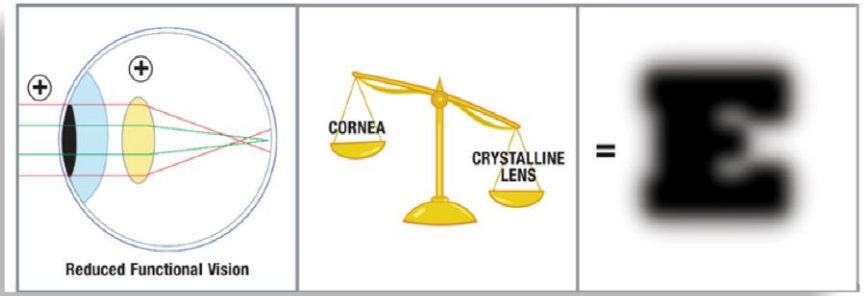
Aspheric Intraocular Lens

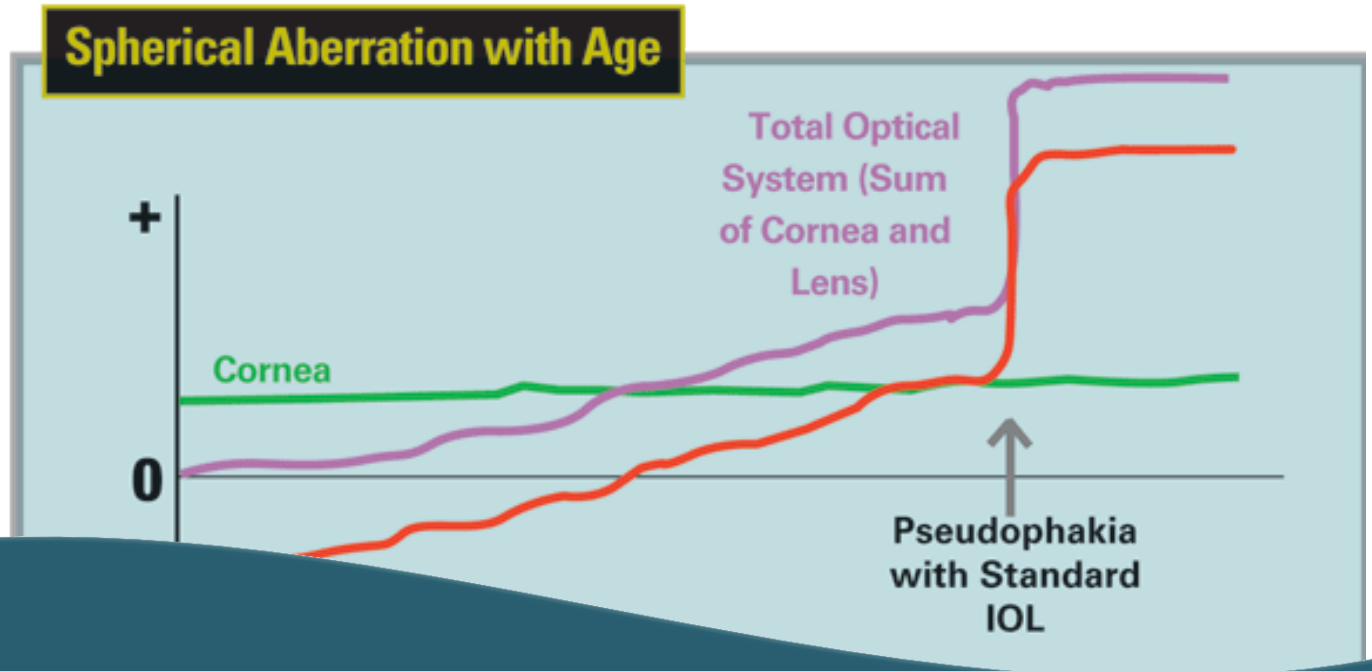
- As the eye ages, optical quality worsens
- The young eye has zero spherical aberration

- With age, spherical aberration increases reducing functional vision



The shift in the spherical aberration of the lens toward less negative or even positive values, combined with the positive corneal spherical aberration, implies a decrease in ocular optical quality with age

