The History of Development of Microincisional Phaco and MICS IOL and their Importance in Modern Phacorefractive Surgery
IOL Technology & CO-MICS

D. Breyer, Düsseldorf

Kassel, 13.03.2010

Background - Science v. Art

“ I´m the first to admit... the use of toric IOL is science....whereas corneal incicions are an inexact art...”

Robert H. Osher in CRST 2009

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What Do We Need for Perfect Toric IOL Surgery?

Repeated, reliable videokeratography (Pentacam HR, Oculus and Wavelight)
Customized, individual, rotation stable toric MICS IOL of high optical quality
Online calculation program
Astigmatism neutral (sub 2.0mm incision) coaxial Microincision Phaco
Reliable, precise marking method (Gerten, Wehner, Osher and Zaldivar.....)
Precise intraoperative IOL orientation method (Breyer - screen Transparency, STACY)
Optional: slitlamp control in the OR
Best of all: live surgery videokeratoscopy

...all of this meeting high international standards of quality management

Is Carl Zeiss Meditec helping us meeting those high standards?

A perfect marriage:

Acri.Tec	and	CZM
Innovative MICS IOL	and	precise diagnostic and operation tools

Goal: high quality management standards and perfect workflow

To provide the highest quality and best standard to our patients

Historical Toric Evolution
or
Disadvantage of previous toric IOL (ESCRS 2005)

No MICS IOL (induction of astigmatism)

Big stiff haptics (danger of capsular rupture)

Silicone IOL (Siliconeoilendotamponade)

Reduced image quality: monotoric principle

no correction of aberration

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Acri.Smart 646 TLC - Technical Specifications

Material:	Acrylate with UV-blocking hydrophobe surface
Optics:	symmetric biconvex aspheric, bitoric
Optical diameter:	6,0 mm
Total diameter:	11,0 mm
Angle of haptics:	0^0
Edge:	sharp edge
Delivery range:	sph + 0,0 D to +32,0 D
	cyl +2,0 D to +12,0 D

The Bitoric Principal

The cylinder is symmetrically distributed on its anterior and posterior surface:

This results in the reduction of the radius distance between sphere and plus cylinders

Result: improved image quality even in high astigmatism

you name it, CZM produces it (no limits)

Just Pretending ?

Another yellow IOL statement

How can we proof this statement with scientific methods?

Quality of Vision Can Be Measured
Measurement of Modular Transfer Function - MTF

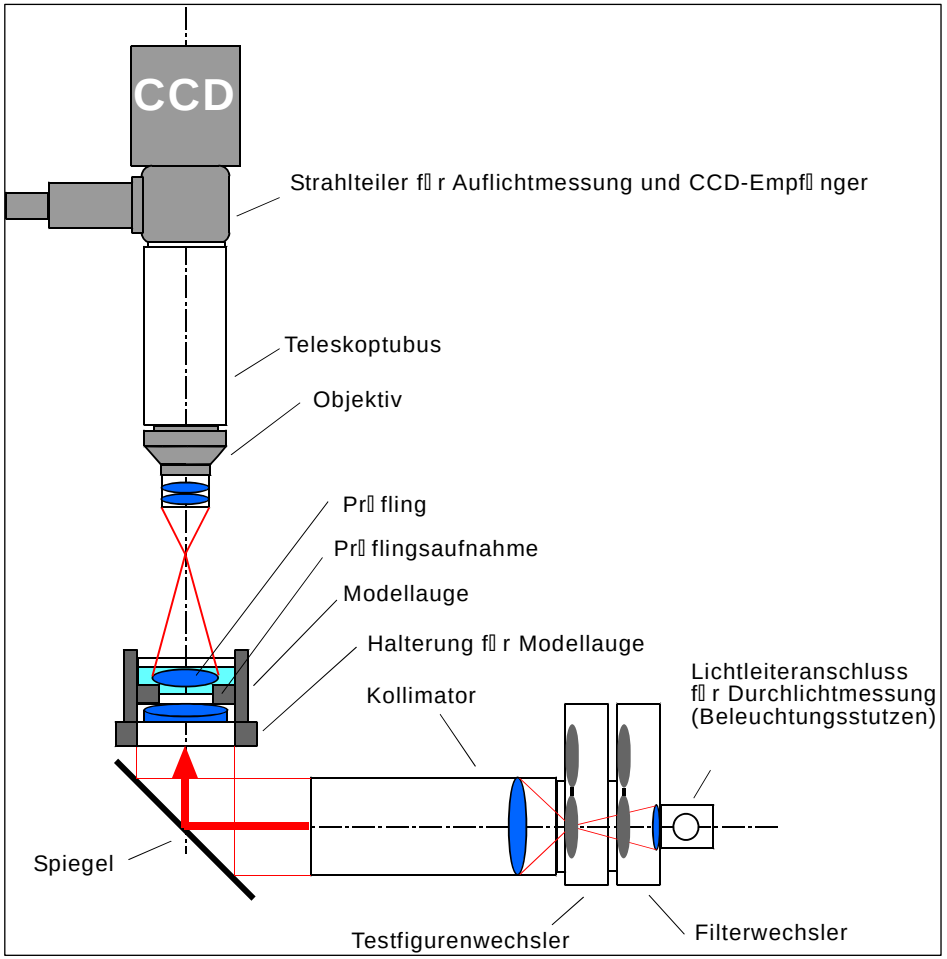
OptiSpheric Anlage

Schematic Portrayal

Light of a cold light source is turned into monochromatic light by a filter

Then directed through a pinhole onto a mirror and through an IOL of a model eye.

The resulting picture is captured by a CCD camera



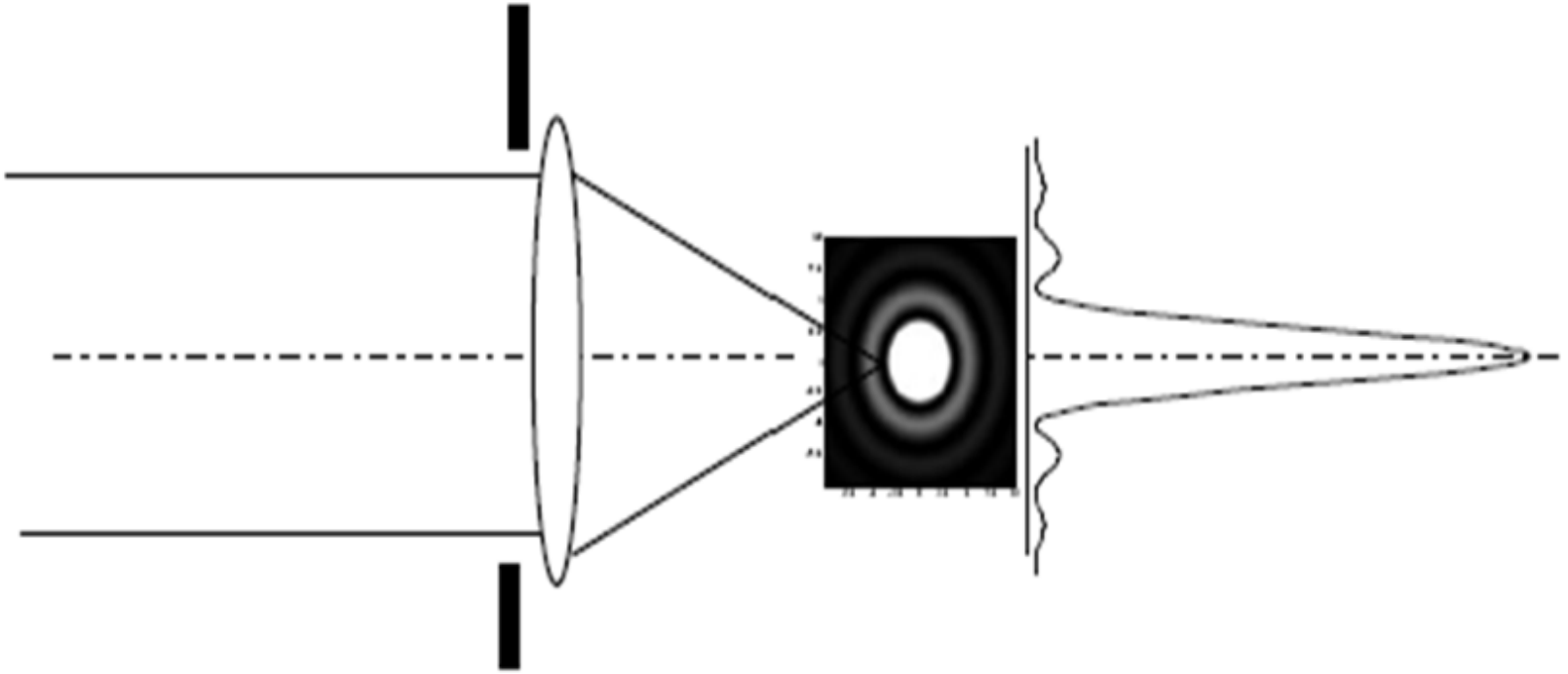
Schematischer Aufbau OptiSpheric nach Buschatz [1]

The CZM Quality Management

Every single IOL that is produced is going through that approval before being delivered to the surgeon !

