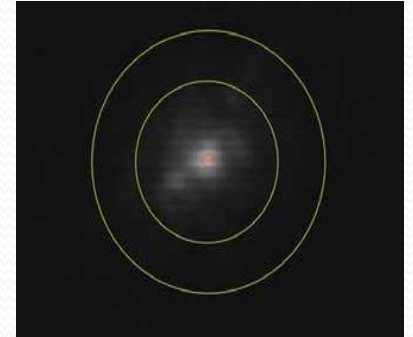
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Financial Interests

- MAQ:
 - Bausch & Lomb
- RC: Bausch & Lomb
- JSP:
 - 1-800-Doctors
 - Abbott Medical Optics
 - Acufocus
 - Bausch + Lomb
 - Calhoun Vision
 - Elenza
 - TearLab

Purpose

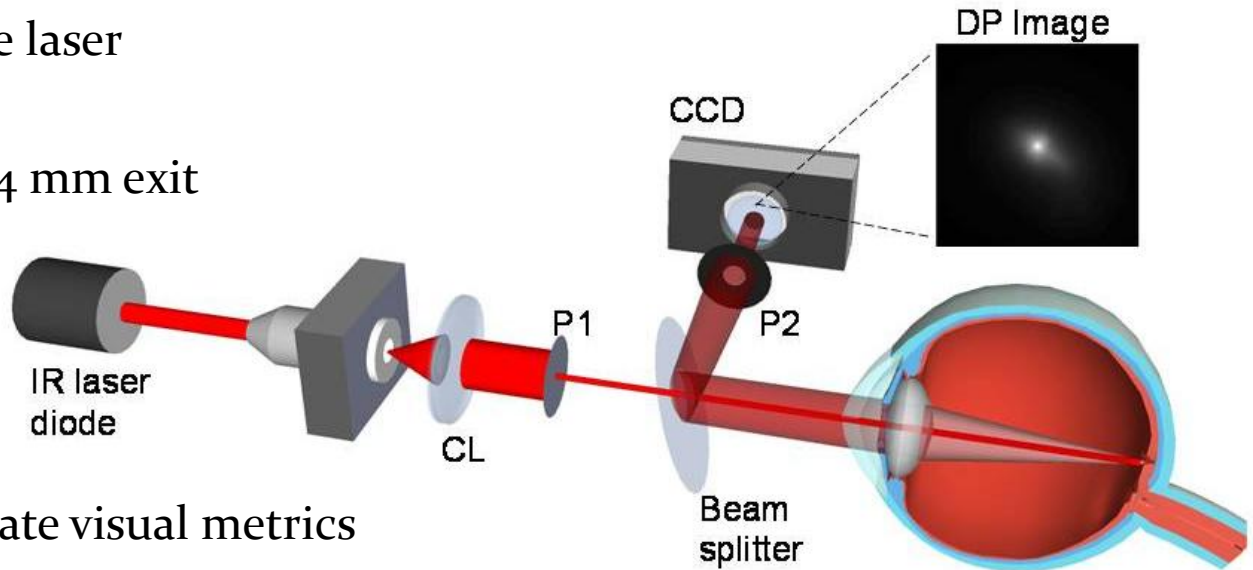
To compare visual quality metrics derived from the Optical Quality Analysis System II (OQAS), which directly measures the point spread function (PSF) of the optical system of the eye via a double-pass technique, following bilateral implantation of 3 presbyopia-correcting IOLs.



Optical Quality Assessment System (OQAS, Visiometrics, Spain)

