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Essentials for IOL's and IOL Calculations

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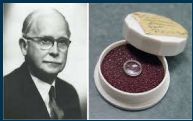
Financial Disclosures:

- None

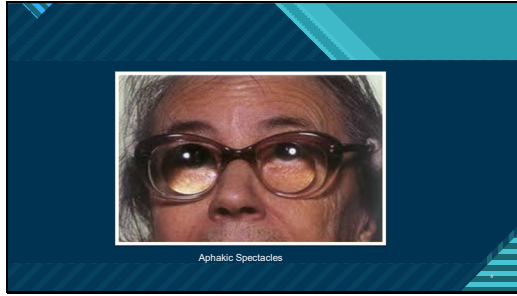
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History:

- 1950 Sir Harold Ridley implanted the first intraocular lens (IOL)
- Routine IOL's were not available until the late 1970's
- Initial Calculations:
 - Add pre-op MRx to a +19.0 lens
 - Ex: -2.00 myope would get a +17.0 power IOL



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First Regression Formula

$$P = A - 2.5L - .9K$$

- P = power of IOL
- A = A constant
- L = Axial Length
- K = average keratometry

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Question #1

- Which factor is more important in your biometry measurements: Axial length or keratometry?
- Why?

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- For every 1 mm you are off on your axial length measurements, there can be up to a 3 diopter difference in IOL power.
- This correlates to 2-3 diopters in spectacles correction!!

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Why the need for such accuracy?

- Patient expectations
 - Quest for youth
 - Spectacle free
- Premium lenses
- Lawsuits

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Benchmark Studies

- +/- 0.50 D for 70% of patients
- +/- 1.00 D for 90% of patients
- Premium lenses +/- 0.50 D 99%

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Types of Biometry

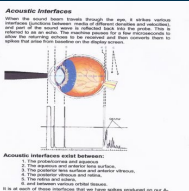
- Contact
- Immersion
- Optical
 - IOL Master
 - Lenstar
 - Pentacam AXL
 - Argos

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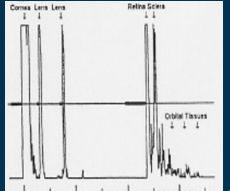
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Acoustic Interface

When the sound waves travel through the eye, it will be reflected back and forth between the cornea and the retina. The reflected waves will be measured by the probe. This will allow the system to determine the distance between the probe and the retina. This will allow the system to determine the distance between the probe and the retina.



Cornea Lens Retina Scans



Optical Tissues

Advantages of Acoustic Interface


1. The probe is not in contact with the eye.
2. The probe is not in contact with the eye.
3. The probe is not in contact with the eye.
4. The probe is not in contact with the eye.
5. The probe is not in contact with the eye.

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Contact

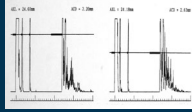
- Pros:
 - cheapest
 - Relative ease of use
 - Can be done in sitting or supine
- Oldest and still very common in some areas



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- Cons:
 - Inherently inaccurate due to corneal depression
 - Studies show contact method read anywhere from 0.14 mm to .36 mm too short
 - Accuracy at best is 0.1mm



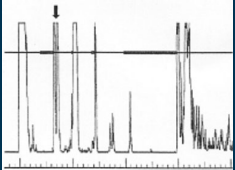
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Immersion Biometry

- Involves using a plastic "shell" or cup placed on the eye
- The probes is attached to the shell but NOT touching the cornea
- Accuracy: 0.02 – 0.05mm



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Immersion A-Scan- Note double corneal peaks


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Pros	Cons
<ul style="list-style-type: none">• Very accurate• Relatively inexpensive• No corneal depression• Can measure through all densities and types of cataracts	<ul style="list-style-type: none">• Slight learning curve• Supine position• Cannot use bleb

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Optical Coherence Interferometry

- IOL Master, Lenstar, Pentacam AXL, Argos
- Measures K's, axial length, ACD, W-W, and lens thickness
- Non-contact
- Extremely accurate: 0.02mm



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Pros	Cons
<ul style="list-style-type: none">• Easy to use• Fast• Accurate• Non-contact	<ul style="list-style-type: none">• Expense!!!• Doesn't work well with dense or PSC cataracts