Airy Disc – PSF - MTF

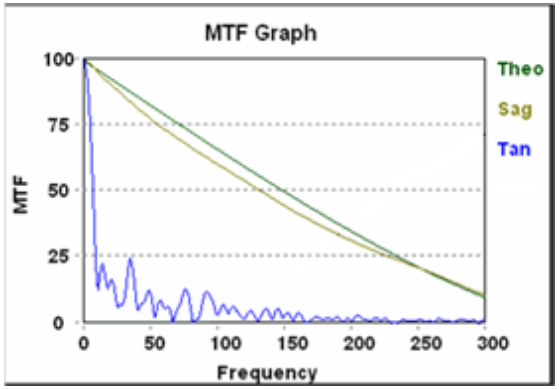
The **distribution of brightness** of the so called **Airy disc** is captured by the CCD camera and the **point spread function** (PSF) and the **modulation transfer function** (MTF) are calculated by the computer

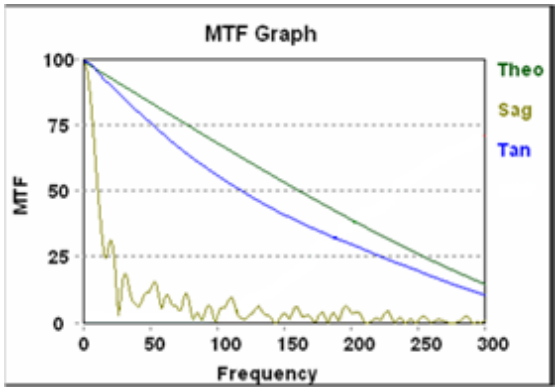


MTF of a monotoric IOL with different pinhole size

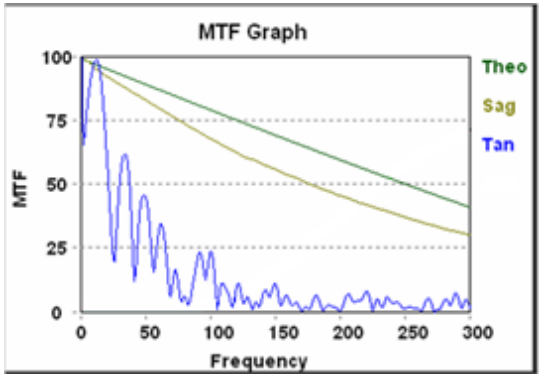
Monotoric IOL (+20.0 sphere +6.0 cylinder)

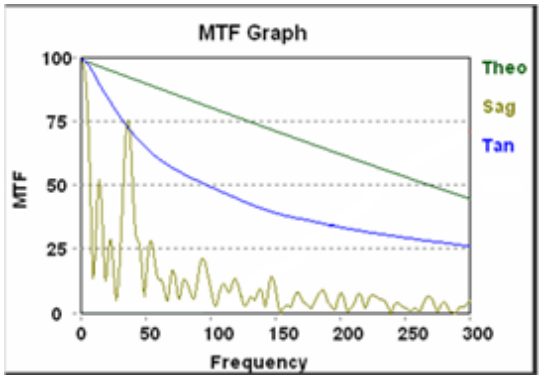
3 mm pinhole





5mm pinhole





Theo (green line) = theoretical optimal MTF
Sag and Tan = focus intersections of toric IOL

MTF of a bitoric IOL with different pinhole size

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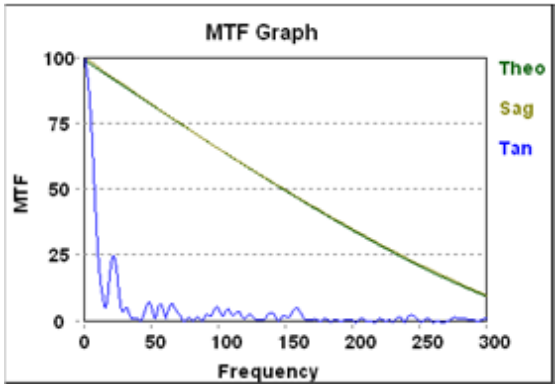
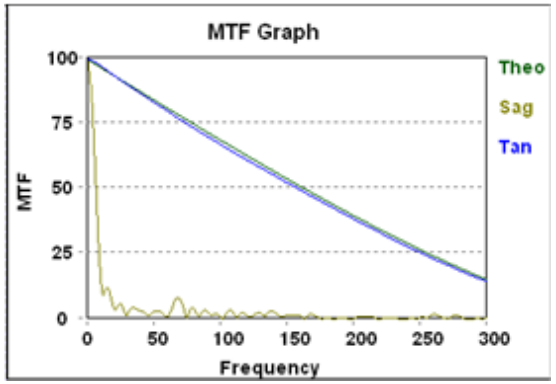
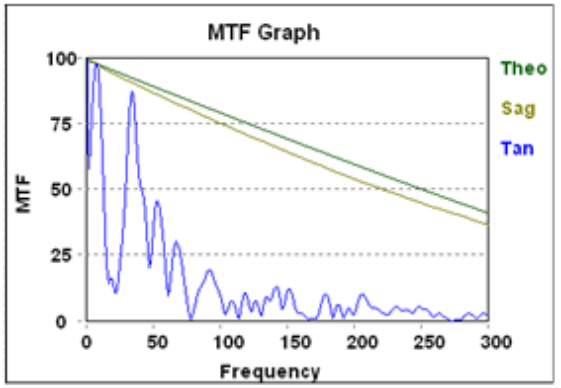
Bitoric IOL (+20.0 sphere +6.0 cylinder)