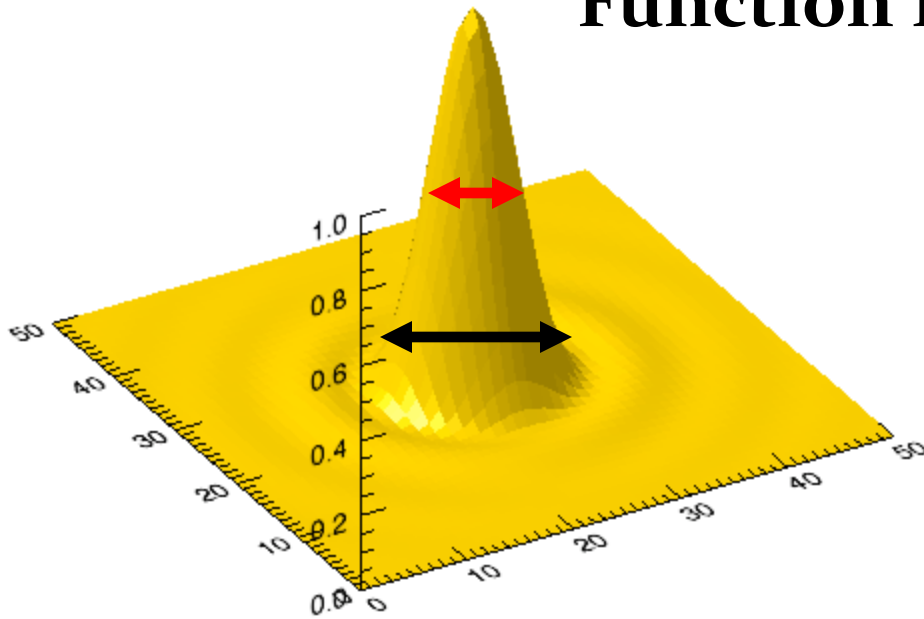
- Measures Retinal Point Spread Function

- IR (780 nm) Diode laser
- Double-Pass
- 2 mm entry, then 4 mm exit
- CCD captures PSF



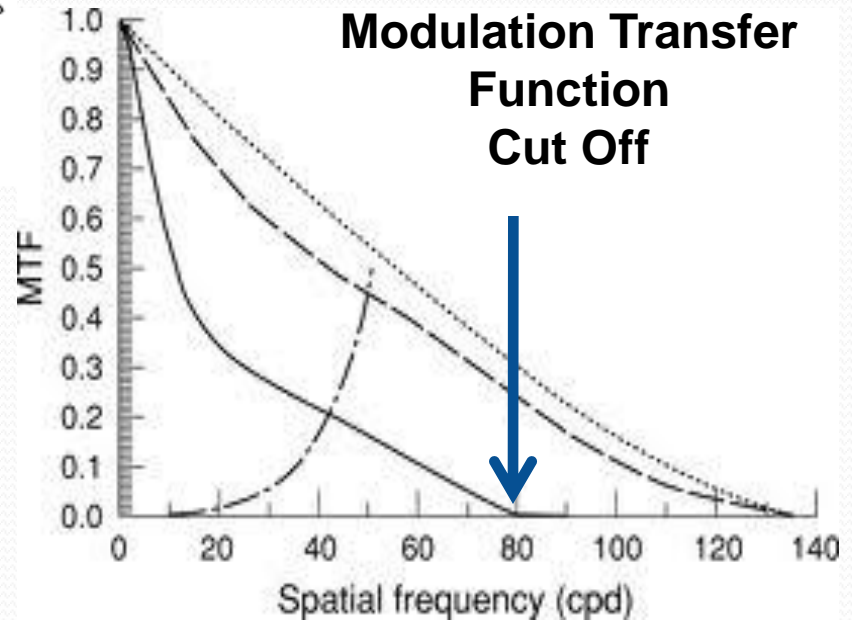
- PSF used to calculate visual metrics
 - MTF, Strehl Ratio, MTF cut-off
 - PSF width at 50% and 10% Height
 - Objective Scatter Index (OSI)

Point Spread & Modulation Transfer Function Metrics



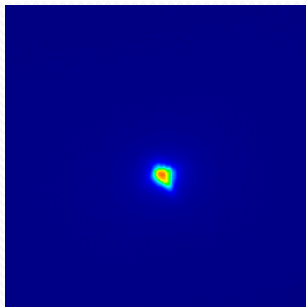
 **Point Spread Function
Width at 50% Height**

 **Point Spread Function
Width at 10% Height**

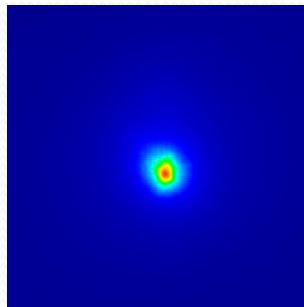


➤ *OBJECTIVE SCATTER INDEX (OSI)*

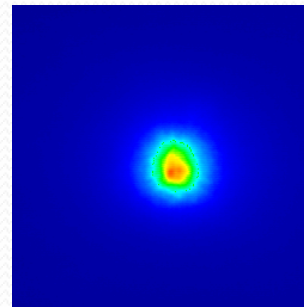
Calculated from
the signal intensity of an external region
of the double-pass image relative to
the signal intensity of a central region



