

INTRAOCULAR LENS POWER CALCULATIONS BEFORE CATARACT SURGERY IN PEDIATRIC PATIENTS

By

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**WHAT IS THE DIFFERENCE BETWEEN
PEDIATRIC AND ADULT EYES AS
REGARDING THE IOL POWER
CALCULATION ?**

**DEVELOPMENT OF THE EYE
AND
OCULAR GROWTH**

DEVELOPMENT OF THE EYE AND OCULAR GROWTH

AT DAY 22

*an optic groove forms within
the lumen of the forebrain*



OVER THE NEXT 3 DAYS

*the neural tube closes at
its caudal and cephalic ends*

DEVELOPMENT OF THE EYE AND OCULAR GROWTH

**At birth, normal newborns have the
following ocular parameters:**

- ❖ Axial length :16.8mm.
- ❖ Corneal steepness :55 diopters.
- ❖ Lens power :34 diopters.

DEVELOPMENT OF THE EYE AND OCULAR GROWTH

Newborn vs. adult ocular parameters		
	Newborn	Adult
Axial length	16.8mm	23.00mm
Mean K	55	43
Optic nerve length	24mm	30mm
Corneal diameter	10.0mm	10.6mm vertical by 11.7mm horizontal
Corneal thickness	0.581mm	0.510 mm
Pars plana length	0.5-1.05 mm	3.5-4mm
Orbital volume	7 cc	30 cc

DEVELOPMENT OF THE EYE AND OCULAR GROWTH

Postnatal Growth And Emmetropization :

- ❖ The refractive error of the newborn eye ranges from between -2.0 and +4.0 diopters.
- ❖ Within two years, this variability of refraction decreases and the mean value shifts so that the eye becomes closer to emmetropia .
- ❖ Most infants are born hyperopic and become near emmetropia by 6-8 years of age.

BASIC OPTICS FOR INTRAOCULAR LENS POWER CALCULATIONS

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❖ **Formulas for IOL power calculation are based on the accurate measurement of the corneal power and of the axial length (AL).**

❖ **All available formulas aim to calculate the exact power of an intraocular lens (IOL) that will produce postoperative emmetropia.**

**BASIC OPTICS FOR
INTRAOCULAR
LENS POWER CALCULATIONS**

❖ **The original formulas included theoretical and regression formulas.**

❖ **The modern theoretical formulas are more complex than the original and modified formulas.**

❖ **The most striking difference is the manner in which the estimated lens position (ELP), also known as the estimated postoperative anterior chamber depth ($\bar{A}CD$), is calculated.**

**BASIC OPTICS FOR
INTRAOCULAR
LENS POWER CALCULATIONS**

In pediatric eyes, no formulas were found to be more accurate than others although in a recent study Inatomi showed that the SRK/T formula was more accurate than empirical formulas in calculating IOL power in short eyes .

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

- ❖ **Predicting axial growth, and the refractive change that accompanies it, is one of the major challenges for long term care following pediatric cataract surgery.**
- ❖ **As the age of implantation in children decreases the selection of the appropriate intraocular lens power becomes more important.**

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

❖ **Axial elongation and changes in corneal curvature are major factors in influencing refractive changes in the first few years of life.**

❖ **changes in keratometry values and axial length have opposing consequences for the refractive state of the eye.**

➤ *Increasing axial length lead to a myopic shift .*

➤ *Decreasing keratometric values lead to a hyperopic shift.*

Overall, the changes in axial length appeared to outweigh for the progressive corneal flattening with age.

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

DIFFERENT OPTIONS

A. The Patient May Be Made Emmetropic At The Time Of Implantation

<u>Birth</u>	34.3 D
0-1 yr	28.7 D
1-2 yr	26.4 D
2-3 yr	23.0 D
3-4 yr	22.1 D
4-5 yr	20.9 D
5-6 yr	19.5 D

**IOL power at different ages
to achieve emmetropia**

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

BUT

A significant myopic shift can be expected into the teenage years

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

DIFFERENT OPTIONS

B. Using the powers appropriate to adults will avoid the future myopic shift

BUT

This will produce high levels of hypermetropia during the first few years of life

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

DIFFERENT OPTIONS

C. Choosing partial under correction at the time of surgery will tend to minimize the amount of anisometropia in both the immediate postoperative period and later in life .

This is of particular importance in the case of unilateral pseudophakia to avoid problems of spectacle induced aniseikonia

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

DIFFERENT OPTIONS

In the study of Flitcort and associates, a correction was made to the calculated IOL power on the basis of the age of the child at the time of surgery to achieve the following postoperative refraction;

AGE	Target postoperative refraction (diopters)
<2 yr	+ 4.00
2-4 yr	+3.00
4-6 yr	+2.00
6-8 yr	+1.00
>8 yr	emmetropia

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

DIFFERENT OPTIONS

➤ **This can be attained by :**

- ❖ In the first year of life 6 D were subtracted from the calculated IOL power.
- ❖ From 1 year to 4 years 3 D were subtracted.
- ❖ From 5 to 12 years 1 D was subtracted.

CHOICE OF IOL POWER IN PEDIATRIC CATARACT

DIFFERENT OPTIONS

According to the study of Dahan and Drusedau, undercorrection is done in a certain percentage from the calculated IOL power .This percentage is determined according to the age of the child as follows :

Age	Dahan and Drusedau
≤ 1 year	20 % undercorrection
1-2 years	20 % undercorrection
3-4 years	10 % undercorrection
5-6 years	10 % undercorrection
7-8 years	10 % undercorrection

Errors in calculating IOL power may arise in several ways

1- Instrumentation error:

The steeper corneas of infants may result in inaccuracy although the overall effect is likely to be small in calculation of IOL power

2- Formula error:

It has been shown that the 3rd generation theoretical formulas are more accurate for short eyes. This is attributed to their improved prediction of post operative anterior chamber depth (ACD).

3- Effect of iol implantation on ocular growth

Intraocular positioning of the IOL will affect the prediction error, with sulcus fixation producing a relative myopic shift from the estimated refraction.

OTHER ALTERNATIVES

PIGGY BACK LENSES

- ❖ Piggy back lenses can either be placed primarily or the second lens placed secondarily over a previously healed IOL.
- ❖ Primary piggy back lenses need special calculations to adjust for the posterior lens shift.
- ❖ Secondary lenses can be calculated using the refraction formula or by a more simple formulation based on the fact that the healed primary IOL is more stable.

OTHER ALTERNATIVES

MULTIFOCAL IOLS

- ❖ **Multifocal (IOLs) were introduced 2 decades ago and have gone successfully in presbyopes.**
- ❖ **Newer versions of the multifocal IOLs offer better vision at distance, intermediate, and near .**
- ❖ **Multifocal IOL implantation in children is still under trials.**

THANK YOU