I. AXIAL LENGTH MEASUREMENT

2011: “IOL POWER” book by Slack

The Ossoining Immersion is proven to consistently produce an axial length measurement that is 0.26 mm longer than that using the application technique- that may indent the cornea, creating an artificially shorter reading. An 8 mHz non-focused transducer is recommended - can be attached to most US machines. An Ossoining shell (cup) is placed between the lids and filled with Goniosol [cut 50% with Dacriose]. The probe is placed into the fluid and aimed in an axial direction. Optical biometry methods are easier and matched to equal Immersion. (See below)

A. Ossoining cups (#303-82)
   Order: Hansen www.HansenLab.com 319-338-1285 $36@ 16-18-20-22-24 mm
   i. Prager Shell: Order from: ESI, Inc. www.ESI.com 763-473-2533 tab@eyesurgin.com

B. Direct read out of oscilloscope is optimal compared to “black box” readouts without scan. PO Rx affected by AL

C. Axiality determined by obtaining simultaneous maximum corneal and retinal spikes.

D. Always measure the axial length of both eyes [Standard of Care Issue].

E. Consider STAPHYLOMA in problem case with AL >25 mm, need B-scan or Optical biometer.

F. ULTRASOUND SPEED

In 1974, I computed the average US speed of a Phakic eye = 1555 m/sec and an Aphakic eye = 1534 m/sec. BUT AL affects this: e.g. 20 mm Phakic = 1560 m/sec & 30 mm Phakic = 1550 m/sec. (Aphakic NOT affected by AL)

WHY? Short eyes are made up of smaller % of fluid axially (short AC, shorter vitreous, thicker lens), , Velocity faster.

1. How to correct for this: PHAKIC EYE: Measure all eyes at 1532 m/sec and add to it a CALF factor of + 0.37 mm.
   a. APHAKIC EYE: Measure at 1532 m/sec and only add + 0.05 mm
   b. PSEUDOPHAKIC EYE: Measure at 1532 m/sec and add CALF of:
      PMMA [* 0.424*(Tt) + 0.037]  Silicone [* 0.563*(Tt) + 0.037]  Acrylic [* 0.243*(Tt) + 0.037]  Tt = IOL Thickness
   c. OR use Average Velocities for 23.5 mm eye: PMMA 1556 m/sec  Silicone 1487 m/sec  Acrylic 1549 m/sec
   d. Piggyback Lens Eye: AL = AL1532 + T1 * (1-1532/V1) + T2 * (1-1532/V2) + 0.037  Where T1 and V1 are the
      thickness and velocity of one IOL and T2 and V2 are the thickness and velocity of the other.

2. If AL not measured at 1532 m/sec, AL can be converted by formula: Vmax= Velocity you used, Vcorrect = correct new Velocity

\[ \text{AL corrected} = \text{AL measured} \times \frac{V_{\text{correct}}}{V_{\text{measured}}} \]

3. Scleral Buckle after RD: Use AL-1 mm for ACD prediction and AL for IOL power calculation, “Double-AL”

4. SILICONE OIL filled Eye
   a. FIRST PROBLEM: Almost impossible to measure with Ultrasound: BEST: USE OPTICAL BIOMETER.
   b. SECOND PROBLEM: Refractive index of silicone acts like a minus lens was placed in the vitreous and will cause the eye to become hyperopic by 2-3 D (Plano-convex IOL) or 3-6 D (Biconvex IOL) [Concave IOL best].

Therefore the IOL power must be increased if silicone will be left in.

c. Due to 1 & 2 above, I recommend waiting and performing secondary IOL using Holladay Refraction Formula.

d. Advise all retinal surgeons to routinely perform AL measurement prior to placing Silicone.

G. OPTICAL BIOMETERS

IOLMaster 1999 Gold Standard
Lenstar 2009 Proven Equal
Aladdin 2013 TBA
AL-Scan 2013 TBA
Galilei G6 2013 TBA

II. CORNEAL POWER [K]

A. The manual keratometer should be standardized often. This is done with steel calibration balls from manufacturer.

B. K reading errors = diopter for diopter error in IOL power. Hard CL ‘s must be kept out > 2 weeks (Medico-legal)

C. Average K reading is always used; Cylinder is ignored. It has NO effect on IOL power

D. Ignore surgical change in corneal power unless a study of your cases reveals a consistent trend.

E. PK: Do secondary IOL after corneal transplant heals when the true K reading is able to be obtained

G. Refractive Surgery Eyes

1. Over 30 methods to calculate K or fudge the IOL power

2. SHAMMAS “NO HISTORY” METHOD: Uses only PO Manual K of LASIK eyes:  \[ K = 1.143^*Kpo – 6.8 \]

3. ARAMBERRI DOUBLE-K METHOD: Use Preop K to predict the ACD and PO calculated K for the IOL power.

4. IANCHULEV OR REFRACTION METHOD: w WaveTec ORA microscope system proven accurate

   Use handheld Autorefractor in OR immediately after catacarat out. \[ P = 2.02^*Rx + (A-118.4) = 21.2 \]

   Because of many methods to predict true corneal power or fudge the IOL we developed an Excel Tool to help you.

