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CLINICAL STUDY

Changes in astigmatism after congenital cataract surgery and intraocular lens implantation using scleral tunnel incision

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Abstract

Purpose **To evaluate the post-operative changes in astigmatism in pseudophakic eyes in children. Only eyes with astigmatism of 3.0 D or more were included in the study.**
Methods **The charts of children who had undergone surgery for non-traumatic cataract, using a scleral tunnel method were retrospectively reviewed. In 11 eyes with astigmatism of 3.0 D or more, the refraction was tested and recorded at 1 week, 3 months and 5 months post-operatively. The paired *t*-test was used to compare between the variables.**
Results **Mean astigmatism 1 week post-operatively was 5.8 ± 3.6 D (range 3.0–14.0 D). Thereafter, the astigmatic component of the refractive error underwent a spontaneous steady decline, reaching a mean value of 2.1 ± 1.3 D (range 1–4.0 D) 5 months after surgery. The change in the difference between the mean values at 1 week and at 5 months was statistically significant ($P < 0.005$).**
Conclusion **Children who underwent congenital cataract surgery and intraocular lens implantation showed a significant spontaneous reduction in astigmatism post-operatively.**
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Keywords: congenital cataract; surgery; astigmatism

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Introduction

Corneal astigmatism is a well-documented finding after cataract surgery in adults. The amount of astigmatism depends on various factors, such as the type and location of the surgical incision, the amount of scleral cauterization performed, the suturing material and suture placement, use of steroids postoperatively.[1–3] The preoperative existing astigmatism also influences the postoperative refractive error of the child. Only mild spontaneous changes in the amount of astigmatism have been described in adults.[4–5] An effective way to reduce or eliminate the post-operative astigmatism is by the removal of one or more interrupted or continuous sutures.[6–9] Removal of sutures was recommended only in eyes with astigmatism of at least 3.0 D.[7,10] Suture removal relieves wound compression, thereby altering the corneal curvature. In this study we describe the changes in astigmatism that occurred without suture cutting after congenital cataract surgery and intraocular lens (IOL) implantation.

Materials and methods

The charts of 24 children (34 eyes) who underwent surgery for congenital cataract between 1996 and 1999 were reviewed. All eyes with astigmatism of 3.0 D or more 1 week after surgery were included in the study. There were no other ocular or systemic abnormalities in the study population. All patients had undergone a uniform procedure for extracapsular cataract extraction and IOL implantation. A fornix-based conjunctival flap had been formed, and after mild local diathermy a 6-mm scleral groove was made with No. 64 Beaver blade 2 mm from the limbus. The incision depth was one third to

one half scleral thickness. A scleral pocket was then constructed with a crescent knife (Alcon, Fort Worth, TX, USA) and dissection extended into the clear cornea for 1 mm. Two paracentesis ports were performed at the limbus at 2 and 10 o'clock. An anterior chamber maintainer (Visitec, Warwickshire, UK) was used and capsulorhexis was performed with a bent 25-gauge needle. All lens material was aspirated with the Anis aspirating cannula (Storz, St Louis, MO, USA). Posterior capsulotomy and anterior vitrectomy were performed with the ocutome (Coopervision, Irvine, CA, USA) in seven eyes. Through the scleral tunnel the anterior chamber was entered with a 3.2-mm keratome (Visitec). An IOL (Balance type, Hanita Lenses, Kibbutz Hanita, Israel) was implanted; an effort was made to implant the IOLs in the bag and most of the IOLs were placed in the bag. However, there were cases where the IOLs were placed in the sulcus. The scleral incision was closed with three or four interrupted 10/0 Mersilene sutures (Ethicon, Edinburgh, Scotland, UK), and the conjunctiva was replaced without suturing. Paracentesis incisions were not sutured. All operations were performed by the same surgeon (AS), using the same surgical technique. Postoperatively, all patients were treated with dexamethasone and neomycin eye drops, six times a day for 1 week and then four times a day for 2 more weeks.

The refractive error of the operated eye was tested (as part of the complete eye examination) with the streak retinoscope, at 1 week and then on average every 1–2 months for 6 months, after dilation of the pupil with 0.5% tropicamide. All refractive errors were corrected with spectacles 1 month after surgery, and treatment for amblyopia was instituted when indicated. No sutures were removed during follow-up.