J Cataract Refract Surg 2009; 35:172–181

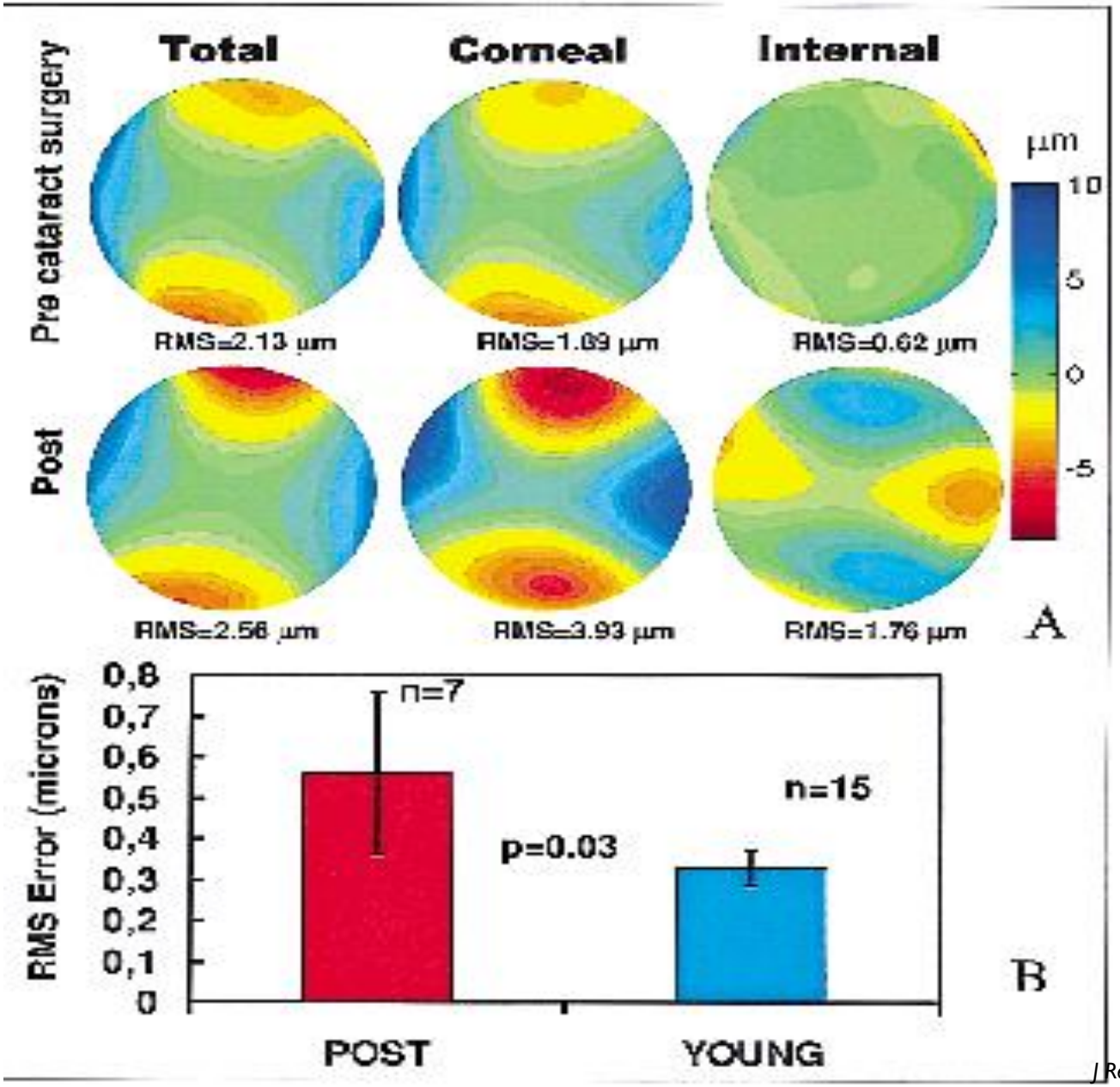


Spherical aberration increases in patients implanted with spherical IOLs (0.20 µm more on average than in young eyes)

aberrati...

http://www.revophth.com/content/d/cover_focus/i/1220/c/22982/
J Refract Surg. 2005;21:1-13

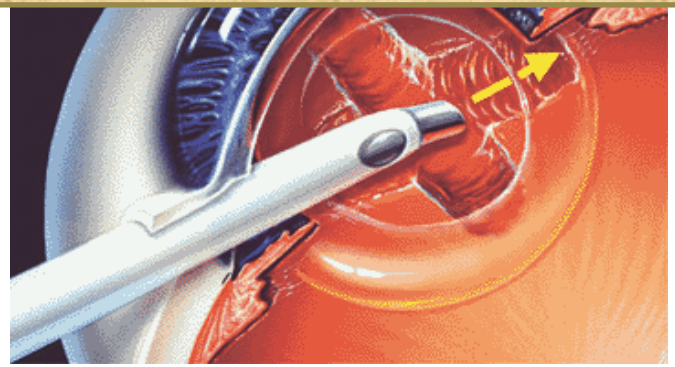
Example of total, corneal, and internal wave aberrations before and after cataract surgery (phacoemulsification) and IOL implantation