   DOWNLOAD FREE HOFFER/SAVINI LASIK TOOL at www.iolpowerclub.org Click Hoffer/Savini Tool

   Be prepared for temporary (2-10 wks) excess hyperopia in an RK eye  DON’T EXCHANGE IOL TOO QUICKLY!

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Hoffer: 411 Lincoln Blvd, Santa Monica, CA 90402 310-451-2020
III. ANTERIOR CHAMBER DEPTH

A. All formulas require an AC depth (ACD) = Corneal thick + Endo to IOL surf dist + 10% TL (Pl-cvx) or 50% TL (Bicvx)]
B. ACD (ELP) is not the ultrasound pre-op anatomical AC depth reading; it is the axial position of the IOL.
C. ACD is individual to each IOL style and can be predicted by the formula or is the average of a PO series.
D. T he A constant in SRK formulas and the Surgeon Factor (SF) in the Holladay formula are used to predict ELP.
E. Hoffer Q formula uses pACD and the Q formula to develop the predicted ELP for an individual eye.
F. Decrease IOL 1.00 D when shifting from bag to sulcus placement (0.50 to 1.50 D depending on power of IOL).
G. Expect ~ 1.25 D/mm shift in IOL Position.

IV. FORMULAS

B. Historical Regression: SRK® (1980) SRK® II (1988): P = A - 2.5 AL - 0.9 K + C | DO NOT USE EITHER ONE!!!
   where C = 0 (AL=22.0-24.5), C = +1.0 (AL<22.0), C = +2.0 (AL<21.0), C = +3.0 (AL<20.0), C = –0.5 (AL>24.5)
C. Modern Theoretic:
   1. Holladay® (1988): Basic theoretic formula which calculates the corneal height (1st used by Olsen) added to
      the corneal thickness (0.56) and an IOL/surgeon specific constant (the SF), to calculate the ELP.
      Anatomically the SF is the distance from the iris plane to the principle plane of the IOL.
   2. SRK/T® (1990): Basic theoretic formula using Olsen method for predicting ACD and uses standard
      A constant to calculate the ELP for the formula. Several parameters are calculated differently.
   3. Hoffer® Q® (1992): Basic Hoffer formula [1974]. Uses Q formula to predict ELP which is dependent upon AL and K.
      As accurate as the Holladay 1 formula and superior in short eyes. Series of 450 eyes revealed no error greater than ±1.93 D and 66% within ±0.50 D and 93% within ±1.0 D of prediction.
      My study ® 317 eyes: Less accurate in eyes 22.0-26.0 mm, equal to Hoffer Q (<22 mm). Better in eyes <18 mm.
   5. Haigis® [2000]: Uses a0, a1, a2 for ELP. Optimize only a0 = Hoffer Q. Better if optimize all 3, but need 350 PO eyes.
   6. Hoffer® H® [2004] Holladay Log Factors of AL, K, CD, ACD, LT and Age: BEST in <22, 24.5-26, Highest % ±0.13D.

V. COMPUTER DATABASE PROGRAMS & PALM PDA OS 5.2.1

1. Hoffer® Programs available on DOS, MAC or Win XP with Database Ver 3.
   Calculates Hoffer® Q, Holladay® I &SRK/T®, and personalized constants.
     Includes LASIK eye calculations (Aramberri Double-K all formulas).
2. Holladay® IOL Consultant. Uses Double-K only for Holladay 2 formula, not Hoffer Q Holladay 1 or SRK/T.
3. Haigis Website
4. Olsen PhacoOptics Olsen C-constant Ray Tracing

VI. BIFOCAL IOL POWER

AL has no effect on Add power, K has minimal but ACD has real effect on add power.

VII. CLINICAL RULES

1. Be sure Surgeon knows more about lens calculation than the Technician.
2. Be wary of transcription errors, e.g. AL and K readings. Calculate an average K quickly and use it from then on.
3. If you are accurate, aim for emmetropia (I have for 35 years without regret). Don’t make all patients -1.5 D myopes. 
   Ask the patient what they want. If they want other than your recommendation have them sign for it in the chart.
4. IOL power for a monocular cataract in a bilateral high myope: carefully discuss the options of monocular emmetropia
   and the necessity of wearing a contact lens on the other eye versus lifelong myopia.
5. 7 D error at 3 days is 7 D at 3 yrs: DO IOL EXCHANGE QUICKLY!
   USE McReynolds Analyzer 217-223-1111
6. MY PRESENT RECOMMENDATION:

   Optical Biometers
   • Work in 90% of eyes.
   • Setup Must Have IR set to 1.3375 or Hoffer Q NG
   • Work in Silicone Oil eyes

   Hoffer Q Formulas <24.5 mm (80%); HOLLADAY Formula: 24.5-26.0 mm (15%);
   SRK-T Formula >26 mm (5%);
   HAIGIS & Olsen Formulas Also good
   NEVER USE SRK I or II
   HOLLADAY II OK for <22

   IF YOU NEED HELP FOR DIFFICULT CASES
   E-mail to: KHoFFerMD@AOL.com

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9. Hoffer KJ. Clinical results using the Holladay 2 IOL power formula. JCRS 2000; 26:1233-9
10. ————. Ultrasound axial length measurement in biphatic eyes. JCRS 2003; 29:961-97