Original Article

Myopic Shift After Intraocular Lens Implantation in Children Less Than Two Years of Age

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Abstract

Purpose: The purpose of this study was to evaluate the myopic shift over a period of 2 years following implantation of intraocular lens (IOL) in children less than 2 years of age with axial length less than 22 mm. **Method:** A retrospective analysis of records of children below 2 years of age with axial length less than 22 mm who had undergone cataract surgery with primary IOL implantation over a period of 7 years was undertaken. Mean myopic shift was analyzed at 6 months, in first year, second year and end of 2 years following surgery. **Results:** Total 40 eyes of 23 children were included (mean age 13.55±7.38 months); with mean myopic shift at end of 2 years -2.35±2.15. Myopic shift in eyes with undercorrection in range of 3-4 D (group-I) and 5-7 D (group-II) was compared using Mann-Whitney test. Mean myopic shift at end of 2 years was -2.93±2.55 in group-I and -1.88±1.77 in group-II (p value not significant). There was no significant difference in myopic shift between two groups at 6 months and 1 year; a borderline significant difference was found in second year (p= 0.04).
Conclusion: In our study amount of myopic shift in first two years in children with axial length less than 22 mm is below the expected normal. There was not much significant difference in the myopic shift over a period of 2 years in eyes, which were undercorrected by 3-4 D against those with 5-7 D. Thus aiming for less residual hyperopia by less undercorrection did not increase myopic shift. Thus high-level hyperopic glasses in the early years could be avoided and help in prevention of amblyopia after paediatric cataract surgery.

Introduction

Paediatric eyes undergo significant refractive changes in early years and in order to achieve a satisfactory long term refractive outcome after implantation of intraocular lens (IOL) in young children, there is need to allow for axial growth and myopic shift (McClatchey SK et al. 1997; Vanderveen DK et al. 2013). Despite recent advances in microsurgical technique and a much better in-depth understanding of growth of eye, the advisability of IOL implantation in children less than 2 years of age is still being questioned (Ashworth JL et al. 2007;

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Kekunnaya R et al. 2012; Neely DE et al. 2005; Mezer E et al. 2004).

The reason for debate is the myopic shift that occurs in paediatric pseudophakic eyes which is largely attributable to axial elongation, which mostly occurs in the first 2 yrs of life. It has been studied that in the follow up of 1 to 7 years, the myopic shift occurred in range of 4 to 7 Dioptres (D) and the majority of it happened in the first two years (McClatchey SK et al. 1997; Nihalani BR et al.2010). Keeping this in view, it has been accepted that an IOL with an undercorrection of 5 to 7 D is required. It's thus required that near dominant glasses of +8 to +10 D are prescribed in infants less than 2 years of age after putting an IOL. However problems encountered are the inability on the part of children to wear such high hyperopic glasses and the chances of such residual high hyperopia causing amblyopia and also persistence of high hyperopia with failure of emmetropisation.

We conducted this retrospective study with an aim to evaluate the myopic shift occurring in the first two years after IOL implantation in children less than 2 years with axial length less than 22 mm who had undergone cataract surgery with primary IOL implantation over a period of 7 years at our institute.

Methodology

We retrospectively analyzed records of children less than 2 years of age and axial length less than 22 mm who underwent cataract surgery with primary intraocular implantation over a period of 7 years (May 2007 to May 2014) at our centre with a follow-up of minimum of 6 months. Both unilateral and bilateral cataracts were included. Excluded patients were those with traumatic cataract, with other associated ocular abnormalities like glaucoma, uveitis, retinal or optic nerve pathology, with intraocular congenital abnormalities like Persistent hyperplastic primary vitreous (PHPV) and those without primary intraocular lens implantation. A prior approval was obtained from the Institutional Review board.