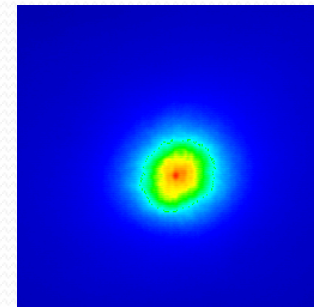
OSI = 0.4



OSI = 2.3



OSI = 3.2



OSI = 6.2

Study Design

Study Design: OQAS evaluation was performed on patients enrolled in a prospective, randomized, partially masked, post-market study of 3 presbyopia-correcting IOLs:

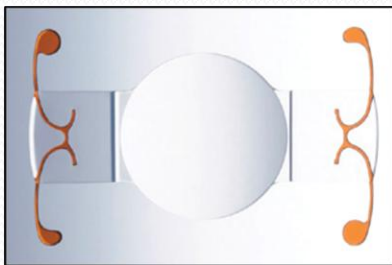
Crystalens AO (n=52)

ReSTOR D1 +3 (n=50)

Tecnis Multifocal (n=46).

One (1), three (3), and six (6) months following bilateral, sequential IOL implantation, point spread function (PSF) parameters, modulation transfer function (MTF), objective scatter index (OSI), and Strehl ratios were recorded and statistically analyzed.

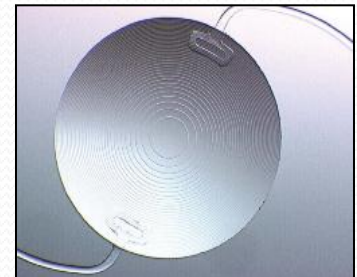
Crystalens AO (AT-50AO)



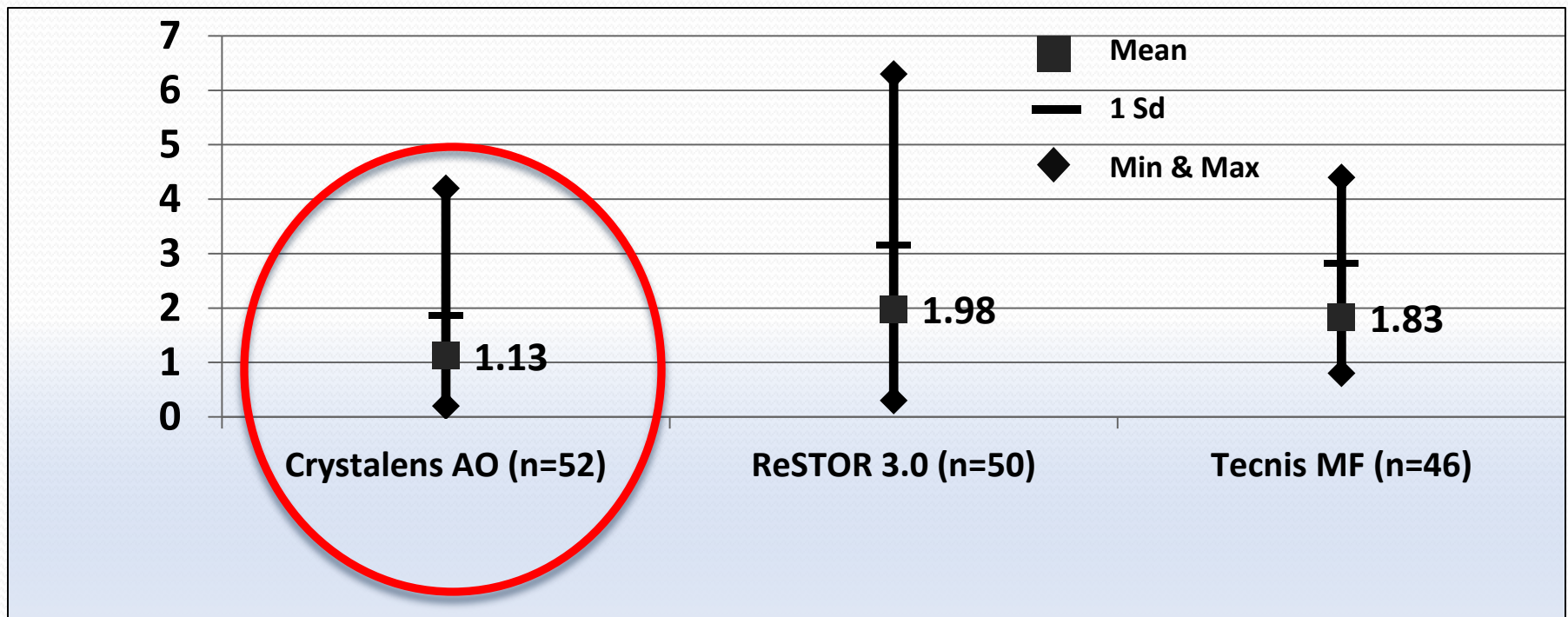
ReSTOR 3.0 (SN6AD1)