J Refract Surg 2002;18:1-8

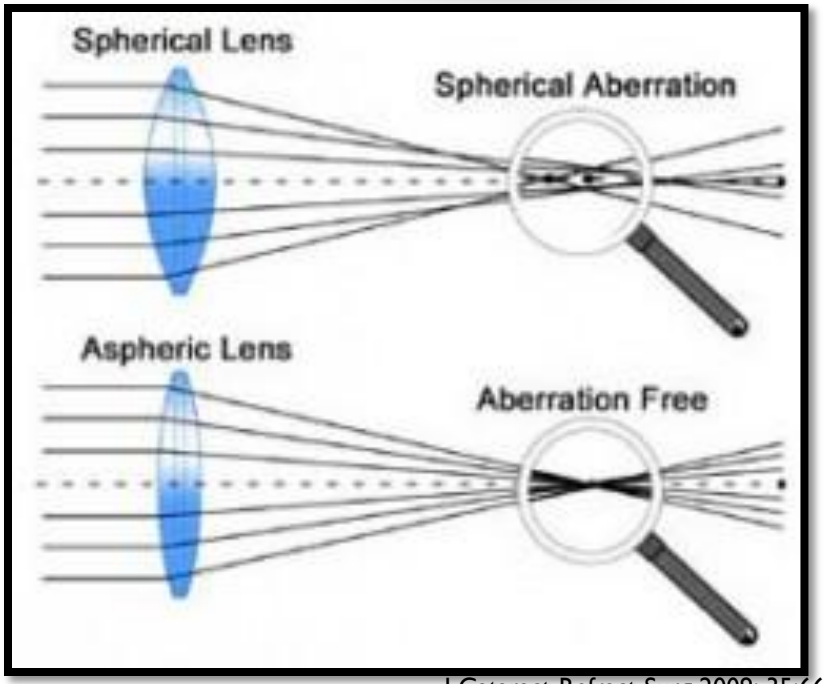
- Today, **the goal of cataract surgery is not only to restore visual acuity but also to provide the best visual quality to patients**

Best optical quality is obtained if the entire amount of spherical aberration is corrected



J Cataract Refract Surg 2009; 35:172–181

Aspheric IOLs were designed to correct for the spherical aberration of the cornea

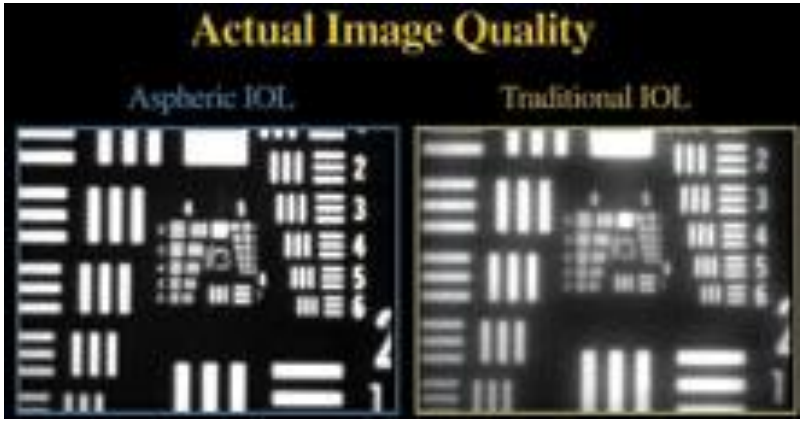


J Cataract Refract Surg 2009; 35:663–671
J Cataract Refract Surg 2009; 35:172–181
http://www.lenstec.com/information/product-features/spherical-aberration/