As per the standard operating policies (SOPs) of our institute, all children undertaken for cataract surgery underwent a detailed pre-operative evaluation including dilated slit lamp examination, fundoscopy, tonometry and biometry. Mean of 3 readings of keratometery using hand held keratometer and average of 10 readings for A-scan by applanation were used for IOL power calculation under the same general anaesthesia sitting as that of cataract surgery. IOL power was calculated according to standard formulae–SRK-II, SRK-T and undercorrected depending on age at surgery with consideration to the refractive status of the other eye.

All surgeries had been performed by the same surgeon (SG) using the standard technique of phacoaspiration of lens matter with a corneo sclera tunnel with manual posterior capsulorhexis and anterior vitrectomy with primary intraocular implantation in bag. Post-operative refraction had been done at end of 6 weeks after removal of suture from the main wound.

All relevant data were collected from the case sheets and recorded. This included age at time of surgery, axial length (in mm), Keratometry (in D), IOL power implanted and post operative refraction (spherical equivalent). Myopic shift was noted at end of 6 months, 12 months, 18 months and finally at end of 2 years. All relevant data was entered in SPSS software and statistical analysis was performed using STATA software.

Results

A total of 39 files were analysed containing data of 68 eyes of 39 children. The age at surgery ranged from 2 months to 24 months with a mean age of 13.5± 7.38 months. There were 24 males and 15 females; 32 children had bilateral cataract. The various clinical characteristics

and parameters studied are described in Table-I.

Myopic shift: Children with minimum follow up of 6 months were included to study the myopic shift; a total of 40 eyes had a follow up of 6 months. Out of these 28 eyes were followed for a period of 1 year and 18 eyes had a follow up of 2 years. These 40 eyes were further grouped into two depending on the amount of undercorrection done at the time of implantation of IOL; group-1 included 23 eyes which have been undercorrected by a factor of 3-4 D while group-2 included 17 eyes which had been undercorrected by 5-7 D. The myopic shift at follow up of 6 months, 12 months, 18 months and 24 months was calculated and compared between the two groups using the Mann- Whitney test. The mean myopic shift for all 40 eyes studied has been described in table-II.

The Mean myopic shift was -0.78± 1.2 at the end of 6 months, -1.66±1.7 in the 1st year and -0.75±1.06 in the 2nd year and the total myopic shift for 2 years for all 40 eyes was -2.35± 2.15 (table-II). This shows that maximum myopic shift is seen in the first year post surgery. The difference in the myopic shift between both the groups has been described in Table number-III. Mann- Whitney test was used to compare the myopic shift at the desired period between the two groups and p-value of < 0.5 was considered statistically significant. Only the myopic shift at 2nd year after surgery was different in the two groups.

Discussion

Although the evolution of surgical techniques has made primary implantation quite popular and possible in paediatric population below 2 years of age, the postoperative target refraction accuracy and emmetropisation of refractive error are still the two debatable issues. The refractive strategy of undercorrecting the calculated IOL power to leave residual hyperopia is usually dealt by the addition of spectacles correcting for near focus. It has been reported that a 0.4 to 0.7 D of myopic shift is seen in infant pseudophakic eye in the first month with slower but continued shifts after the first year and low to moderate myopia is anticipated by the second decade (Nihalani BR et al. 2010; Gavin EA et al. 2008; Tromans C et al. 2001). Previous studies by Lambert and associates (Lambert SR et al. 2004) and Ashworth et. al. (J L Ashworth et al. 2007) have reported a mean myopic shift of 5.49 and 5.43± 3.7 in the first 12 months after IOL implantation in children below 12 months to 24 months of age. Thus in most of studies an under correction by +6 to +8 has been done to aim for residual hyperopia which emmetropises with time; IATS included infants with unilateral cataract and was a prospective study (Vanderveen DK et al. 2013). The expected refraction was +8D for children from 4-6 weeks of age and was +6 for those more than 6 weeks old. 43 eyes with IOL implantation were included with mean age of 2.5±1.5 months with mean axial length of 18.1± 1.1 mm.