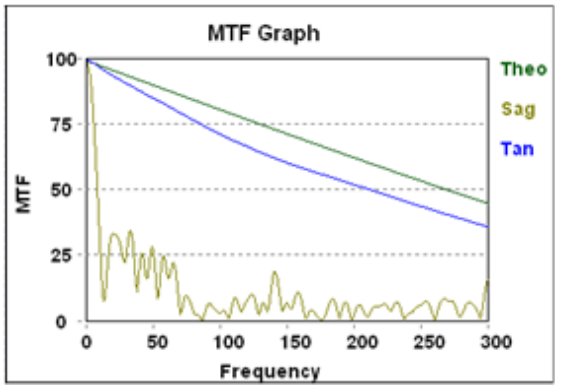
3 mm pinhole





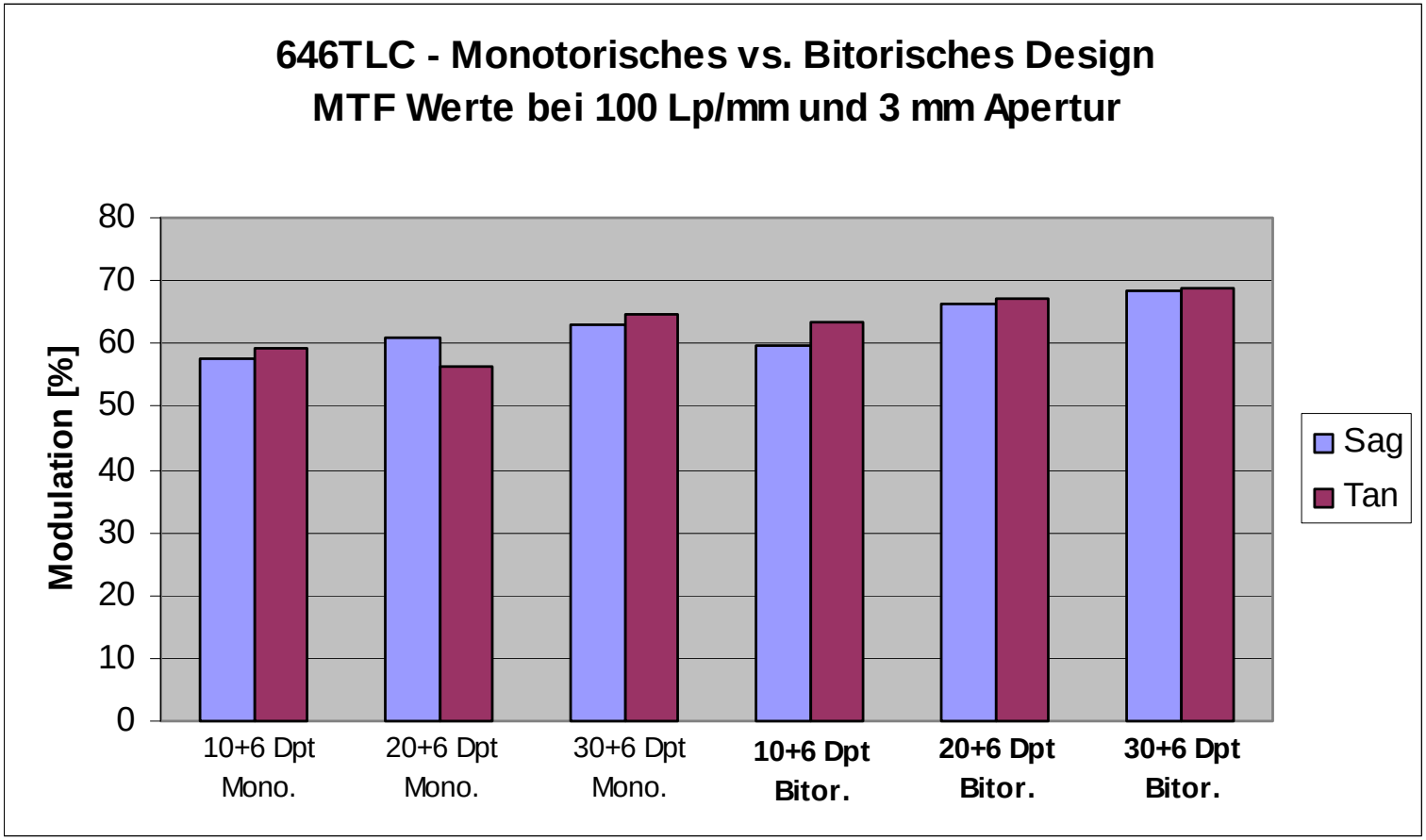
5mm pinhole



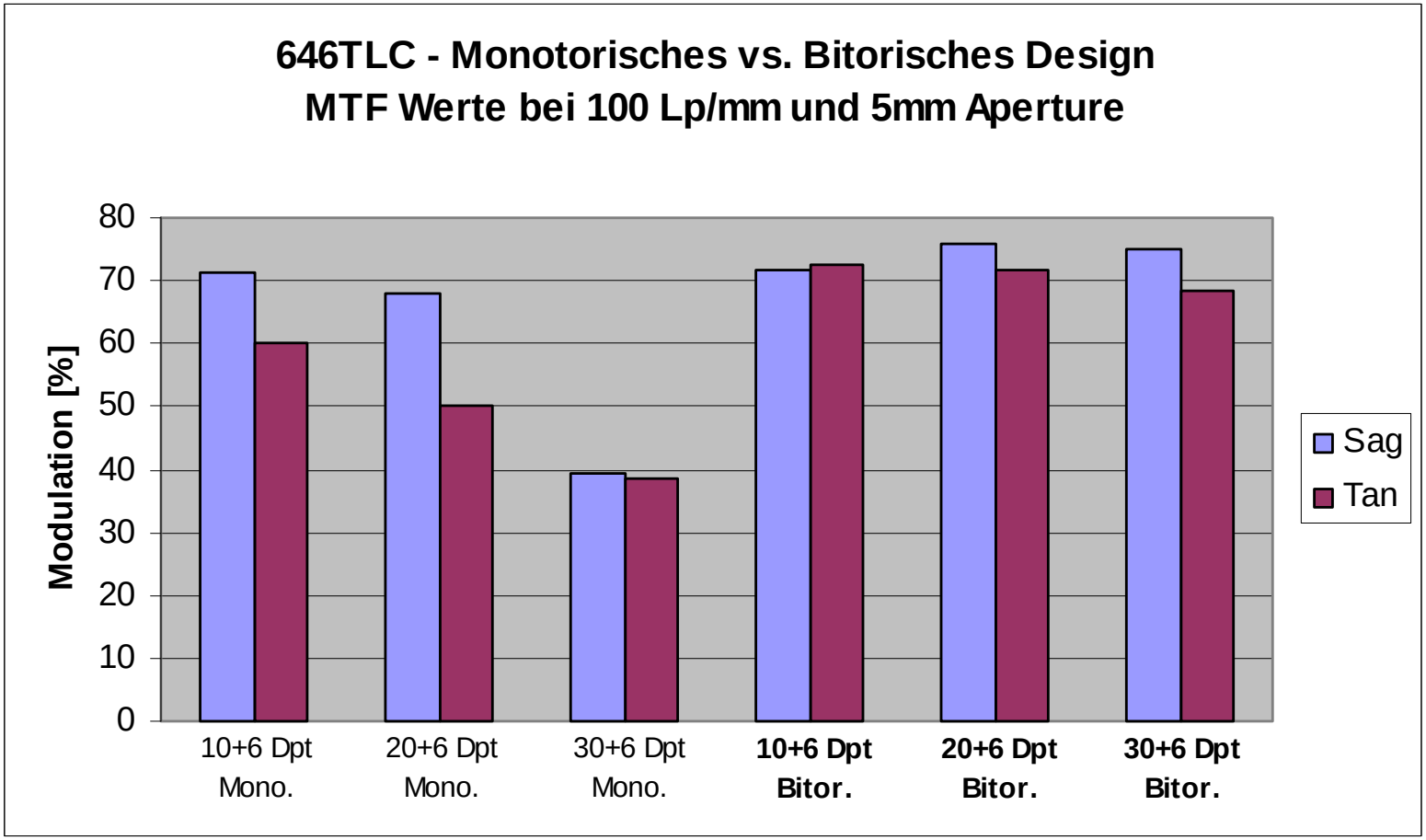


Theo (green line) = theoretical optimal MTF
Sag and Tan = focus intersections of toric IOL

MTF Monotoric v. Bitoric Design, Different Diopters, 3mm



MTF Monotoric v. Bitoric Design, Different Diopters, 5mm

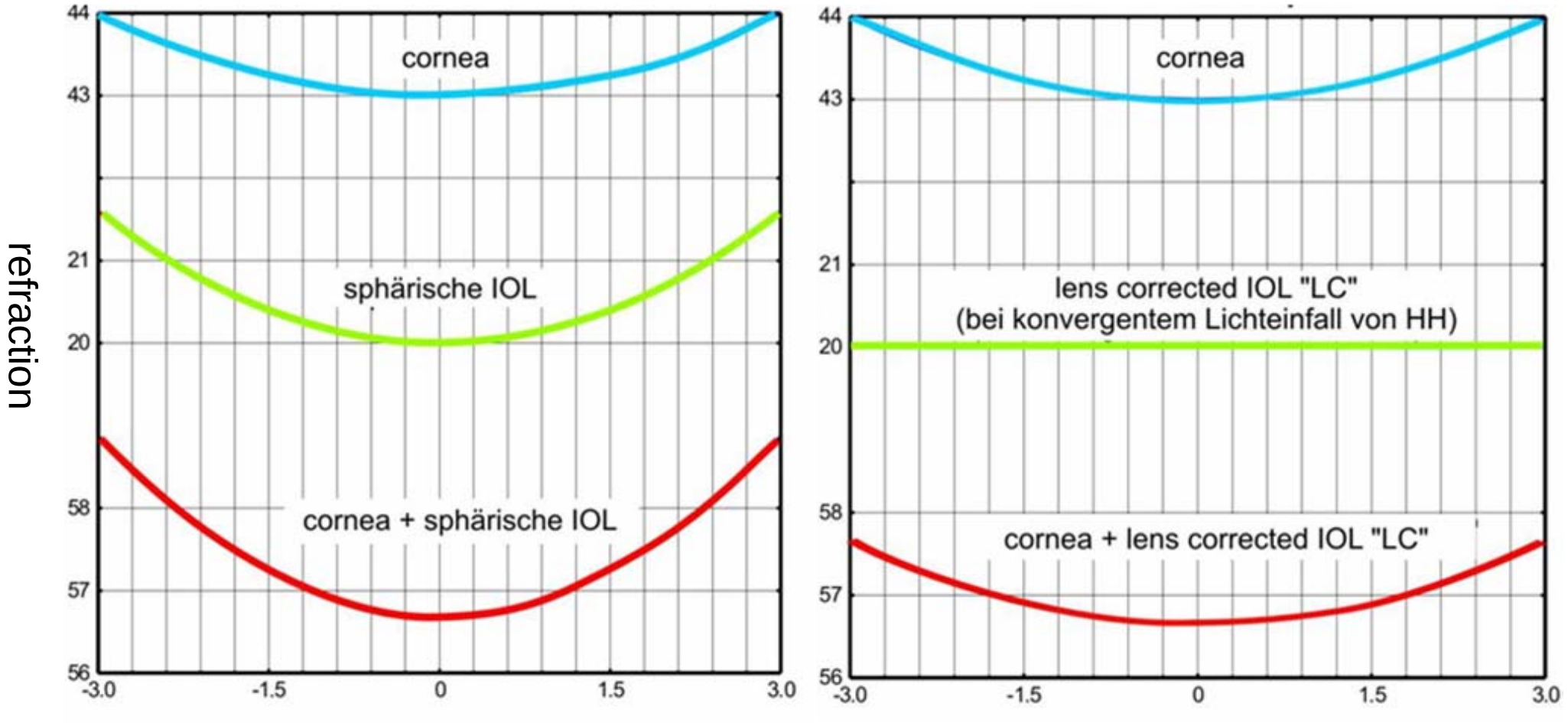


The advantage of the bitoric optic becomes more dominant at larger apertures

Aspheric = Aberration corrected IOL

spheric optic

lens corrected optic



Injection of the IOL with Cartridge and Injector

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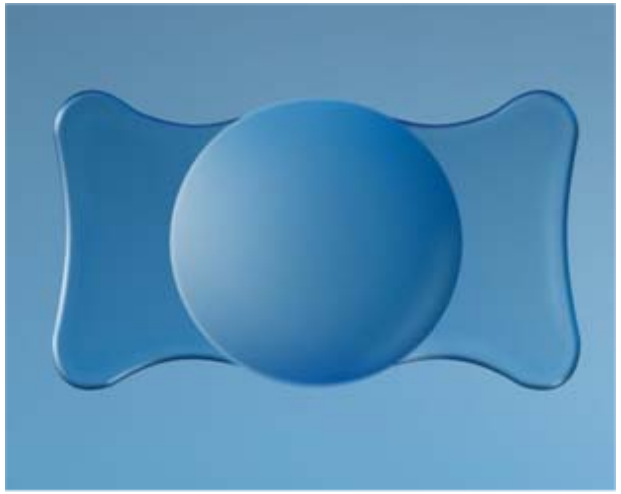
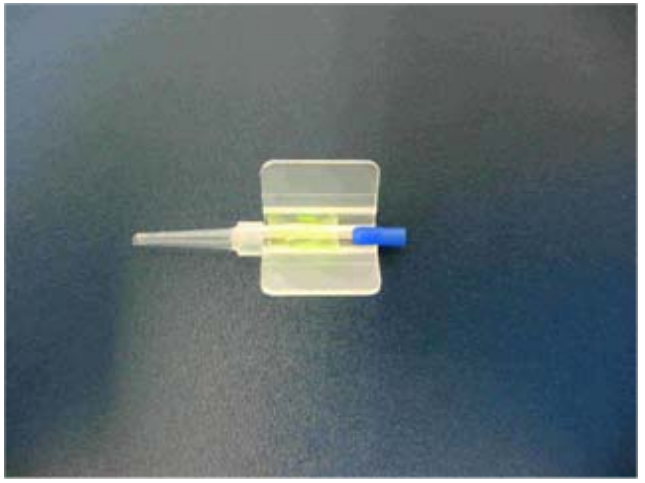
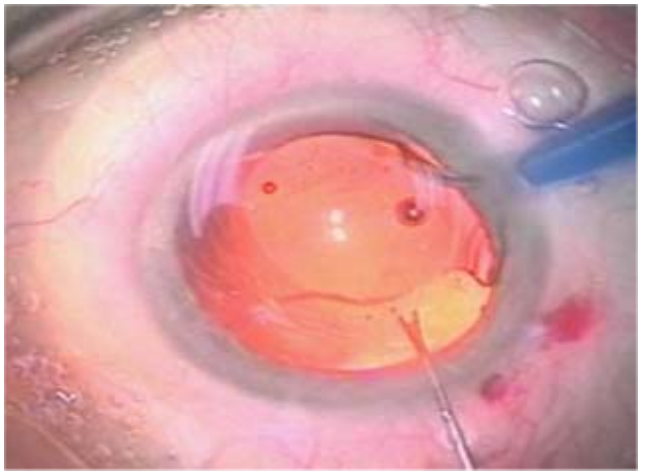
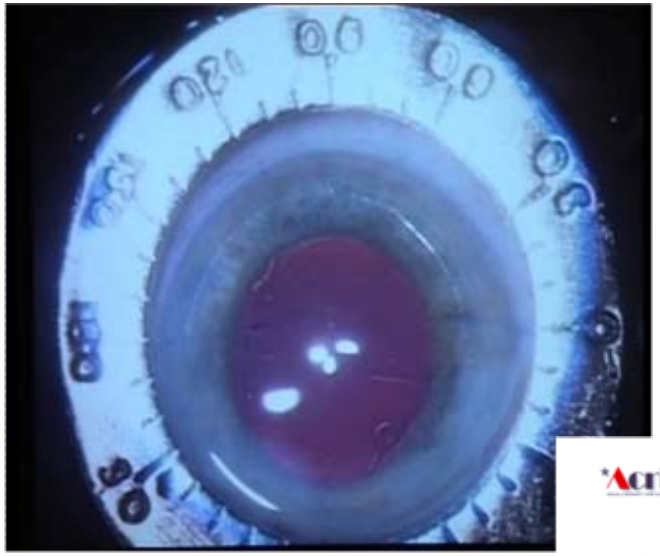
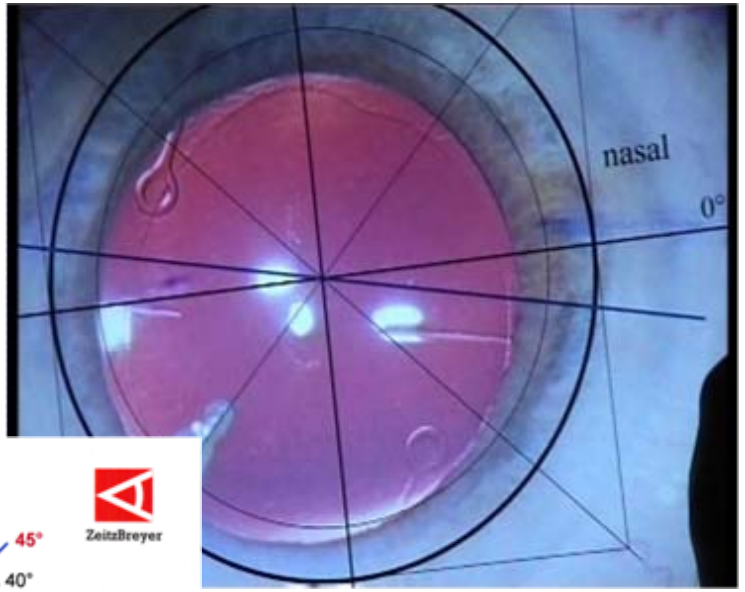


