ELP, The Fifth Decade

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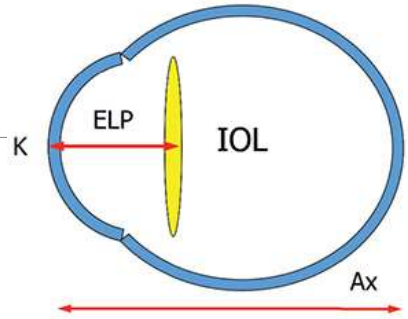


Ridley, 1949

Applied the curvatures of the natural lens (Gullstrand) to the IOL (different material & RI).

Ridley, 1949

Postop refraction:

- -18.00D sph., -6.00D cyl. ax. 120

Evolution

- Ridley
- Standard power IOL.
- The 1.25D rule.
- Formulas.

“Standard lens”: 19D, 23.7D (Gernet and Zorkendorfer, 1982).

Unacceptable range of error

-8.00 to +6.00D.

“The Basic Refraction Method”

(The 1.25 D. Rule)

Spectacle correction X 1.25
Added algebraically to 18.0D

- Up to 10.0D error

Prediction error

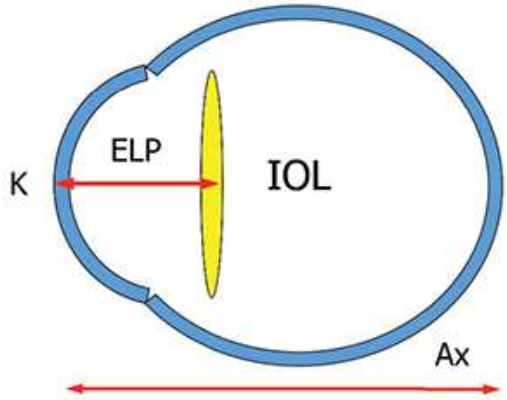
Difference between "predicted" and "actual" postop SE.

Prediction

% of eyes within +/- 0.5D, +/-1.0D.....

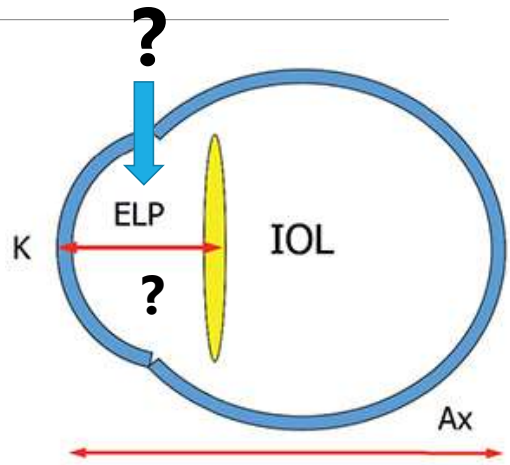
IOL power calculation (Fyodorov & Kolinko, 1967)

Fyodorov, 1975



IOL power calculation formulas (Fyodorov, 1975)

- Empirical
- Theoretical



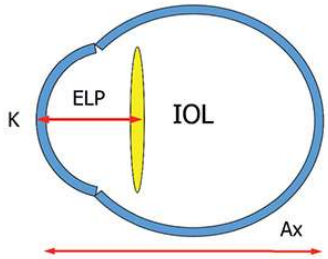
ELP

= Postop ACD

Formulas

- First generation: SRK, Binkhorst.
- Second generation: SRK II.
- Third generation: Hoffer Q, SRK/T, Holladay 1.
- Fourth generation: Haigis, Holladay 2, Hoffer H, Olsen.
- Fifth generation: Hoffer H-5, Barrett, Hill RBF, Ladas superformula.

Evolution of formulas



Evolution of **ELP**

Formulas

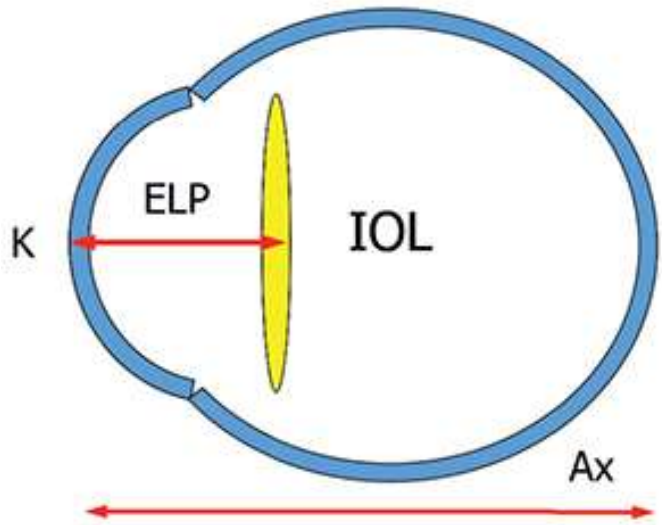
Assumptions

Assumptions

- ✗ ELP is the same (4mm) in all eyes for any IOL (SRK)
- ✓ ELP varies with "L" (SRK II, Binkhorst): longer in longer eyes and shorter in shorter eyes?
- ✓ ELP also varies with "K": Longer with steep and shorter with flat "K"?
- ✓ ELP also varies with preop ACD.
- ✓ ELP also varies with Lens thickness (LT).
- ✓ ELP also varies with horizontal W to W.

Effective Lens Position (ELP)

More significant with higher powers



The hyperopic eye

"A small eye":

With a small anterior segment: 20% (surgical difficulties)

With a normal anterior segment: 80% (IOL power difficulties…ELP)

Short eyes

…The Haigis, Hoffer Q, and Holladay 2 formulas are the best options for IOL power prediction in short eyes (<22 mm)..

