



Understanding Biometry

Linda Ellis

Principal Optometrist, Cataract Unit
Manchester Royal Eye Hospital





Sources of Error Keratometry

1 D ERROR IN K_s \approx 1 D ERROR IN IOL CALCULATION

- Eye piece not focussed
- Off axis
- Axis of astigmatism
 - 2 readings at 90°
- Corneal irregularity/scarring
 - compare to fellow eye
 - approximate with manual keratometry



Best Practice

- Keratometry
 - Instruments regularly serviced and calibrated
 - Operated in accordance with the manufacturers instructions
 - Measure both eyes
 - Take an average of 3 readings
 - Include the axis



Scan Interpretation

IMPORTANT TO INSPECT SCANS

- Most machines automated
- Records scan dependent upon echo height
- Not necessarily on axis



Clinical Accuracy of Ultrasound

- Resolution of 116 μm with 10 MHz a-scan
- Axial length measurement 100 to 120 μm
- 100 μm error \sim 0.28 D
- 54% prediction errors in post op refraction after IOL due to axial length

Olsen (1992) Sources of error in IOL calculation.
J Cataract Refract Surg. **18**, 125-9



Sources of Error

Axial Length in Ultrasound

1mm ERROR IN AL \approx 2.5 D ERROR IN IOL CALCULATION

- Applanation
- Fluid stand off
- Off axis
- Gain
- Ultrasound velocity ?? in cataract
- Transducer design



Axial Length Measurement Laser Interferometry

- Uses infrared light reflected back from the anterior cornea and retinal pigment epithelium
- Non contact
- Velocity of light too high to measure echo delay - interferometry

Drexler et al (1998) Partial Coherence Interferometry: A novel approach to biometry in cataract surgery. Am J Ophthal. 126, 524-534



Graph Interpretation

IMPORTANT TO INSPECT GRAPHS

- Automated
- Records all graphs with signal to noise ratio of > 1.6



Clinical Accuracy of PCI Compared to Ultrasound

- Ultrasound
 - Resolution of 116 μm with 10 MHz a-scan
- Partial Coherence Interferometry
 - Precision 0.3 to 10 μm
- 100 μm error \sim 0.28 D



Best Practice

- Axial length measurement
 - Instruments regularly serviced and calibrated
 - Operated in accordance with the manufacturers instructions
 - Measure both eyes to allow for cross checking
 - Focimetry or latest refraction to be available



Which Formula?

Axial Length (mm)	Formula
< 22 mm	Hoffer Q or SRK/T
22 – 24.5 mm	SRK/T or Holladay, Habis
> 24.6 mm	SRK/T



Best Practice

- Biometry printout should be kept in the patient's notes clearly identified with the patient's details
- Details of which equipment used
- Any additional considerations
- Date, signature and name of operator



References

- ***Drexler et al (1998)*** Partial Coherence Interferometry: A novel approach to biometry in cataract surgery. Am J Ophthal. 126, 524-534
- IOL Master hand book
- Ultrasound of the Eye and Orbit, Second edition, Susan Frazier Byrne and Ronald L Green
- **Royal College of Ophthalmologists**, Cataract Surgery guidelines 2007



Contact Details

linda.ellis@cmft.nhs.uk