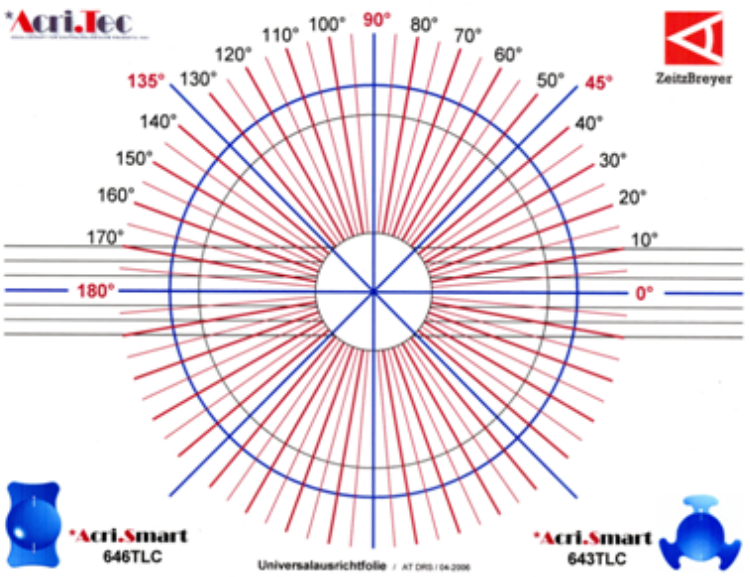




Optimized Position of the Bitoric IOL (DOC & ESCRS 2005)
Comparison Monitor Foil - Mendez Ring

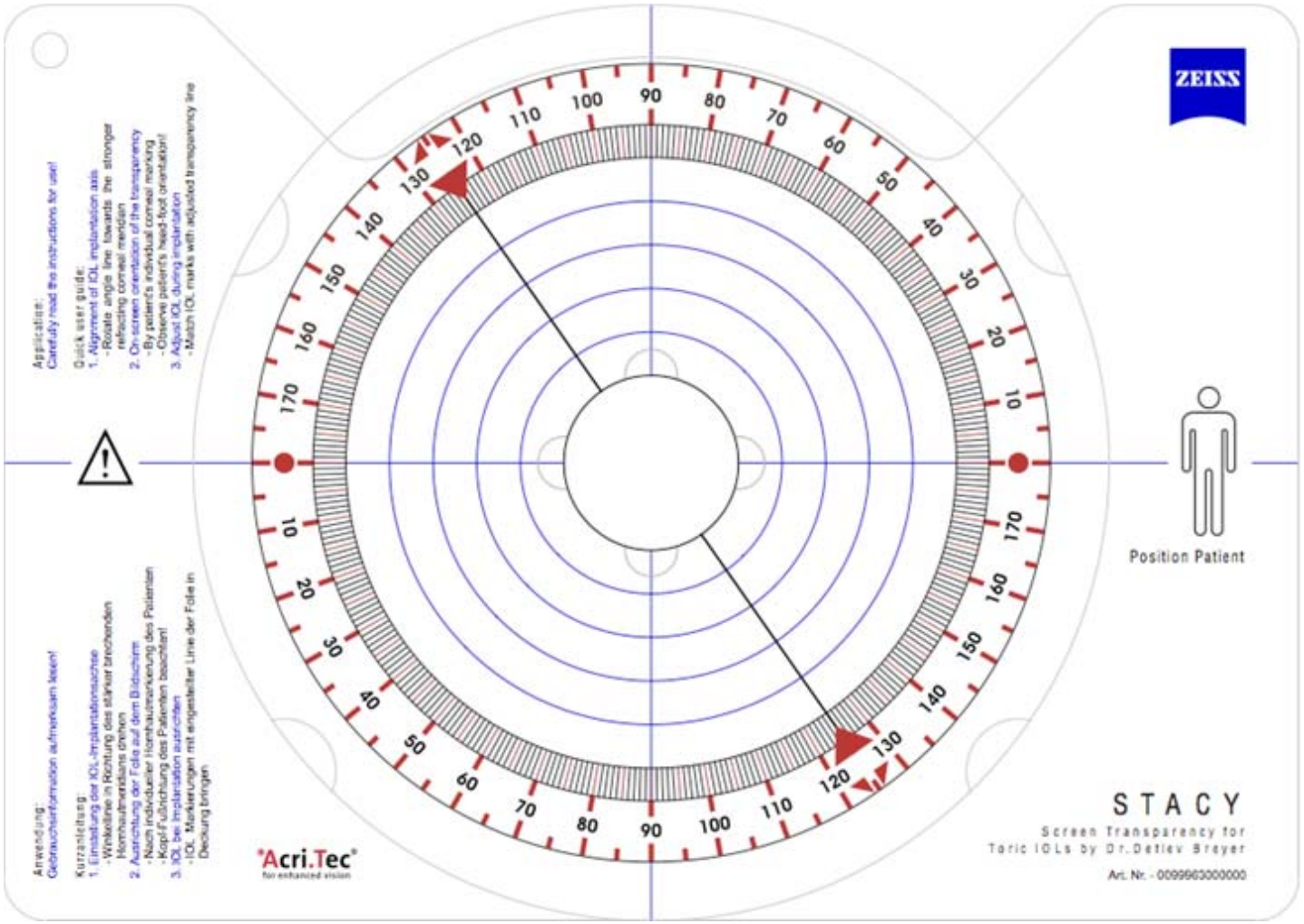






STACY - Screen Transparency for Toric IOL

Emmel, Breyer DOC 2006



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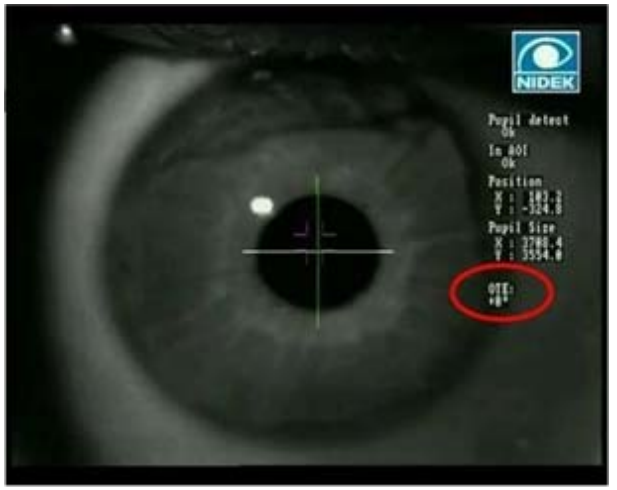
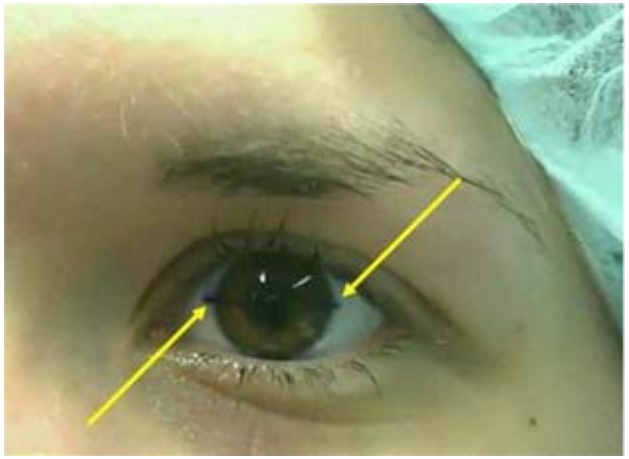
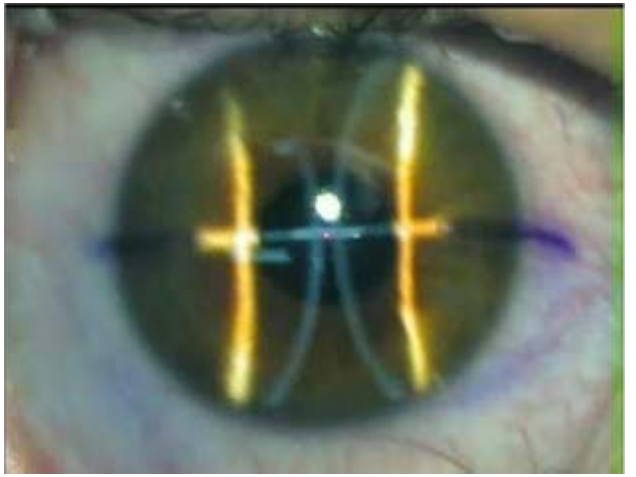
Marking With Gerten Plumb Marker - ON 05/08

„...the plumb marker is a precise and reliable surgical tool...“







Original photographs courtesy to Dr. Gerten

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Rejection of an Old Bias on Plate Haptic Design
Rotational stability proven

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DOC 2005

Wehner – Nürnberg
„…absolute rotational stability of all IOL after one year…“

ESCRS 2006

Menapace - Vienna and Breyer - Düsseldorf
„ ....same results...“

!!! Do not make the mistake and compare this highly stable acrylate IOL with the historic Staar silicone toric IOL wich disappeared in the vitreous after YAG Capsulotomy !!!!