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Formulas

- 1st Generation
 - SRK
 - SRK-I
- 2nd Generation
 - SRK-II
 - Holladay
- 3rd Generation
 - SRK-T
 - Holladay 1
 - Hoffer Q
- 4th Generation
 - Holladay 2
 - Haigis

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Formulas

- Short eyes (<22.0 mm): Hoffer Q
- Average (22-25 mm): SRK T, Holladay
- Longer (>25.0 mm): Holladay, Holladay II

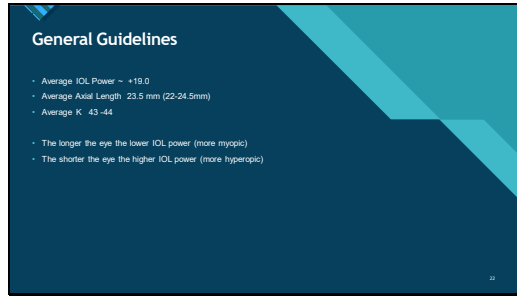
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Modern Formulas

- Barrett Universal II
- HII-RBF 2.0
- Ladas Super Formula

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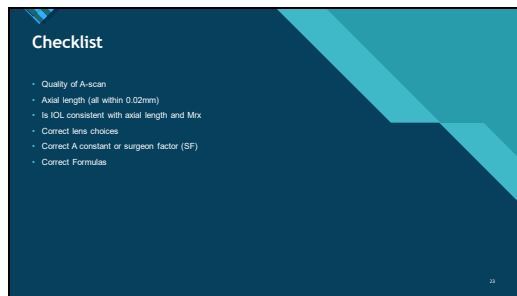
General Guidelines

- Average IOL Power ~ +19.0
- Average Axial Length 23.5 mm (22-24.5mm)
- Average K 43-44

• The longer the eye the lower IOL power (more myopic)
• The shorter the eye the higher IOL power (more hyperopic)

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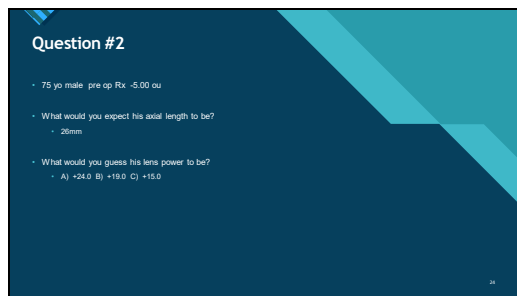


Checklist

- Quality of A-scan
- Axial length (all within 0.02mm)
- Is IOL consistent with axial length and Mtx
- Correct lens choices
- Correct A constant or surgeon factor (SF)
- Correct Formulas

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Question #2

- 75 yo male pre op Rx -5.00 ou

• What would you expect his axial length to be?
• 26mm

• What would you guess his lens power to be?
• A) +24.0 B) +19.0 C) +15.0

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Complex Calculations

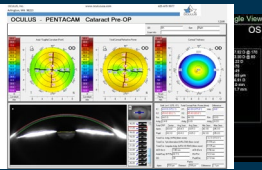
- Toric (astigmatism-correcting)
- Multifocal
- Post-Refractive
 - LASIK/PRK
 - RK
- Keratoconus/Ectasia

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Toric Lens Calculations

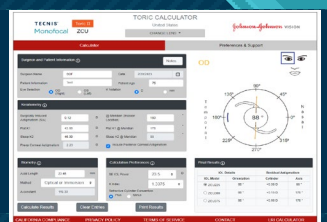
- IOL Master
- Pentacam
 - Cataract Pre-op
- Topography
- Online Toric Calculators



The screenshot shows the Pentacam software interface with several topographic maps (color-coded) and a data table. The title bar reads 'ODUS - PENTACAM - Cataract Pre OP'. The interface includes various input fields and a 'Calculate' button.

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Online Toric Calculator




The screenshot shows an online toric calculator interface. It includes input fields for 'Spherical error', 'Cylinder', 'Axis', 'IOL Power', 'IOL Axis', 'IOL Position', and 'IOL Diameter'. There are also sections for 'Astigmatism' and 'Corneal Toricity'. A topographic map is displayed on the right side of the interface. The calculator is branded with 'TECNIS' and 'Johnson & Johnson' logos.

