Predicting the IOL power to be implanted in pediatric cataract aiming the desired refraction in adulthood.

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Abstract

This article approaches the development of a model for axial length growth from pseudophakic children's eyes by primary Intraocular Lens (IOL) implantation. The aim is to guide the power of the IOL to be implanted at the surgery to reach the desired refraction in adulthood.

Keywords: Intraocular lens, Pediatric Cataract, Hyperopia, Rate of refractive growth.

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Commentary

The implantation of intraocular lenses in children has become increasingly common thanks to the technological development of surgery and intraocular lenses (IOL); however, the biometry and the choice of the IOL power to be implanted remains a great challenge [1].

In children, residual hyperopia is recommended at the time of surgery in order to minimize the myopic shift that will occur with the growth [1] but how much hyperopia should be considered?

McClatchey et al. developed logarithmic models based on the aphakic refraction of children undergoing cataract surgery to indirectly estimate the Axial Length (AL) growth; at that time, only postoperative refractive measures were available. Based on aphakic refractions measured during the eye growth, the authors created a Rate of Refractive Growth (RRG) to predict the myopic shift and recommend residual hyperopia values, according to the age, after IOL implantation in children in order to avoid major myopia in adulthood [2-4].

The recently published article "Predicting future axial length in patients with paediatric cataract and primary intraocular lens implantation" explores the same model, but using AL measurements from pseudophakic children by primary implant to estimate directly the AL growth and create a Rate of Axial Length Growth (RALG) [5].

Unlike the previous model, which recommends the same hypermetropic residual for all children of the same age [2-4], the current model considers the initial measure of AL for future estimates [5] because, for example, not every 3-month-old child will need a hyperopic residual of +9.00 for emmetropia in adulthood; the initial AL has an important influence on this estimate. Assuming that a child at 3 months of age (0.25 years old) has an AL of 17 mm, using the RALG model [5], the AL estimated for the adulthood (21 years old) is 23.34 mm; using an average keratometry (K) of 43 for adulthood [6], the estimated IOL for emmetropia in adulthood is +22.00 D (SRK-T formula and cte 118). If this IOL is implanted in the child, it will have a hypermetropic residual of +13.00 D, assuming that at this age the average keratometry is 48.5 D [6]. However, if the AL at 3 months of age is 18 mm and not 17 mm, the hyperopic residual will be + 11.50 D, following the same calculations.

RALG model for future AL calculation [5]

AL=Initial AL+RALG x log10 ((age+0.6)(initial age+0.6))

Where:

AL=Axial Length at desired future age (mm)

Initial AL=measured AL at surgery (mm)

RALG=Calculated Rate of axial length growth=4.51

Age=future age desired (years)

Initial age=age at surgery (years)

Observation: 0.6 years was added to the ages because the AL growth starts in the uterus and not at the birth.

Another possible advantage of the model is that using estimated AL and K values for adulthood, the calculations should be more accurate since these formulas were made for adults and they are inaccurate in calculations for children.

Recent advances in optical biometers allow non-invasive measurement of AL. Obtaining these measures in children after a cataract surgery should be encouraged because only with a large amount of data, we can improve the predictability of the models.

Differences in AL growth in different groups, such as unilateral and bilateral cataract eyes, eyes with different initial AL, eyes of different races and different sexes, have not yet been statistically proven [5,7-9]. A large number of measurements may demonstrate statistical differences among them and make it possible to individualize different RALGs for each group.

Keratometry has less influence than AL in IOL power calculation; however, serial keratometry measurements can also lead to the development of similar models to predict future keratometry, improving the IOL power estimates to be implanted.

It is important to highlight that the article presents a model that can be used to guide the choice of IOL power, but the number of eyes used in the model was limited and the model should be improved enlarging the sample. Other factors must also be taken into account when choosing the power of the IOL to be implanted, for example, the refractive status of the fellow eye and difficulties that can be encountered in combating amblyopia.

Conclusion

The article shows a model for estimating AL growth and predicting IOL power to be implanted in children with cataracts to reach a chosen refractive target in adulthood. Periodic AL measurements of pseudophakic children's eyes should be encouraged to expand the samples and improve the predictability of the models.

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