A High Quality Toric IOL Requires MICS Surgery

If we spend so much time and effort on evaluation of preoperative data and IOL production, these data should be one by one transferred into our OR

i.e.

We need atigmatism neutral incisions !

Monomanual CO-MICS or Bimanual Sleeveless MICS ?

Bimanual MICS Problems

incision too wide: no sleeve phaco

➡ intraoperative leakage

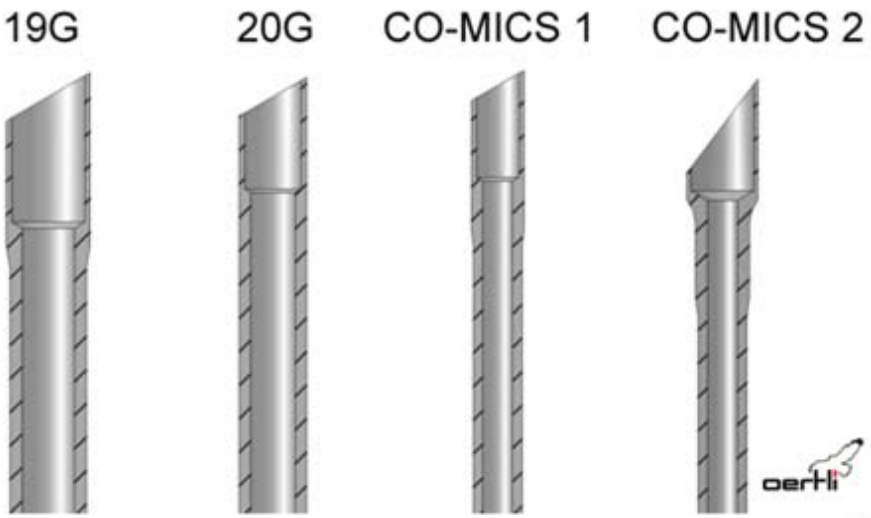
incision too tight: irreversible stretching of collagen fibers

➡ postoperative leakage

Obvious solution: coaxial phaco with sleeve

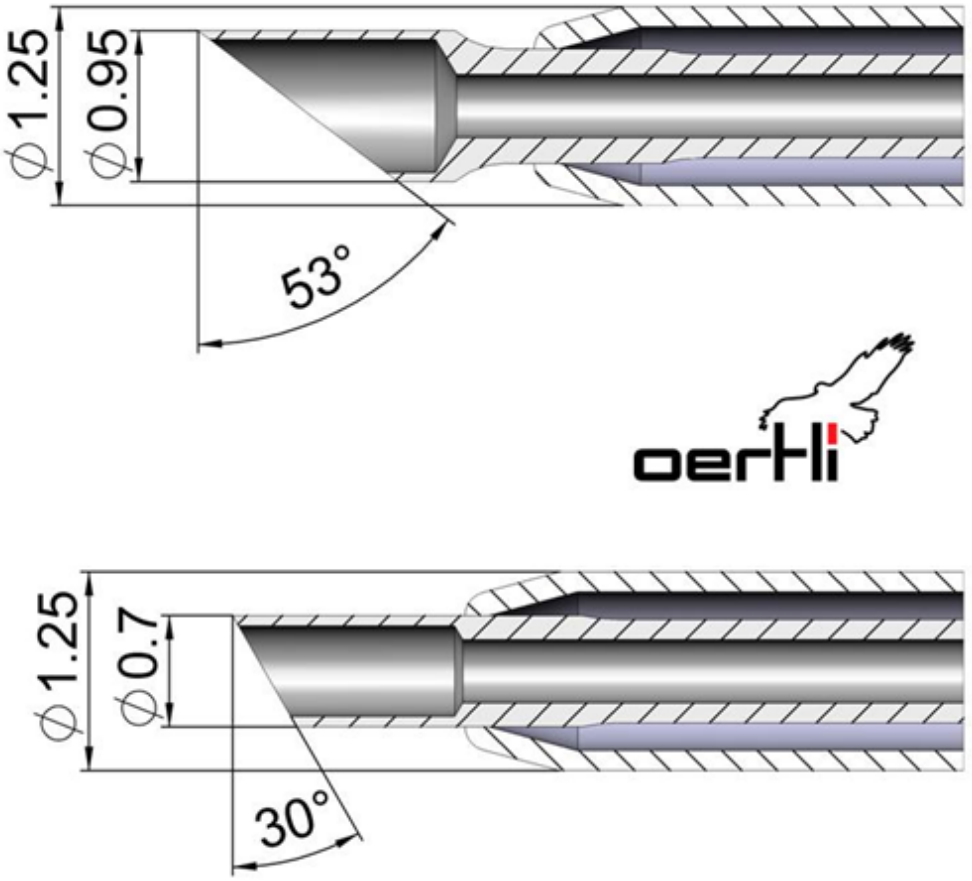
➡ no leakage & quiet fluidics

Monomanual Coaxial Microincision Cataract Surgery



Graphics courtesy of Oertli

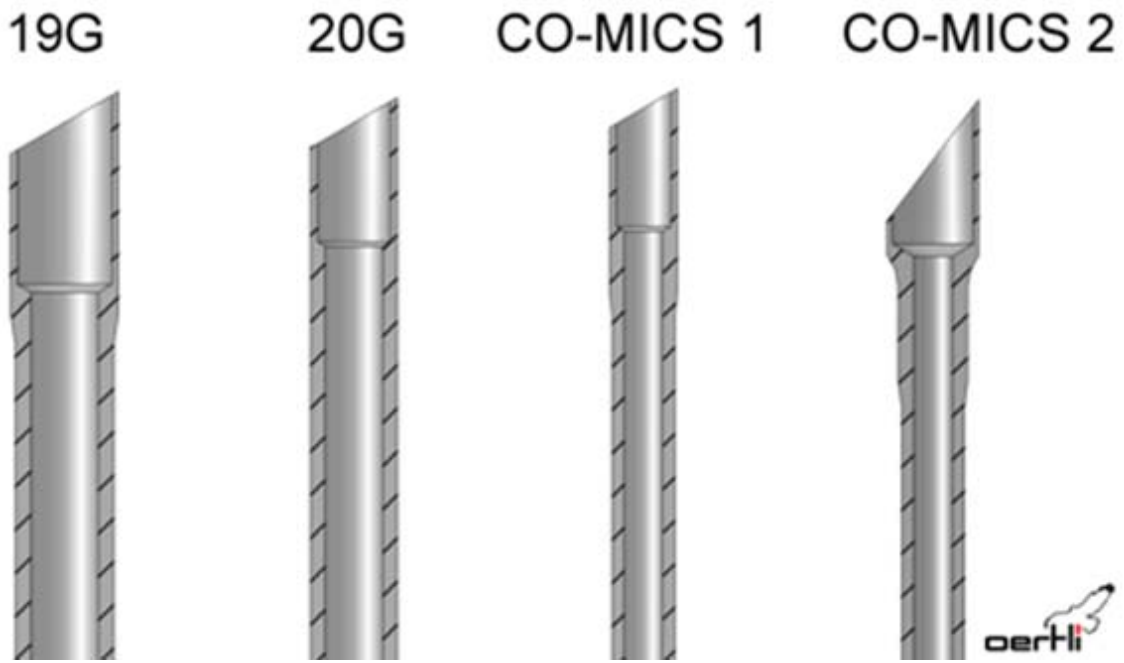
CO-MICS Tip Geometry Evolution



Graphics courtesy of Oertli

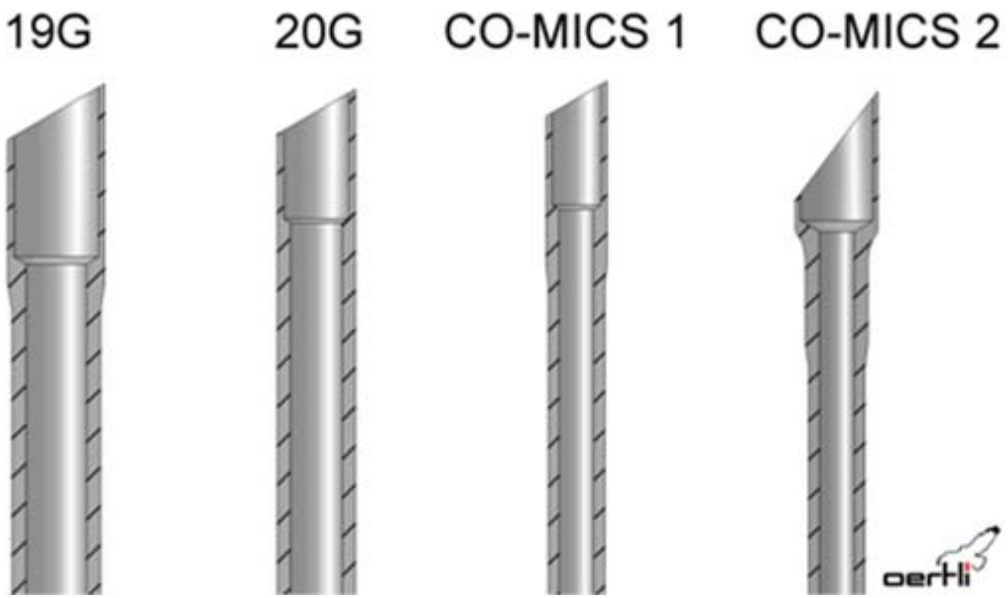
Emulsification Power

Phaco tip	Design	Incision Size	Emulsification power
19G	Traditional	2.8 mm	100%
20G	Traditional	2.2 mm	54%
CO-MICS	Traditional	1.6 mm	29%
CO-MICS 2	Smart	1.6 mm	146%