IOLs

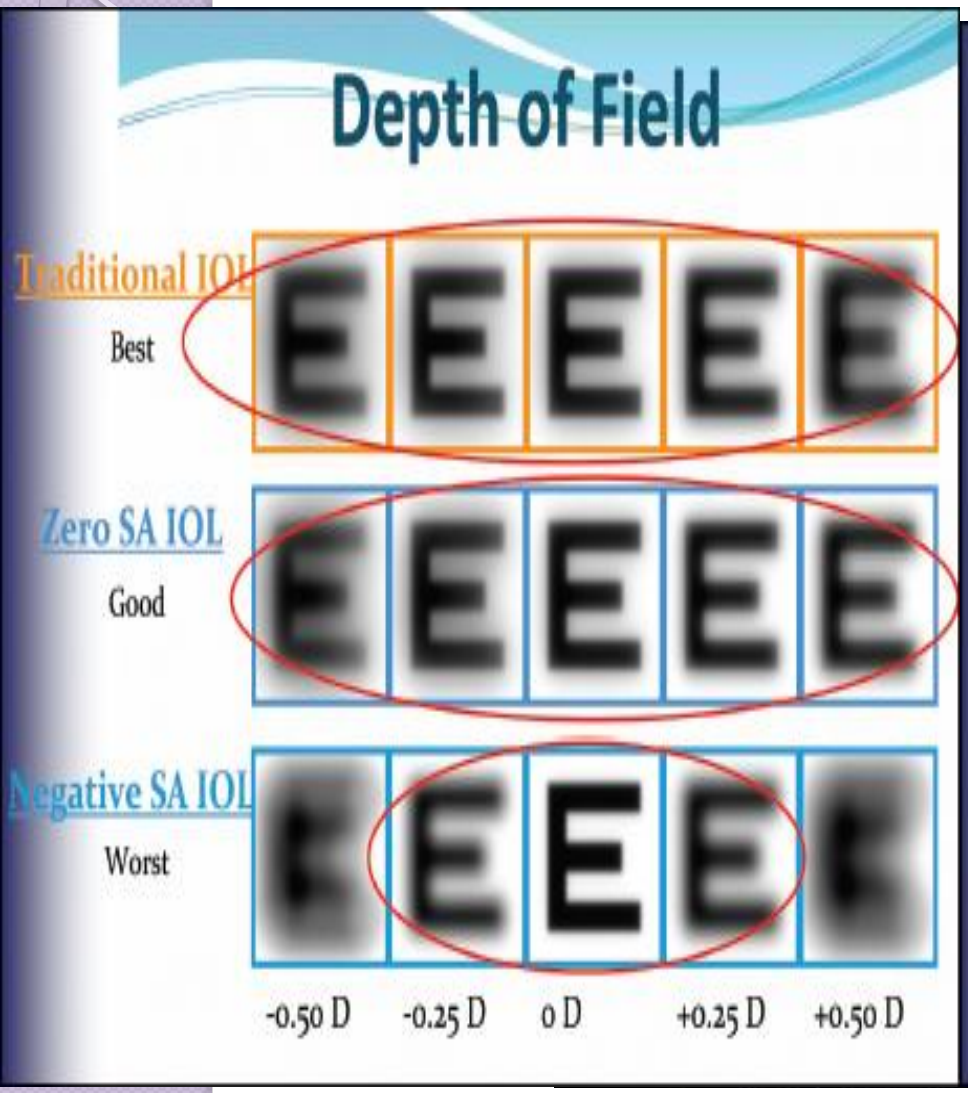
- Spherical
  - Positive spherical aberration
- Aspheric
  - Zero spherical aberration
    - Example: SofPort AO
  - Negative spherical aberration
    - Example: Tecnis IOLs (model