Tecnis Multifocal (ZMA00)



Objective Scatter Index (OSI): 6 month postop (monocular)



$p < 0.001$

$p = 0.002$

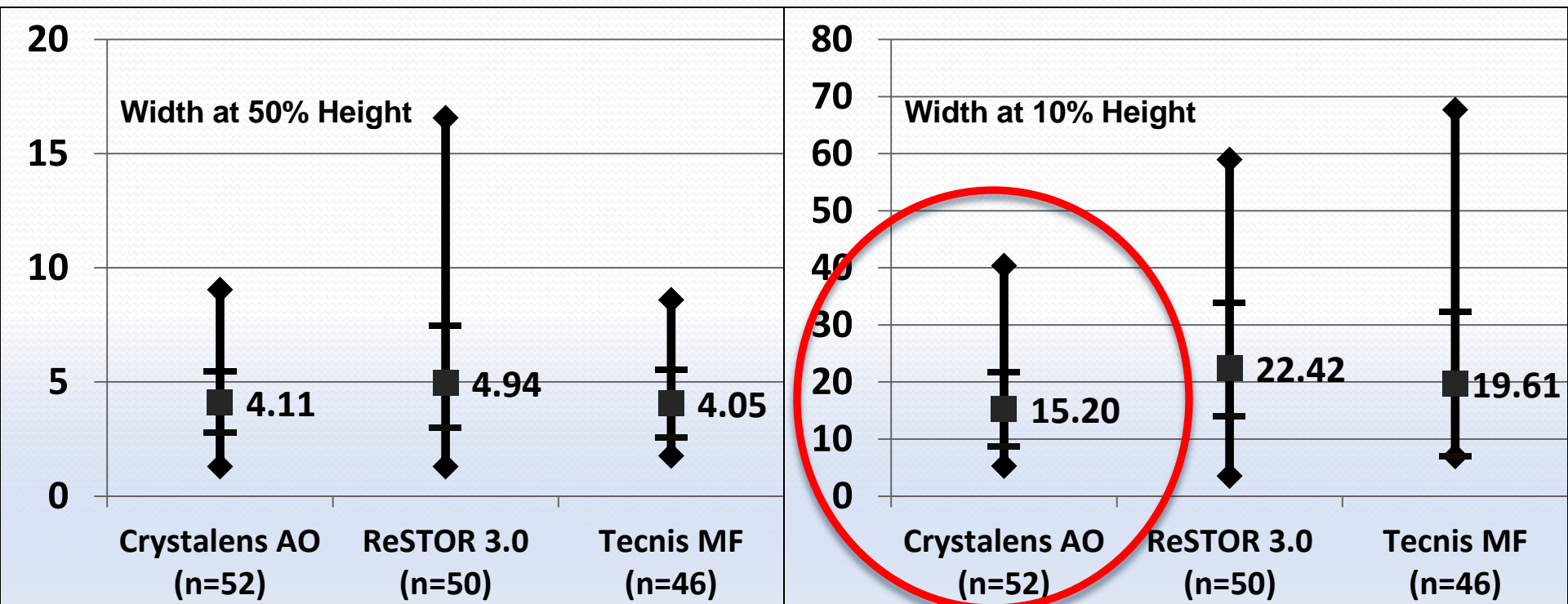
$p = 0.571$

Crystalens vs ReSTOR

Crystalens vs Tecnis

ReSTOR vs Tecnis

Width at 50% & 10% of PSF Height (arc min): 6 month postop

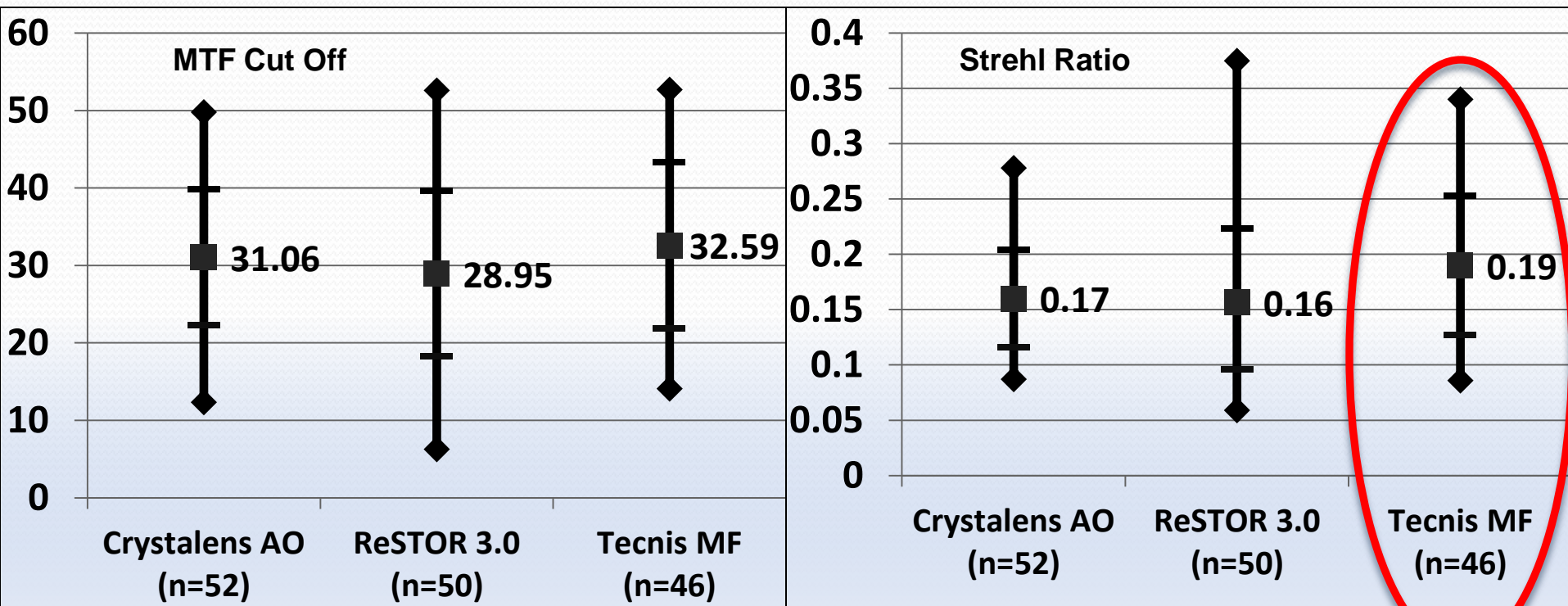


$p=0.061$
 $p=0.860$
 $p=0.064$

Crystalens vs ReSTOR
Crystalens vs Tecnis
ReSTOR vs Tecnis

$p=0.001$
 $p=0.056$
 $p=0.316$

MTF Cut Off (cycles/degree) & Strehl Ratio: 6 month postop



$p=0.347$
 $p=0.503$
 $p=0.151$

Crystalens vs ReSTOR
 Crystalens vs **Tecnis**
 ReSTOR vs **Tecnis**

$p=0.437$
 $p=0.034$
 $p=0.019$

Summary

- At 6 postoperative months:
 - mean OSI for the **Crystalens AO** group (~ 1.1) was about 40% less ($p < 0.01$) than the mean OSI for Tecnis MF (~ 2.0) and ReSTOR D1 +3 (~ 1.8),
 - but there is no statistical difference in OSI between the two multifocal groups ($p > 0.5$).
 - **Crystalens AO** had a narrower PSF (at 10% height) than for ReSTOR D1 +3 ($p = 0.001$) or Tecnis MF ($p = 0.06$)
 - **Tecnis MF** had a higher Strehl Ratio (0.19) than for Crystalens AO (0.17, $p = 0.03$) or ReSTOR D1 +3 (0.16, $p = 0.02$).

Conclusions

- **The OQAS provides objective measurement of optical quality after presbyopia-correcting IOL implantation.**
- **The optic designs of the
Crystalens AO (aspheric monofocal) and
Tecnis MF (negative aspheric anterior surface with a
posterior diffractive surface)
enhance the quality of the point spread function,
as measured in vivo using the OQAS.**