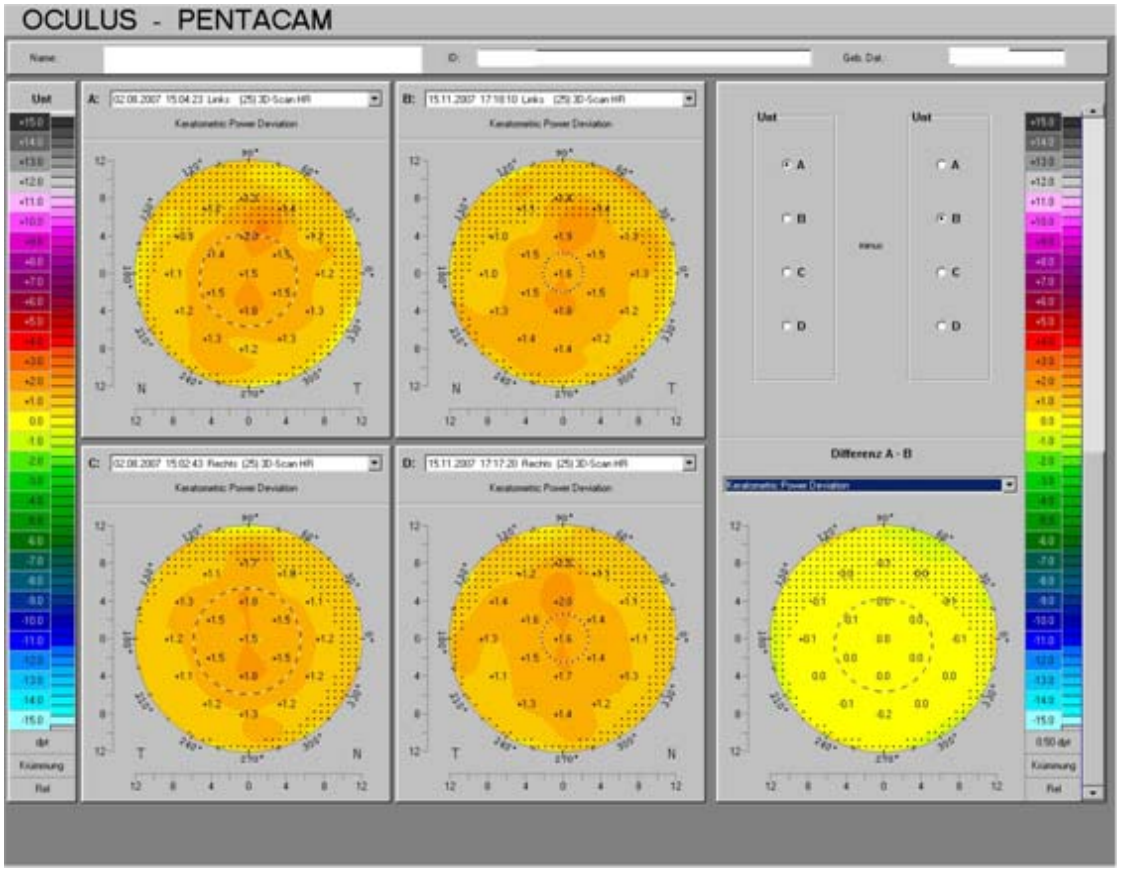
Holdability

Phaco tip	Design	Incision Size	Holdability
19G	Traditional	2.8 mm	100%
20G	Traditional	2.2 mm	59%
CO-MICS	Traditional	1.6 mm	34%
CO-MICS 2	Smart	1.6 mm	106%



Results - Videokeratography

No surgically induced astigmatism with CO-MICS
(see studies by R. Menapace)

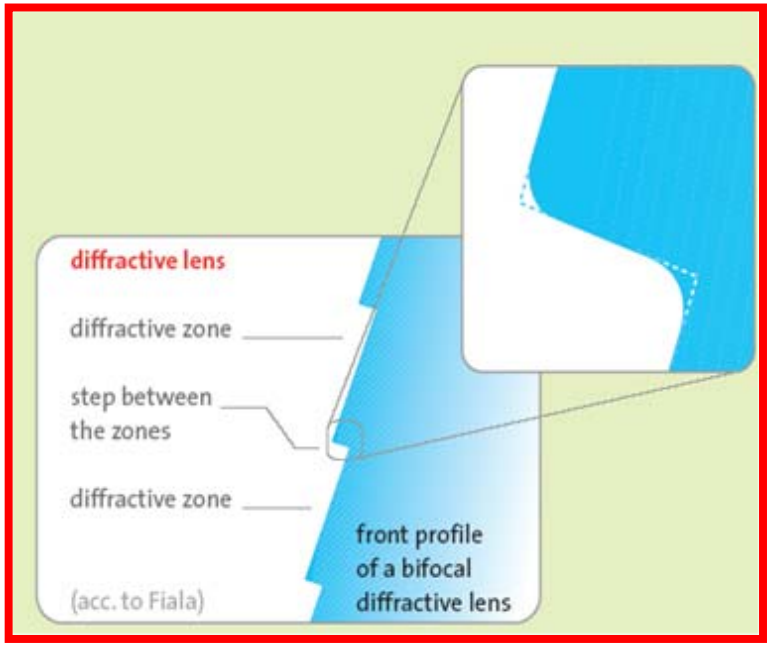


Next Revolutionary Step: Toric MIOL

Encouraged by excellent results and happy patients with the toric and multifocal IOL of the CZM Smart Family the development of a toric MIOL was a logic consequence

Background

Acri.LISA results: very promising:

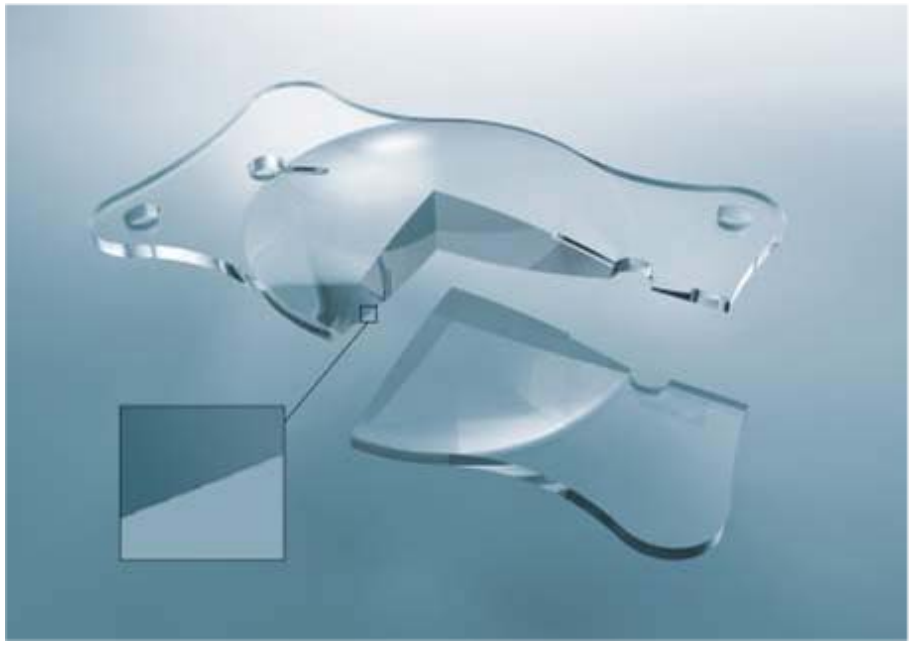


best intermediate vision, very good contrast vision, less light scattering,

high patient satisfaction !

(Aggarwal, Alio, Author, Mester, Pietrini, Zaldivar)

Unique: The Queen of IOL: Acri.LISA TD: Toric MIOL

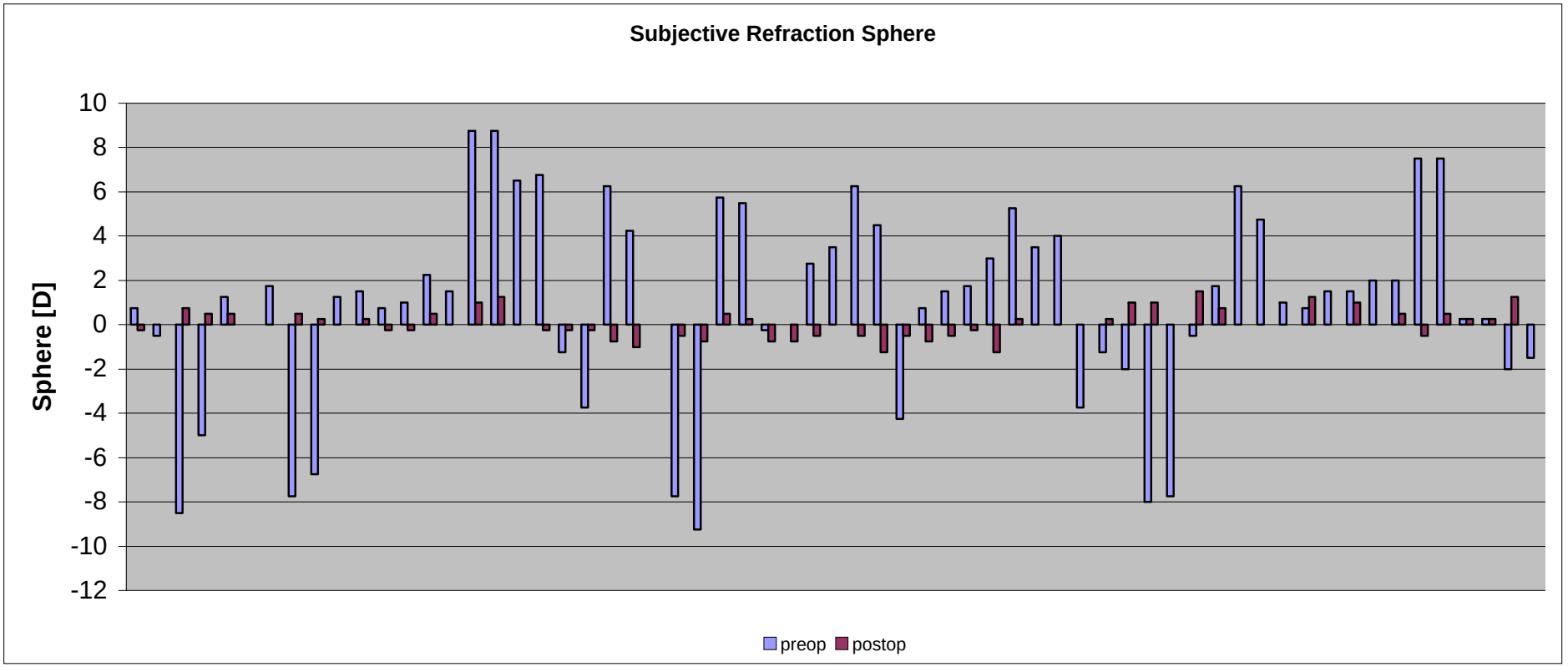


Front face toric
Back surface bifocal
Pupil independence
Light allocation 65:35
Light intensity refractive distant focus 65%,
Light intensity diffractive near focus 35%
Near addition: + 3,75 dpt
MICS-Technology:
an incisionwidth of only 1,5 mm allows an astigmatism neutral operation