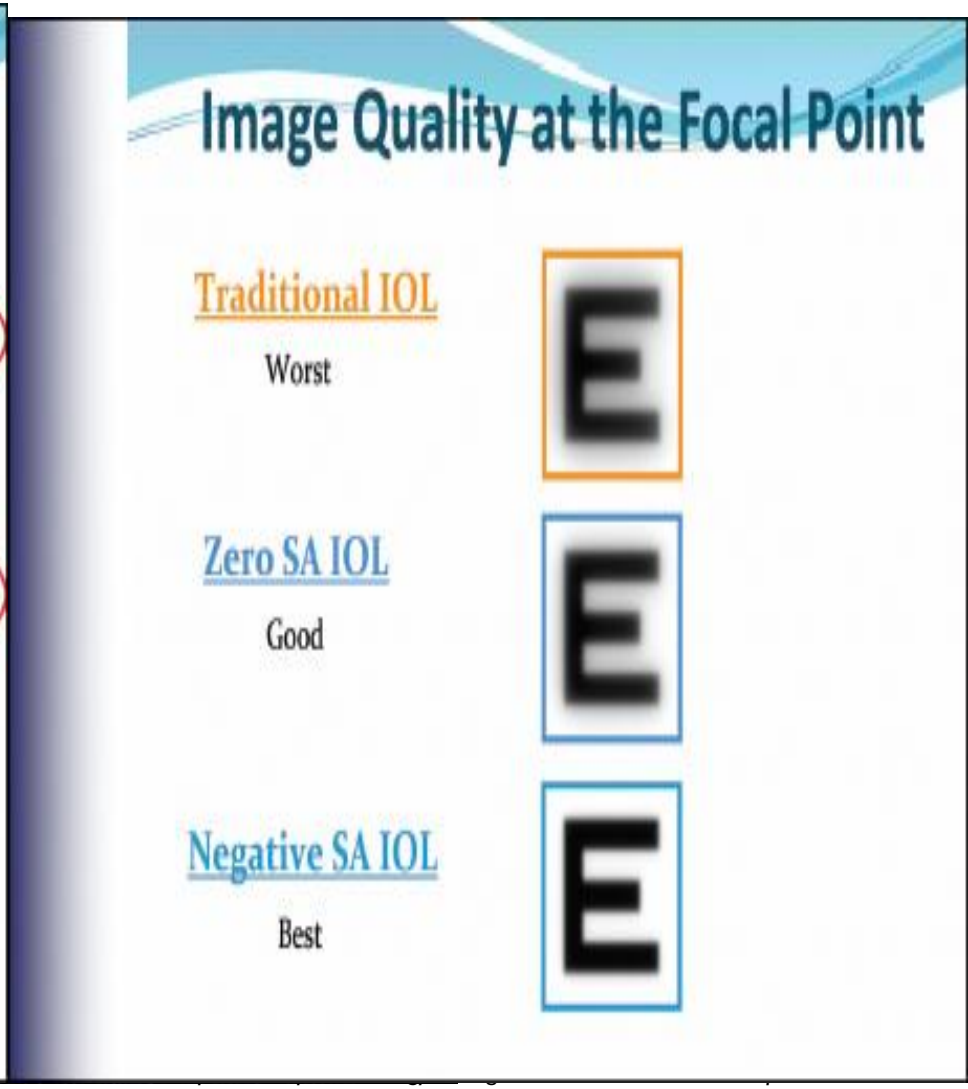
Traditional IOLs with positive spherical aberration give a poorer quality image than the aspheric IOLs in the vast majority of patients



http://www.ophthalmologymanagement.com/articleviewer.aspx?articleid=86679

Relationship of Depth of Field to Image Quality





http://www.ophthalmologymanagement.com/articleviewer.aspx?articleID=107209

IOL Selection

With distinct classes of IOLs, which IOL do we choose for which patient?