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Multifocal IOL calculations

- Must hit emmetropia (plano) for these lenses to work



- Cylinder < 1.00

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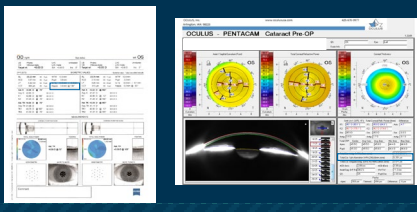
Multifocal Calculations

- IOL Master
- Pentacam
 - Cataract pre-op
 - Bink/Ambrósio
- Topography
- Angle Koppe

- * OCT macula

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Post-refractive Calculations

- IOL Master
 - Post-refractive setting
- Pentacam
 - Power Distribution
 - Holladay Report- Equivalent K's
- Topography
- ASCRS Post-refractive calculator
- Historical data

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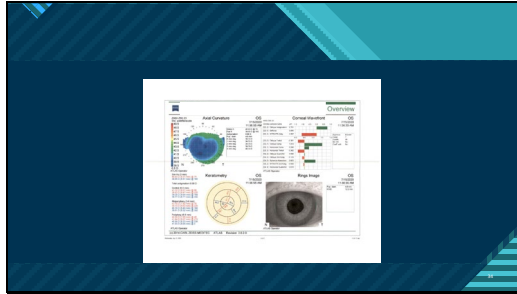
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The screenshot displays the Ocular Pentacam software interface. It features several circular topographic maps showing corneal curvature and power distribution. To the right, there are data tables and a line graph. The interface is titled 'OCULUS - PENTACAM'.

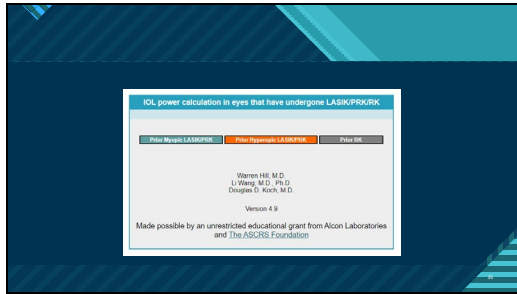
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The screenshot shows a detailed 'Power Distribution' report from the Ocular Pentacam software. It includes a table with columns for 'Power (D)', 'Area (mm²)', and 'Percentage (%)'. Below the table, there is a line graph showing the distribution of power across different ranges. The interface is titled 'OCULUS - PENTACAM Corneal Power Distribution'.

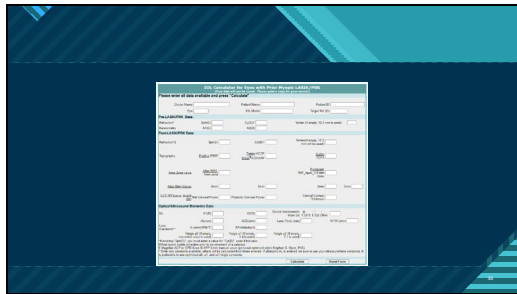
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Classes of IOL's

- Monofocal
- Toric
- Extended Depth of Focus (EDOF)
- Multifocal
- Small aperture
- Light-adjustable (LA)

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Monofocal IOLs


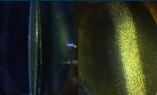
Pros	Cons
<ul style="list-style-type: none"> • Covered by insurance • No night-time halos • No loss of contrast sensitivity 	<ul style="list-style-type: none"> • Only 1 focal point corrected

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Monofocal IOL's

- J&J
 - Technis (DCBDD)
 - Negative spherical aberration
 - Glisening free
- Alcon
 - Acrysof (SN60WF)
 - Clareon (SY60WF, CNA0T0)
 - Glisening-free
 - Negative spherical aberration
- B&L
 - Akreos (AC90)
 - Envista (MX60)
 - No spherical aberration
 - Glisening free

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Toric IOLs

- J&J
 - Technis toric II (ZCU)
- Alcon
 - Clarion toric (CNW0T)
- B&L
 - Envista Toric (MX60ET)



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Question #3

- A 65 y/o female presents for cataract evaluation OD.
 - spectacle correction of -2.50 + 2.00 x 92
 - Ks: 43.5 x 44.0 @ 94
- Would you offer this patient a toric IOL?