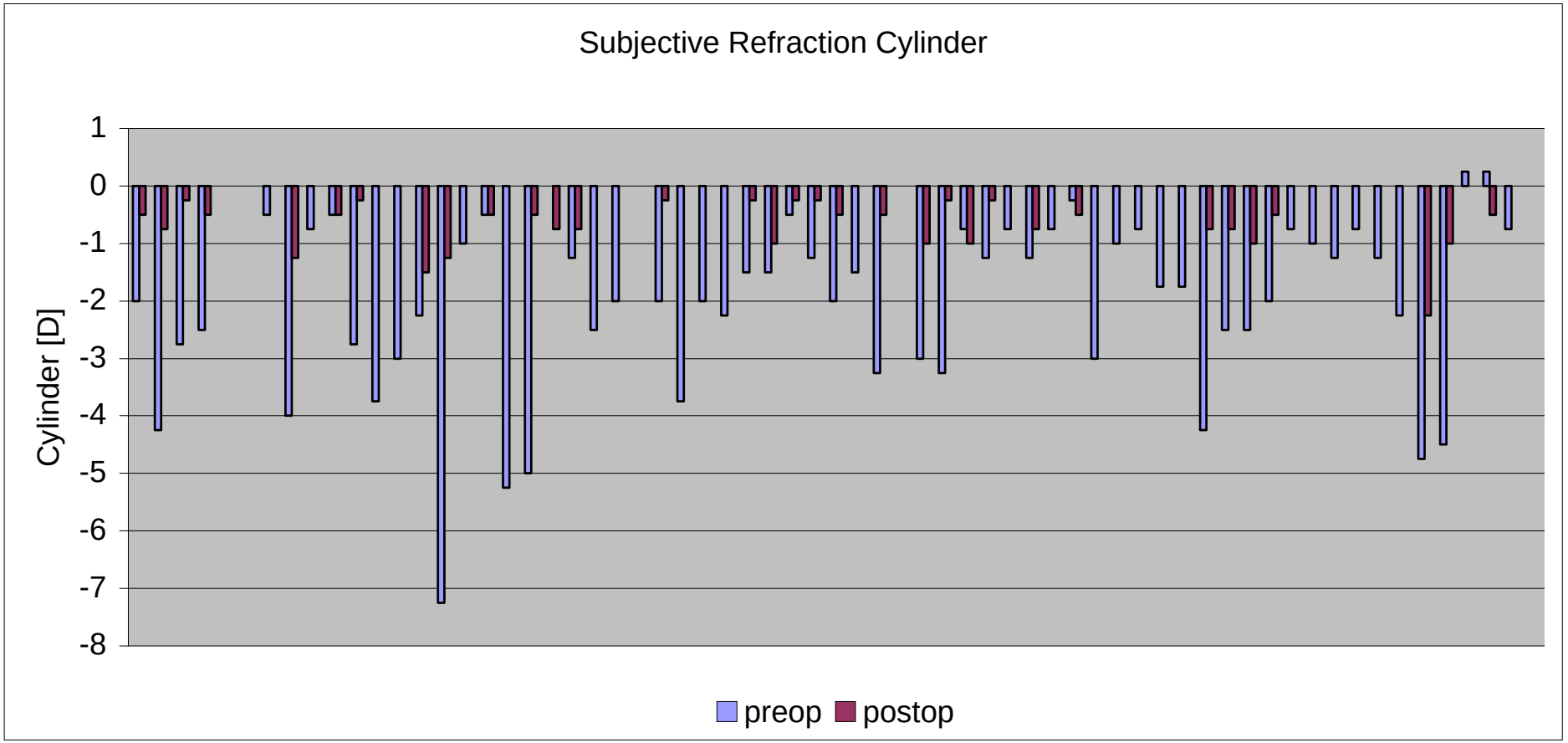
First Implantations - Toric MIOL

Wolff und Breyer	December 2007
Wolff in ON:	„...very precise, promising results...“
Breyer ASCRS 2008	CO-MICS and toric Acri.LISA first study results