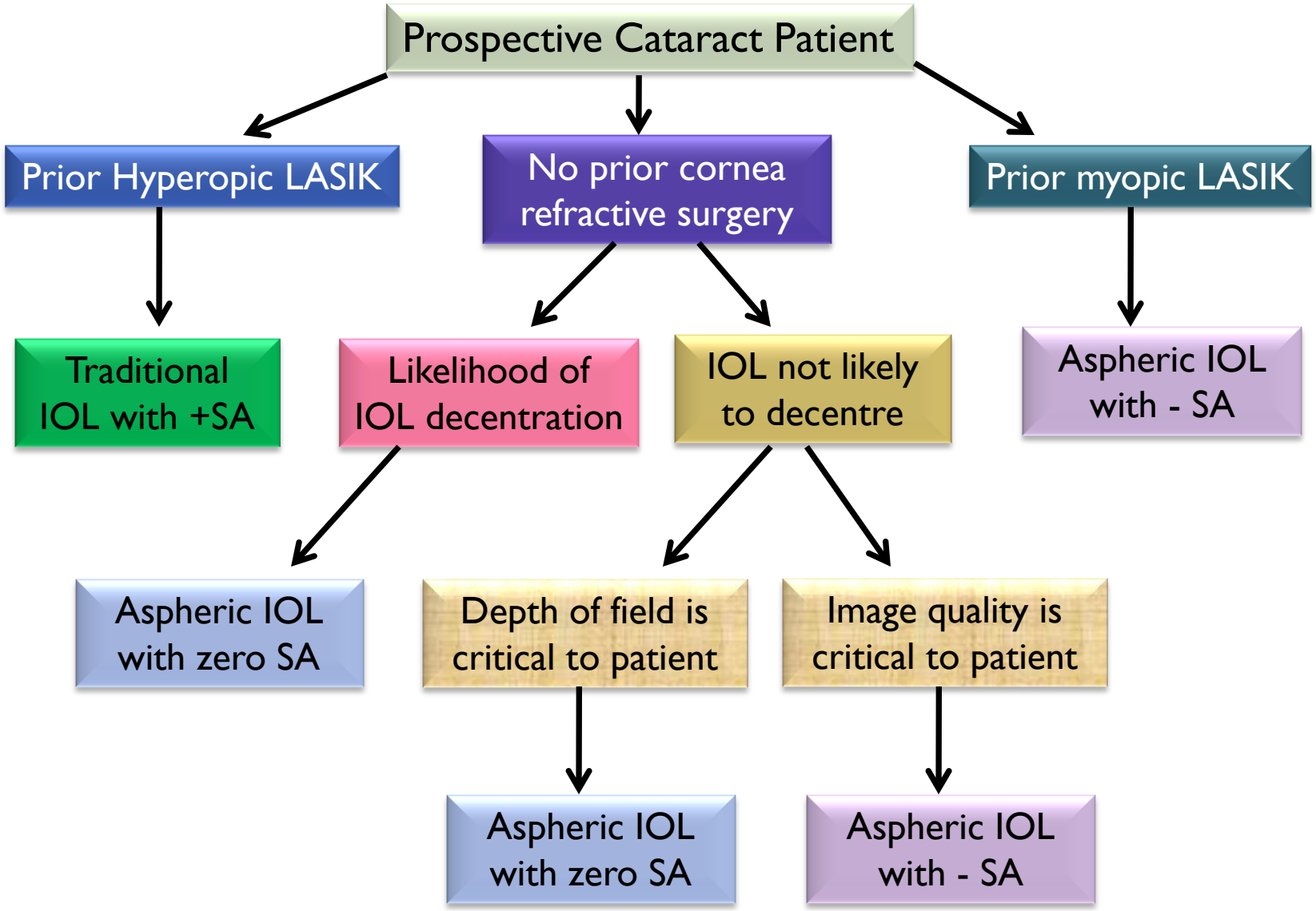
Important po

- What is the upil size?
- What are t ion?
- How hyper
- Has the pa tive surgery?
- How is the e likelihood of IOL dece

http://www.ophthalmologymanagement.com/articleviewer.aspx?articleid=86679

Simplified decision tree for IOL selection

(Actual IOL selection depends on many factors)



http://www.ophthalmologymanagement.com/articleviewer.aspx?articleid=86679

Aspheric IOL's

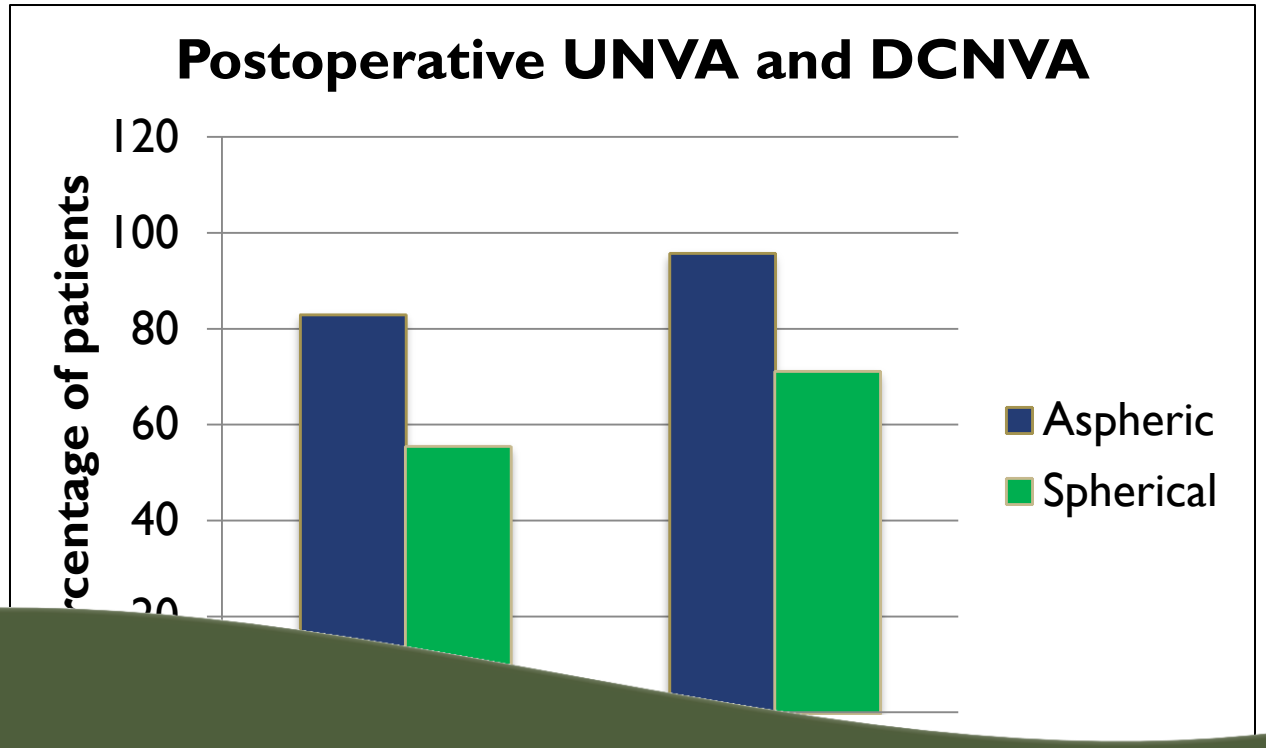
Characteristics	Tecnis	AcrySof IQ	SofPort AO	Acri.Smart
Model	Z9000, Z9002, Z9003	SN60WF	LI61AO	36A
Design	Prolate anterior surface	Prolate posterior surface	Prolate anterior & posterior surfaces	
Optic (mm)	6	6	6	6
Spherical aberration (mm) with a 6.0 mm pupil	- 0.27	- 0.20	0	- 0.26

