Biometry:
A Step by Step Approach

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What is it?

- Measurement of the corneal power and the axial length of the eye
- From these a computer calculates the power of the implant the patient needs to be emmetropic after surgery
- Patients can be also made nearsighted upon request

Why is it necessary?

- To improve uncorrected vision
- In rural/poor urban setting: Eye glasses are not available and/or patients are not able to afford them
- In private clinic setting: patient expectations are increasing, they demand good uncorrected vision

Why is it not done?

- Lack of equipment, time, expertise, motivation, reimbursement

- Need to keep an inventory of different power of IOLs – a bit cumbersome

But…

- Without biometry about 1/3 of patients become either significantly myopic or hyperopic and will have poor uncorrected vision !!!

- **With minimal extra effort you can greatly improve outcomes!!!**

Needed:

- Instruments:
  - Keratometer
  - A-scan

- Personnel:
  - Optometris
  - Eye-nurse
  - Can train laypeople – NOT difficult !

Keratometer

- Manual (cheap)
- Automatic, non-portable – usually combined with autorefractometer (expensive)
- Automatic, portable - can be used in outreach and in pediatric cataract surgery

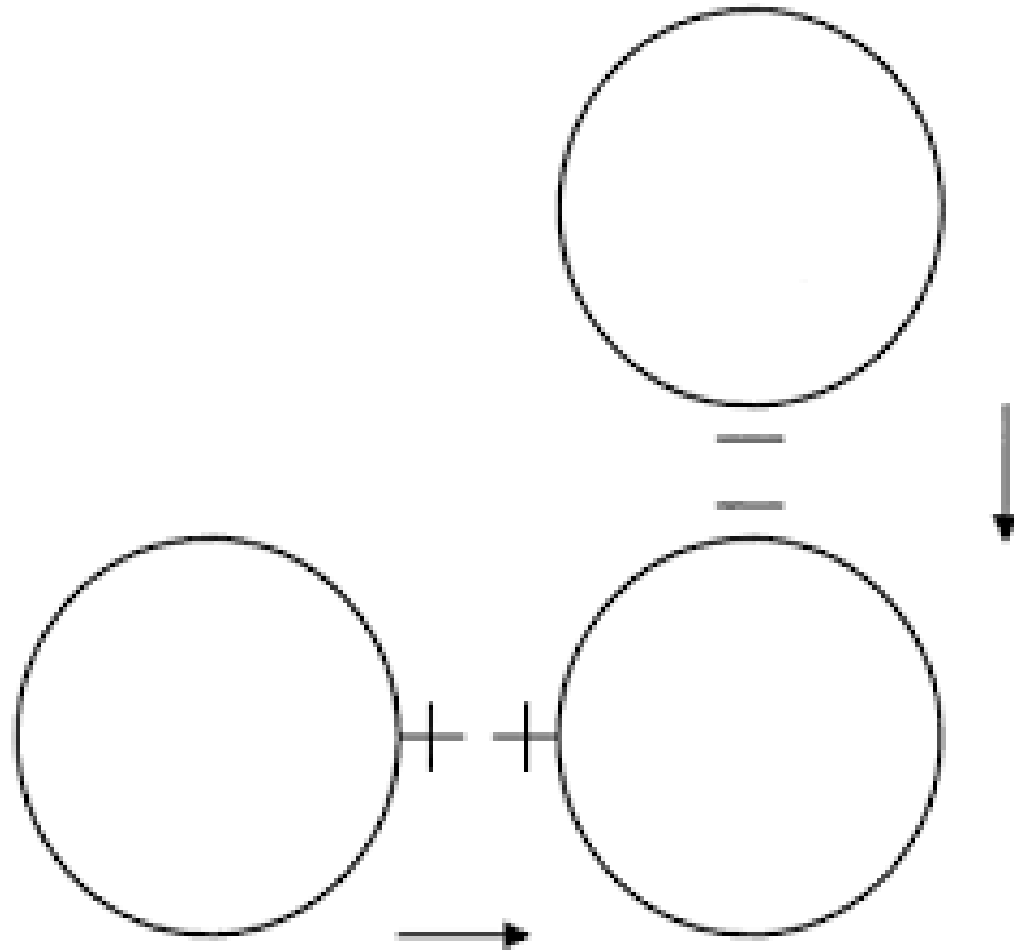   (expensive) – buy one working with regular batteries

Manual keratometry

Keratometer

Align myers

Portable keratometer

Wireless Print

SW-100

Portable keratometry

A-scan

- Better to buy portable – can be used on outreaches, price is not different
- Lasts for decades if well taken care of
- Do not drop probe!
- Needs trained personnel to use

A-scan measurement

SRK-II Formula

- IOL Power =

  A-constant - 0.9 X K - 2.5 X Axial Length

Myopic eye – longer AL , higher K-s LOWER IOL power

Hyperopic eye – shorter AL, flatter K-s HIGHER IOL power
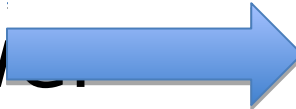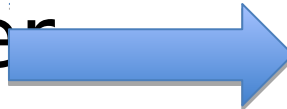
A-constant

- Always written on box of IOL
- Depends on material/shape

- **For PC lenses: 118.0 - 119.2**
- If you have different lenses, take average
- Better to use the same IOL brand

- **For AC lenses: 115.0 – 115.3**

Error in measurement

IOL Power=A-constant - 0.9 X K - 2.5 X AL

- 1 mm difference in AL   2.5D
- 1 D difference in K   1 D
- 1 difference in A-constant   1 D

Error in measurement

- Implanting too high power: MYOPIA
- Implanting too low power HYPEROPIA

Better to err on the side of higher power – better to be myopic!!!