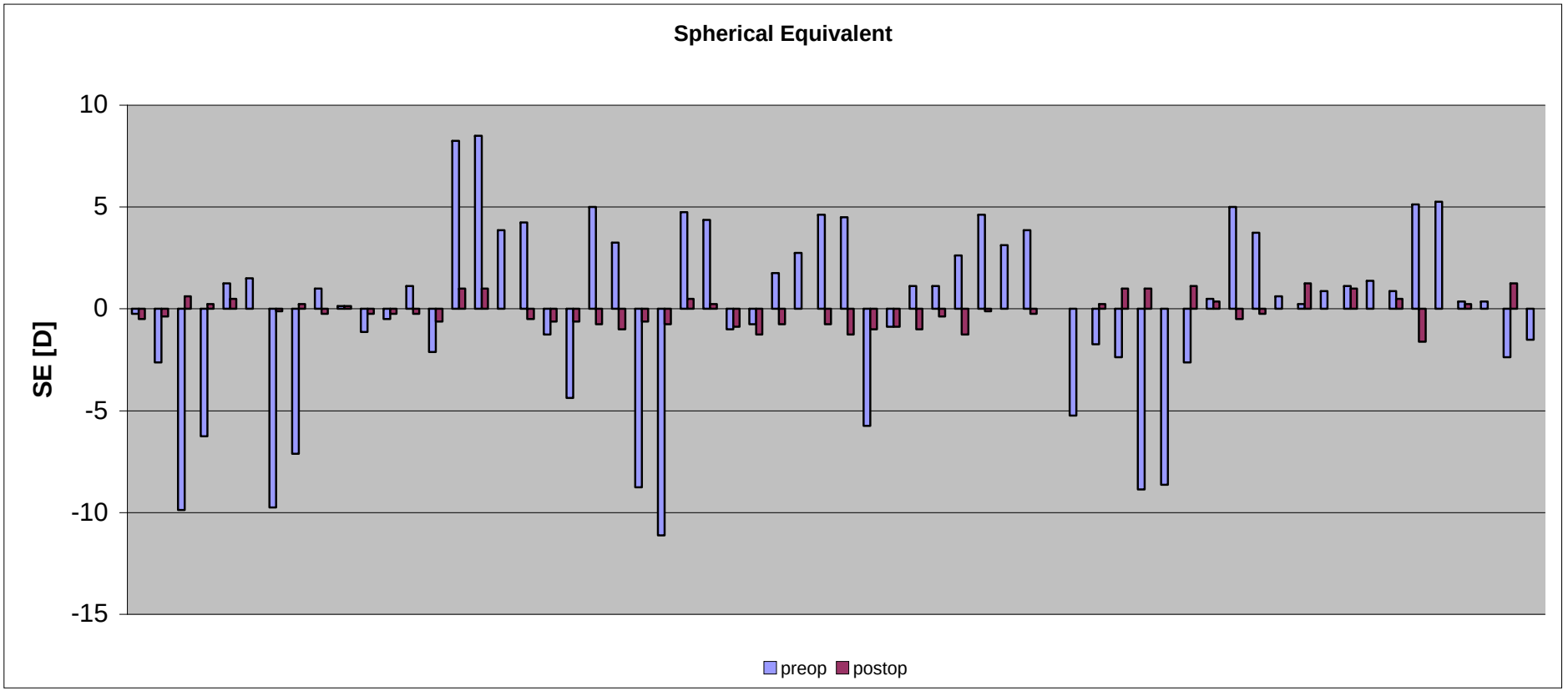
Preop. Vs. Postop Refraction Sphere



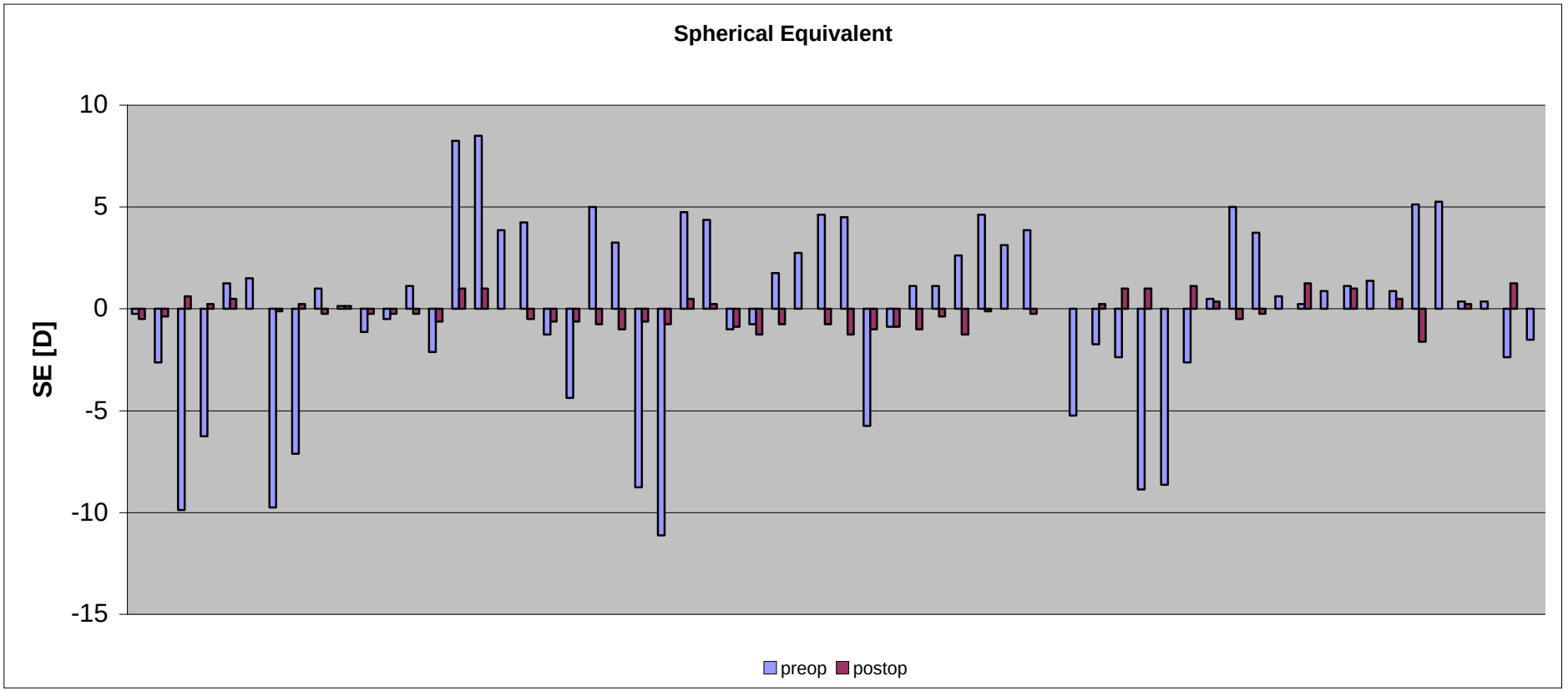
Preop. Vs. Postop. Cylinder



Spherical Equivalent



Spherical Equivalent



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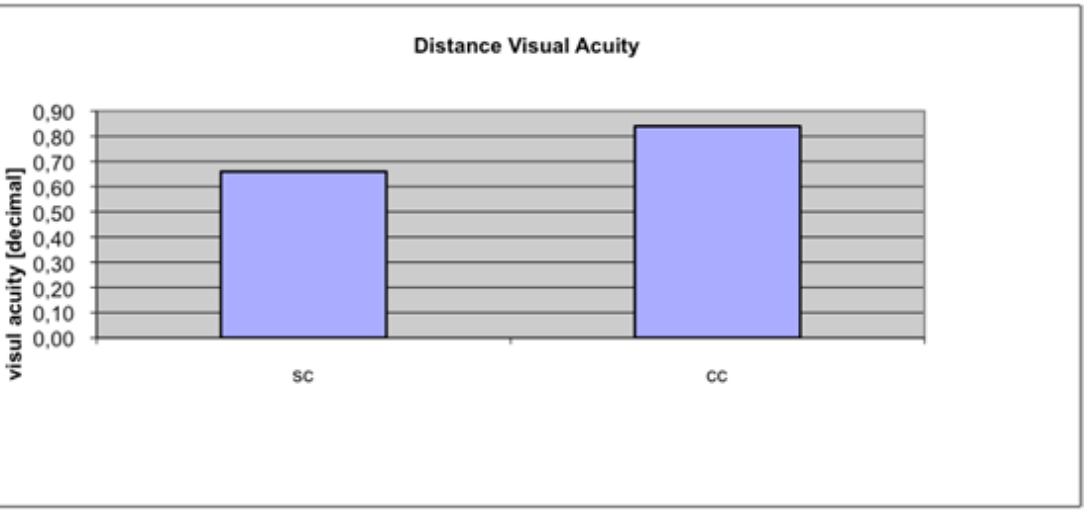
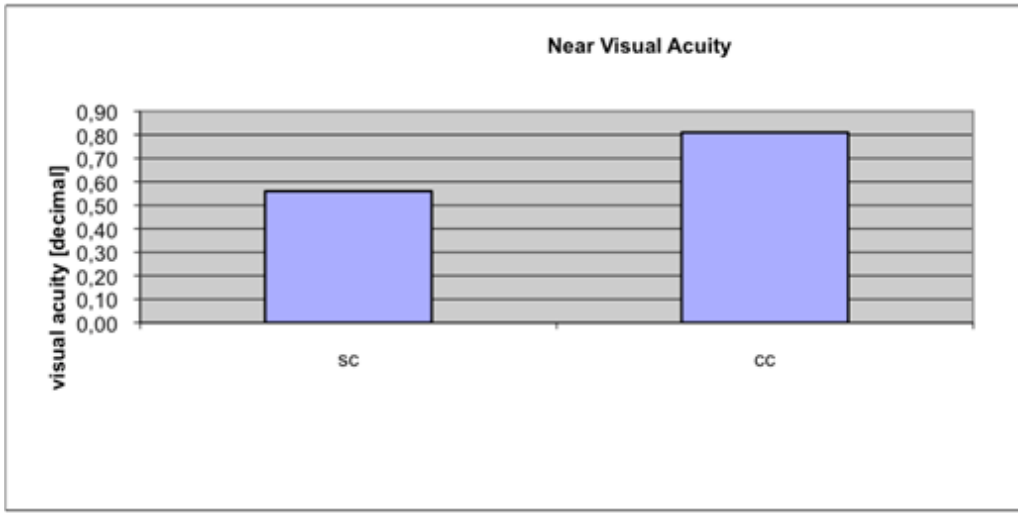
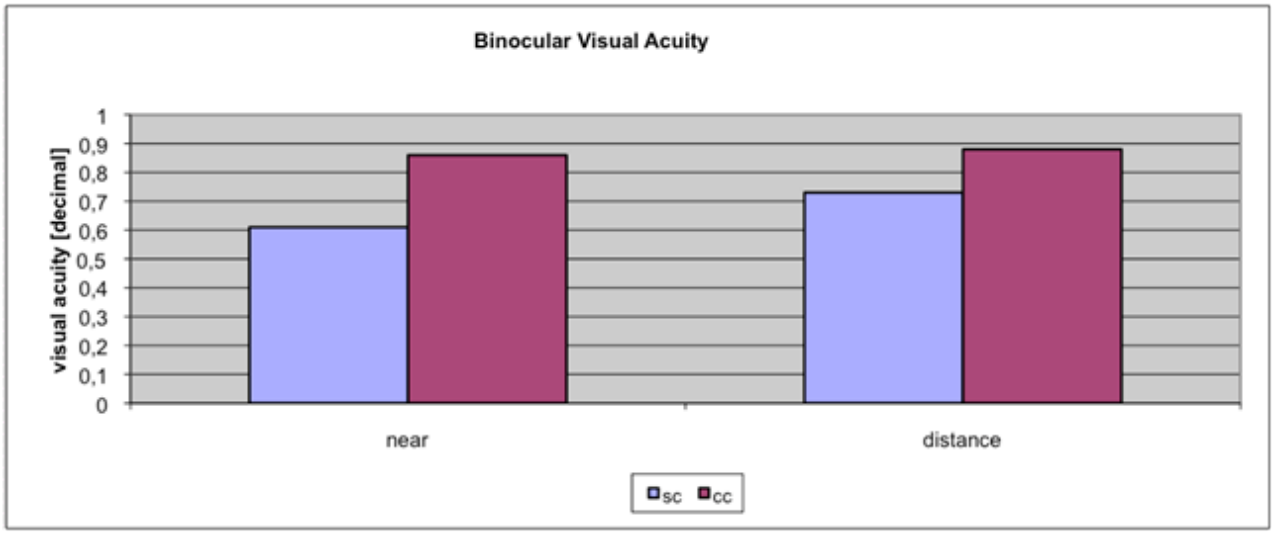
Visual Acuity, n = 78







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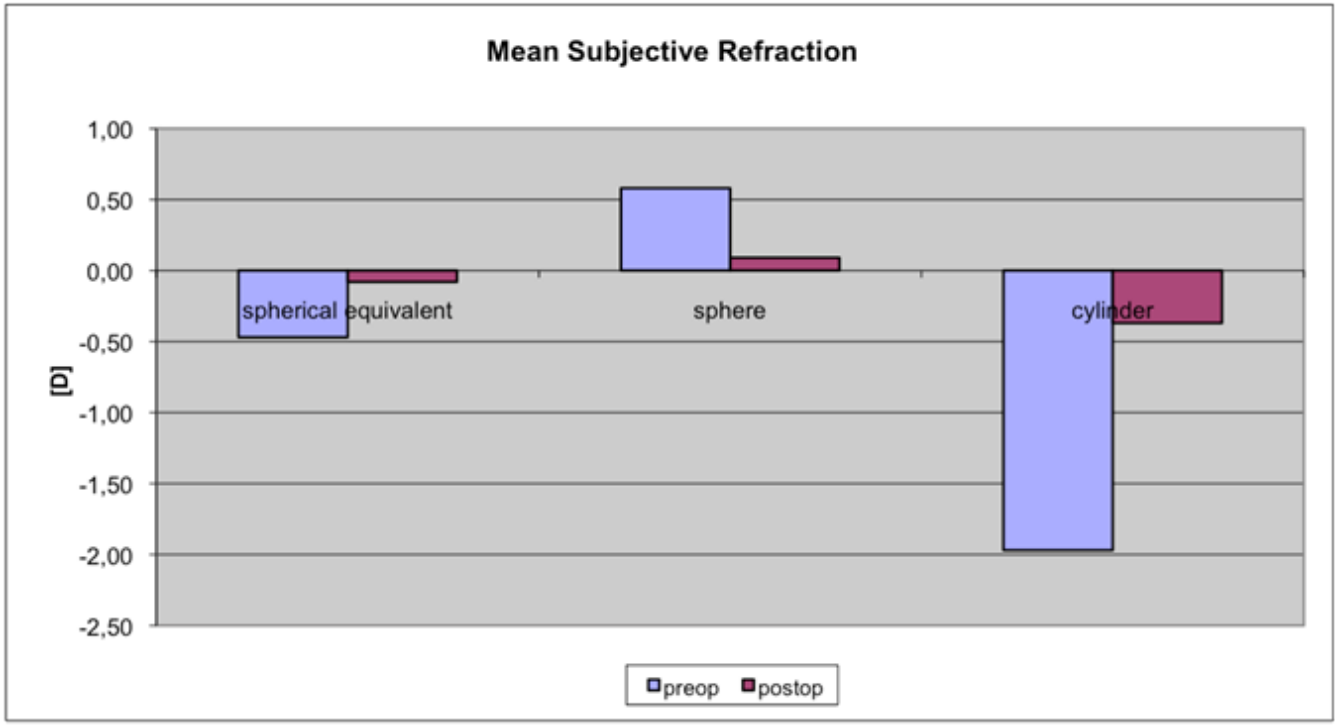
Mean Subjektive Refraction, n = 78



Conclusion

The CO-MICS procedure avoids any surgically induced astigmatism

The objective measurements and especially the subjective patient statements are very satisfying and promising

By using the Acri.Lisa TD one can avoid a bioptic procedure in patients with higher astigmatism and the wish for bifocal IOL

CO-MICS and the Acri.Lisa TD are a perfect match in phacorefractive surgery

Standardized Quality managment reliable online calculation methods and documentation (Z CALC) and live alignment methods (Z ALIGN) are developed and in clinical trial for even better refractive outcomes

After The Pioneer Work:
Improvement of Workflow and Standardization (QM)

Improvement of workflow:	Z CALC:	online calculation program
Improvement of standardization:	Z ALIGN:	live video IOL orientation

Thank You....

Very much for your kind attention !

„All truths are easy to understand once they are discovered; the point is to discover them“
Galileo Galilei

„A discovery is said to be an accident meeting a prepared mind“
Albert Szent-Gyorgyi