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- No
- Toric lenses only correct corneal astigmatism

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Toric IOL's

Pros	Cons
<ul style="list-style-type: none">• Corrects regular corneal astigmatism<ul style="list-style-type: none">• Beware of irregular astigmatism• No night-time halos• No loss of contrast sensitivity	<ul style="list-style-type: none">• Only corrects one focal point• Out-of-pocket cost

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EDOF IOL's

- J&J
 - Eyhance (DIBOO)
 - Eyhance Toric (DIU)
 - Symfony OptiBlue (DXROOV)
 - Symfony OptiBlue Toric (DXW)
- Alcon
 - Clareon Vivity (CNET0)
 - Clareon Vivity toric (CWNET)
- B&L
 - LuxSmart
 - LuxSmart Toric



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EDOF IOL's

Pros	Cons
<ul style="list-style-type: none">• Provides good uncorrected distance and intermediate vision• No night-time halos	<ul style="list-style-type: none">• Still need readers• Out-of-pocket cost*• Some loss of contrast sensitivity*

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Multifocal IOL's

- J&J
 - Synergy (DFROOV)
 - Synergy toric (DFW)
- Alcon
 - Clareon PanOptix (CNWTT0)
 - Clareon PanOptix toric (CNWTT)



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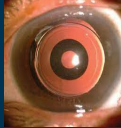

Multifocal IOL's

Pros	Cons
<ul style="list-style-type: none">• Provides full range of uncorrected vision from distance to near• Spectacle independence	<ul style="list-style-type: none">• Out-of-pocket cost• Some loss of contrast sensitivity• Halos/starbursts at night• Need a pristine eye

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Small-aperture IOL


- B&L IC-8 Aphera
- Uses an opaque ring to create a pinhole effect
- Provides an extended range of vision from distance to near
- Placed in one eye combined with a monofocal or monofocal toric in the fellow eye



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Light-adjustable IOL's

- Allows surgeon to change power of IOL post-operatively
 - Can adjust for spherical and cylindrical power changes
- 3-piece silicone IOL containing UV-absorbing macromers
- Uses UV light to change and lock-in IOL power
- May need 3 to 5 light treatments to achieve vision goals



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Light adjustable IOL's (LAL)

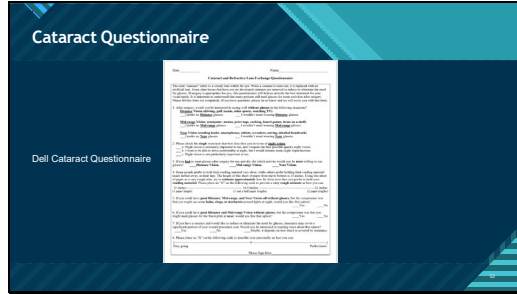
Pros	Cons
<ul style="list-style-type: none">• Able to fix post-op refractive surprise or change post-op refractive target	<ul style="list-style-type: none">• Expensive equipment• Out-of-pocket cost• Post-op care

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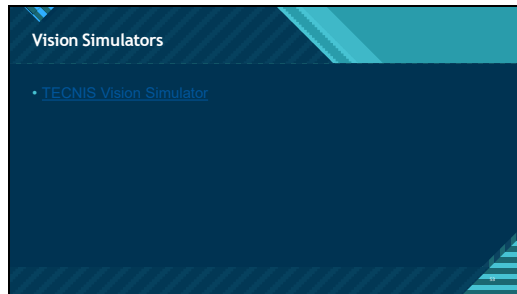
Factors to consider when offering IOL's

- Cost
- Lifestyle
 - Rely on near vision
 - Spectacle independence
 - Night-time driving
- Patient personality
- Astigmatism?
- Any other eye conditions?

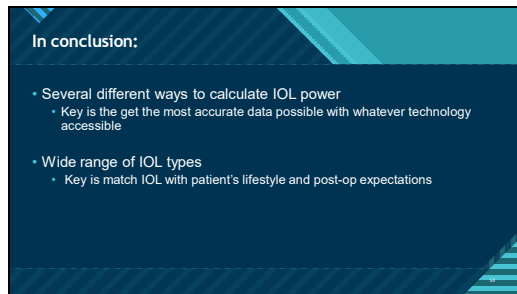
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