The main difference between these aspheric IOLs is the difference in their asphericity, and thus the spherical aberration they are capable of correcting when implanted

J Cataract Refract Surg 2009; 35:172–181

Aspheric versus Spherical

Visual Function



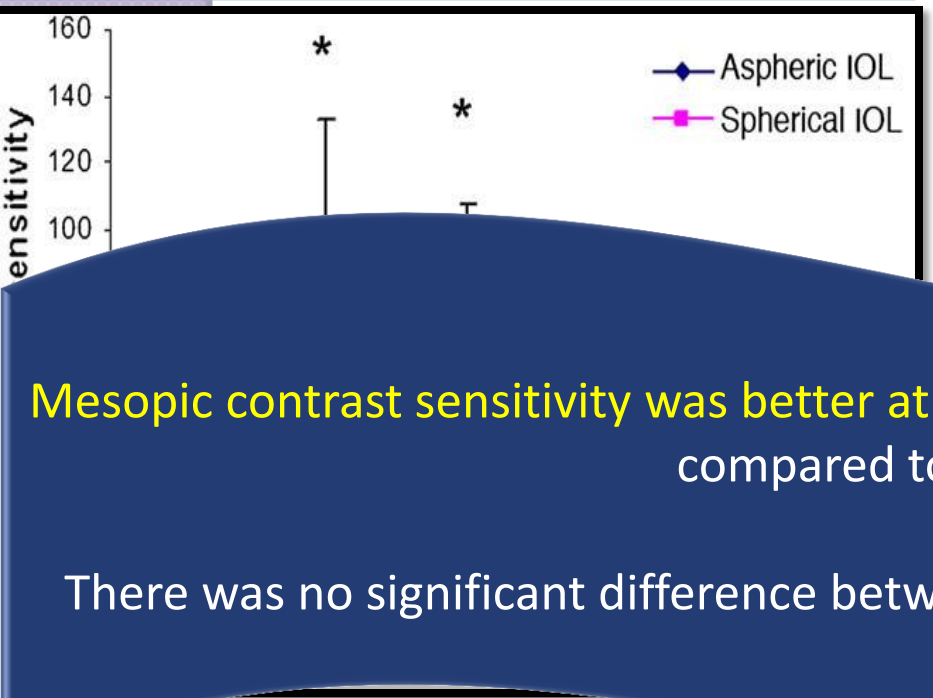
The better near vision may be the result of the better quality retinal image conferred by the lower levels of spherical aberration with aspheric IOL

DCNVA: distance-corrected near visual acuity
UNVA: uncorrected near visual acuity
Spherical: AcrySof ReSTOR SN60D3 IOL
Aspheric Acry-Sof ReSTOR SN6AD3 IOL