Table 1: Clinical characteristics of children operated for paediatric cataract

Parameter	Mean±Standard Deviation	Range
Keratometery (D)	44.40 ± 1.85	40.62 to 49.50
Axial Length (mm)	19.82 ± 1.42	16.93 to 21.91
IOL Power (D)	28.40 ± 4.92	20 to 40
Under correction (D)	4.88 ± 2.97	1 to 17
Post-Operative refraction (SE)	3.35 ± 2.38	-2.5 to 9

Table 2: Myopic shift seen at the end of 6 months, 1 year and 2 years post Cataract Surgery in shorter eyes in children less than 2 years

	n	Myopic shift Mean ±SD; median
6 months	40	-0.78 ± 1.2; - 0.5
12 months	28	- 1.66 ± 1.7; -1.25
18 months	18	-0.75 ± 1.06; -0.5
24 months	18	-2.35±2.15; -1.875

Table III: Myopic shift seen at the end of 6 months, 1 year and 2 years post Cataract Surgery in the two groups divided on the basis of amount of under correction done in shorter eyes in children less than 2 years.

	Myopic Shift at 6 months N; Mean±SD; Median	Myopic Shift at 1 year N; Mean±SD; Median	Myopic Shift at 2 years N; Mean±SD; Median	Total Myopic Shift at the end of 2 years N; Mean±SD; Median
Group-1 n= 22	23; -0.875±1.34; -0.5	19; -1.78 ± 1.78; -1.62	8; -1.29±1; -1.12	8; -2.93±2.55; -2.25
Group 2 n= 17	17; -0.65±1.2; -0.5	9; -1.38±1.59; -1	10; -0.31± 0.93; 0	10; -1.88±1.77; -1.5
P-value	0.84	0.45	0.04	0.47

In our study we found a mean myopic shift of -0.78±1.2SD in the first 6 months, -1.66±1.7SD in the first year and -0.75±1.06 SD in the second year with mean total myopic shift of -2.35±2.15SD in the two years post IOL implantation, this shows that maximum myopic shift is seen in the first year post surgery but it continues at a constant but slower rate in the second year. In our study the mean myopic shift was lesser as compared to previous studies. The mean target refraction for 68 eyes in our study was 4.88±2.97, with a wide range of 1-17D. To evaluate the amount of myopic shift in the eyes which were undercorrected lesser to normal, only 40 eyes with a range of target refraction of +3 to +7 D were included and were grouped into two: 17 eyes with undercorrection of 5 to 7 D and 22 eyes with undercorrection of 3 to 4 D. The mean total myopic shift seen in the group of eyes, which were undercorrected, less in our study was 2.93±2.55 SD while it was 1.88±1.77 in the group which was undercorrected more.

There was no significant difference seen in the two groups suggesting that less hyperopic target refraction can be aimed to prevent amblyopia in this age group due to inability on the part of children to wear glasses with higher refractive powers.

There are certain limitations of our study. This study was a retrospective study, so progressive axial length measurements could not be

documented. The sample size chosen to study the myopic shift was 40 eyes, but only 18 eyes have follow up for 2 years post surgery which is a small sample size in terms of extrapolating the result but no clinical and statistical significant difference in the myopic shift was seen which shows that more studies can be planned to evaluate the myopic shift in children below 2 years of age who have been undercorrected from 3 to 4 D to aim for residual hyperopia of +6 to +8 D (with near add). There is a scope of taking this study forward to evaluate and compare the visual outcomes in these two groups as the rationale of undercorrecting less is to get best visual outcome if all amblyogenic factors can be removed.

Conclusion

There was not much significant difference in the myopic shift over a period of 2 years in eyes which were undercorrected by 3-4 D against those with 5-7 D. Thus aiming for less residual hyperopia did not increase the anticipated high myopic shift. Thus high level hyperopic glasses in the early years could be avoided and help in prevention of amblyopia after paediatric cataract surgery.

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