Relationship between IOL power and refraction

- 1D more power results in 0.7 D more of myopia
- 2D more ~ 1.5D
- 3D more ~ 2.0D
- 4D more ~ 3.0D
- 5D more ~ 3.5D

Tricks with keratometry

- Always check both eyes – usually the same
- If different, double-check
- If cannot do one eye (eg. Pterygium), use other eye's measurement

How to do A-scan

- Better if always same personnel does it
- Touch probe to center of cornea, aim at center of eye
- Take at least 5 measurements, 8 better
- Machine averages them
- If standard deviation is too high (>0.1), retake

Tricks with A-scan

- If cannot do one eye, use other eye's measurement
- Always do both eyes (unless PT is pseudophakic) and if IOLs are more than 1D different, repeat
- If cannot do one eye, might mean PT has RD, coloboma or other pathology – do B-scan if you have it

Picking the correct IOL

- Aim to - 0.5 – -1.0 D refraction – make pt slightly myopic, unless PT drives

- Just a personal preference, you can aim for emmetropia too

Correcting A-constant

- After about 2-3 months of surgeries, measure your refractive outcome of about 50 patients
- If most of them have the desired refraction, you are doing well
- If some are nearsighted, some are farsighted, you have to improve the quality of your biometry
- If most of them are either near or farsighted, you need to change the A-constant

Measuring refractive outcome

- Take spherical equivalent in a month:
- Eg: -0.50 - 3.00x90 deg = [-2.75]
- Eg: +1.00 - 2.00X80 deg= [0.00]
- Eg: +3.00 – 3.00x110 deg=[+1.50]

- Spherical equivalent stays constant after astigmatism wears off

Correcting A-constant

- If your patients come out too nearsighted, means you are implanting too high IOL

- Decrease A-constant – IOL number will be lower

- Ie. You are aiming for -0.5D but PTs are -1.5D, change A-constant from 119.5 to 118.5

Correcting A-constant

- If your patients come out too farsighted, means you are implanting too low IOL

- Increase A-constant – IOL number will be higher

- Ie. You are aiming for -0.5D but PTs are +0.5D, change A-constant from 118.5 to 119.5

Monovision after bilateral cataract surgery

- Goal is for PT to see distance **and** also near without glasses
- Can be achieved only if **biometry** is available
- Improves the PT's quality of life with minimal extra effort – prescription glasses are available only for the affluent part of society

Eye dominance

- Determine by holding up circle from fingers in front of small distance target with both eyes open

- Can also ask PT to shoot or take picture with camera– eye kept open is dominant eye

Eye dominance

Eye dominance

- 80% of people are RIGHT eye dominant
- Dominant eye should be corrected to distance
- Non-dominant eye should be corrected to near
- In a population with lower visual needs, the **right** eye can automatically be corrected to **distance** and **left** to **near**
- Usually no problem cinically if wrong eye is picked

Calculations

- Add 2 diopters to the IOL power of non-dominant eye (usually OS) – this will mean -1.5D myopia
- The brain can tolerate <3.0 D of anisometropia
- It is always **better to err on the side** of myopia meaning **higher IOL power** – it is better to be myopic than hyperopic (At least one can see near) – so if in doubt, always implant the HIGHER IOL power.

Examples:

- Biometry is IOL 21 OU – implant 21 OD and 23 OS

- Biometry is IOL 19 OD and 21 OS – double-check, the two eyes should be within 1D

- If same the second time – implant IOL 19 OD and 23 OS

- If biometry is 23D OD and 24D OS, implant 23D OD and 26D OS

Correcting IOL power for monovision after one eye had cataract surgery

- Perform autorefraction or refration on the operated eye
- If eye came out nearsighted, make other eye emmetropic
- If eye came out farsighted, make other eye -2.00D less (to avoid anisometropia)
- If eye is emmetropic, make other eye nearsighted

Examples

- Biometry is 21.0 D OU, but OD is [-1.50D] postop – make OS 19.0 D
- Biometry is 19.0 D OU but OD is [+1.0D],

  make OS 21 D
- Biometry is 24.0 D OU, and OD is [0.0D], this is as you planned – make OS 26.00-success!!!

Checking outcomes of monovision

- Check uncorrected **binocular** distance and near vision 3 months postop

Thank you for your attention !