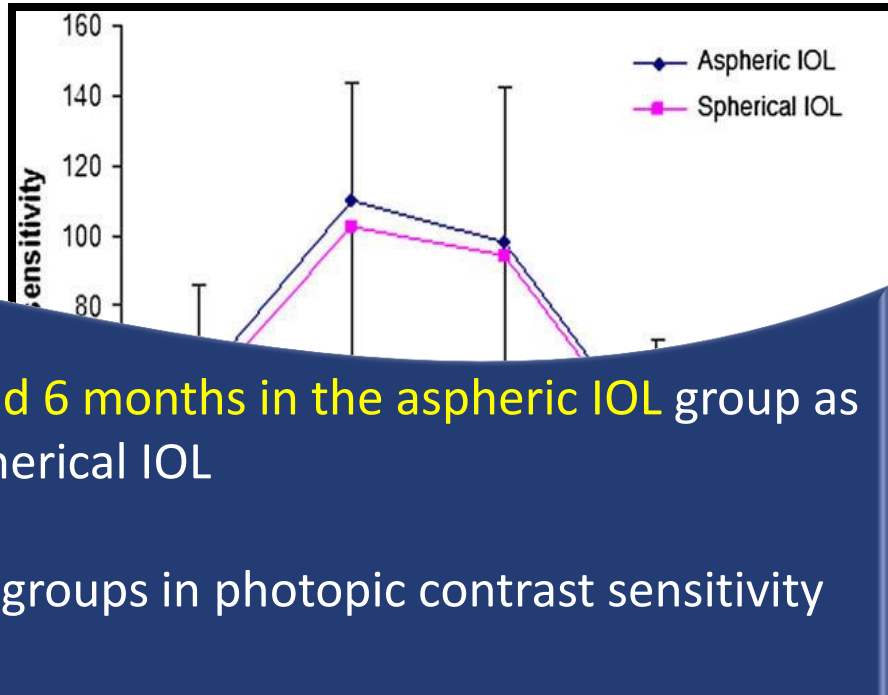
J Cataract Refract Surg 2010; 36:1897–1904

Contrast Sensitivity

Mesopic contrast sensitivity at 6 months



Photopic contrast sensitivity at 6 months



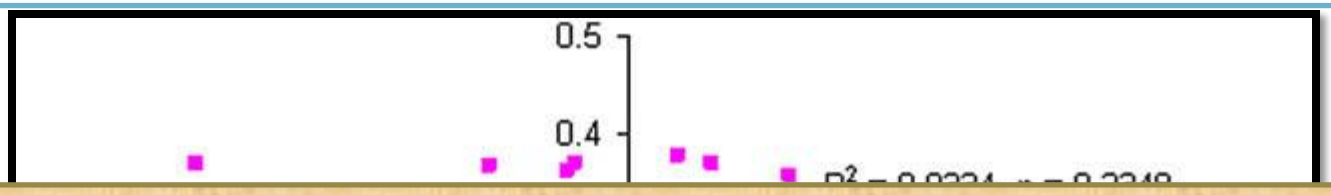
Mesopic contrast sensitivity was better at 3 and 6 months in the aspheric IOL group as compared to spherical IOL

There was no significant difference between groups in photopic contrast sensitivity

Cataract Refract Surg 2009; 35:663–671

Aberrations

Relationship between corneal Q values and entire-eye spherical aberrations



Reduction in HOAs after aspheric IOL implantation occurs when the pupil is at least 4.0 mm in diameter

Large differences between spherical IOLs and aspheric IOLs are found with larger pupils (ie. 5.0 mm and 6.0 mm)

Decentration and/or tilt & combination of different aberrations may contribute to high level of reduction in HOAs with aspheric IOLs

Asphericity of the cornea increased, the spherical aberration decreased linearly after aspheric IOL implantation and remained fairly stable after spherical IOL implantation

(IOL: intraocular lens; RMS: root mean square)

Cataract Refract Surg 2009; 35:663–671

Optical advantages of aspheric IOLs over spherical IOLs related to:

- Pupil size
- IOL tilt and/or decentration
- Depth of focus
- Customization to a specific corneal spherical aberration

Cataract Refract Surg 2009; 35:171-181

Benefits of Aspheric IOL may be limited by:

- Inaccurate or absent preoperative measurement of the ocular parameters necessary for IOL power calculation
- Inaccurate manufacturing
- Inability to locate the IOL in the correct plane
- Surgically induced aberrations

Cataract Refract Surg 2009; 35:172-181

However, the optical and visual performance of aspheric IOLs is, even in the worst cases, equal to or better than that with spherical IOLs

Cataract Refract Surg 2009; 35:172-181

Take home message

- Aspheric lenses are the new standard for most patients undergoing cataract surgery
- Shown better contrast sensitivity, night driving simulation improvement, etc
- Try to customize aspheric IOL's asphericity depending on the patient's corneal spherical aberration to obtain the optimum visual performance

http://www.revophth.com/content/d/cover_focus/i/1220/c/22982/


Thank
You