Hoffer Q vs Haigis

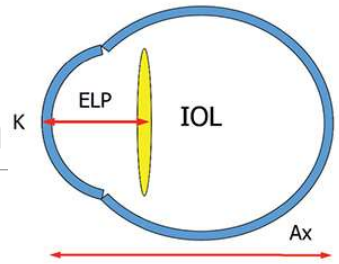
The Haigis formula becomes more accurate than the Hoffer Q in short eyes as the ACD gets shallower than 2.40 mm. (Eom et al, 2014)

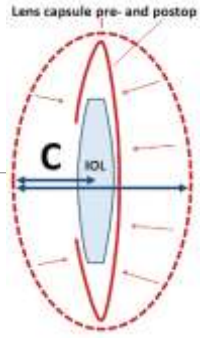
After LVC

Myopic ablation: Flat cornea + Large ELP

Hyperopic ablation: Steep cornea + Small ELP

The Olsen Formula



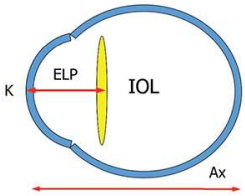


Lens thickness, "C-constant"

The Hoffer Q and Haigis formulas are less accurate than the Olsen formula in short eyes.

(Olsen &Hoffmann, 2014)

Evolution of formulas



Evolution of ELP

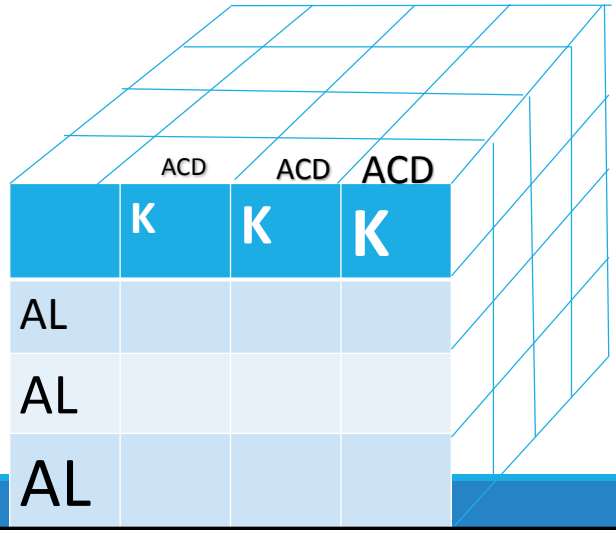
Predicting ELP

Anatomy of the individual eye

Classifying eyes?...variables?...2?.....

	K	K	K
AL			
AL			
AL			

Classifying eyes?...variables?...2?..3?....7?



Anatomical "Variables"

Measurable:

AL, K, ACD, LT, W-W

Non-measurable:

Ciliary body, zonular and capsular anatomy.

Postop capsular anatomy.

"Demographic variables"

Age

Sex

Race

"Special" eyes

We can classify eyes, but every eye is unique

Individual surgeon's A-constant

Same equipment, IOL, & surgical technique

- Record postop. Refraction
- Calculate A-constant for every case….average of 50 cases
- In subsequent cases, use the "individual A-constant instead of the one provided by manufacturer

Personal "A"

- Symmetry of "A" in fellow eyes
- The personalization is more of the eye than the surgeon

Personal “A”

- Operate on nondominant eye first
- Postop calculate personal “A”
- Apply Personal “A” to IOL calculations in the dominant eye

Human “races”

Caucasoid (White).

Negroid (Black).

Capoid (Bushmen/Hottentots).

Mongoloid (Oriental/ Amerindian).

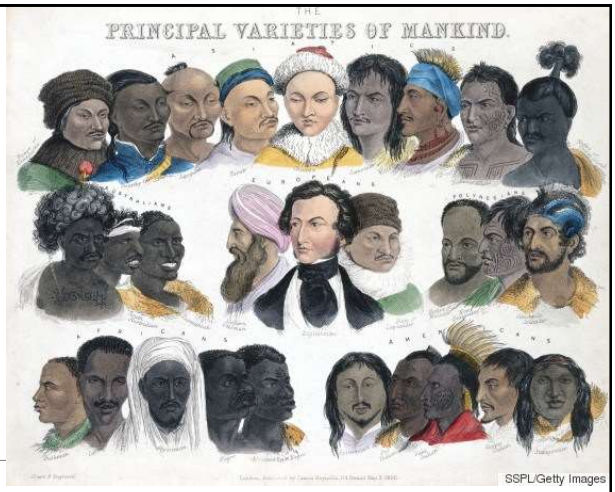
Australoid (Australian Aborigine and Papuan).

Subdivisions of "white" race

- Blond hair, white skinned, blue or grey eyes = Aryans/Nordic
- Dark haired, white skinned, brown eyed = Alpine
- Dark haired, suntanned/olive skinned, brown eyed, aquiline nose = Mediterranean
- Red hair, suntanned/olive or white skinned, brown eyes = Anglo-Celtic/Gaelic

SSPL/Getty Images

An individual?



Latest formulas

- Barrett Universal
- Hoffer H-5
- Hill-RBF
- Ladas Super Formula

Hill-RBF (radial basis function)

- A big-data/neural-net-based formula, data from thousands of eyes.
- Not a specific equation; but a method of using existing data to predict results for your set of measurements.

The Ladas Super Formula

Incorporates many existing formulas into a single equation that shifts your measurements into the right formula automatically.

"Best"

- To find, in a huge data base, an eye almost exactly the same as the eye you will operate on, and from experience with that eye, pick the best formula.
- Fellow eye of the same patient

Thank you