The paired *t*-test was used to compare the variants at the different postoperative periods.

Results

When examined 1 week after surgery, 11 eyes (nine children) had astigmatic error of 3.0 D or more, and were therefore included in the study. In seven of the eyes there was with-the-rule post-operative astigmatism. The age range of these children was 2–10 years (mean 5.2 years). There were five males and four females. In all cases the surgical and post-operative course was uneventful, and no complications were noted.

One week after surgery mean astigmatism was 5.8 ± 3.6 D (range 3–14 D). The mean refractive error declined to 2.8 ± 1.4 D (range 1.25–5 D) at 3 months post-operatively, and to 2.1 ± 1.3 D (range 1–4 D) at 5 months post-operatively. No significant further decline was recorded 1 year after surgery. The refractive errors of the individual patients are summarized in Table 1.

The observed changes in astigmatism were statistically significant between 1 week and 3 months ($P = 0.023$) and between 1 week and 5 months ($P < 0.005$). No significant change was found between 3 months and 5 months ($P = 0.27$).

Discussion

In this study post-operative corneal astigmatism spontaneously decreased from a mean value of 5.8 D 1 week after surgery to 2.1 D 5 months postoperatively, the majority of this decrease occurred during the first 3 months after surgery. The amount of immediate post-operative astigmatism and its subsequent changes are affected by factors such as the surgical technique, type of suture used, and the experience of the surgeon.[1–3,11] The present series was comprised of children who had undergone surgery performed by the same surgeon using the identical surgical technique, sutures and IOL type in each case. Any changes in astigmatism that occurred in this uniformly operated group could, therefore, be considered as spontaneous, and not affected by any specific surgically dependent variable. Most of the eyes in the series had post-operative with-the-rule astigmatism and in three the astigmatism shifted towards against-the-rule. This shifting phenomenon has previously been described in adults.[10] Using retinoscopy as a method for measuring astigmatism, resulted in the measurement of both corneal and lenticular astigmatism.

The finding of post-operative astigmatism is important, especially in children, because of its adverse effect on vision development and the attendant risk of

Table 1 Astigmatism in children after congenital cataract surgery and intraocular lens implantation

Eye No.	*Age (years)*	*Post-operative astigmatism*		
		At 1 week	*At 3 months*	*At 5 months*
1	4	−5.25	−4.25	−4
2	2	−5	−1.25	−1
3	7.5	−3.75	−1.5	−1.25
4	6	−3	−2.25	−1
5	6	−3	−1.75	−1.5
6	10	−11	−4.25	−4
7	6	−14	−4.25	−1.25
8	4.5	−6	−5	−4
9	4	−3	−2.75	−3
10	4	−3	−2	−1.5
11	3	−7	−1.5	−1
Mean ± SD	5.2 ± 2.2	−5.8 ± 3.6	−2.8 ± 1.4	−2.1 ± 1.3

amblyopia.[12] In adults, a few months of delay in refractive error correction has no effect on the final visual acuity, whereas in children precise refractive optical correction must be made as soon as possible.

Accordingly, all our patients received their refractive correction after surgery, and any further changes in astigmatism were promptly followed by changes in the refractive correction. On the other hand, whereas post-operative surgical astigmatism in adults can be corrected by removal of one or more sutures in a simple office procedure,[6,7] in children this procedure usually requires general anaesthesia. Only mild spontaneous regression of post-operative astigmatism has been described in adults. Without suture cutting, mean changes of only 0.5 D[4] and 1.25 D[5] were reported during the first year after cataract surgery. In our paediatric series, an average spontaneous decline in astigmatism of 3.7 D was observed 5 months after surgery. The following factors might have contributed to this marked spontaneous regression in post-operative astigmatism: (1) The ocular tissues in children exhibit a high degree of elasticity. In adults, wound compression caused by the sutures does not change over time, whereas in children, because of the elasticity of the cornea and sclera, the tissue tension may spread evenly to neighbouring areas, reducing the amount of astigmatism. (2) Growth of the globe continues in children (but not in adults) under constant centrifugal intraocular pressure, and results in a more spherical growth of the eye, thereby diminishing the amount of astigmatism. This factor may be particularly important in young children.

In adults, correction of astigmatism is advised by suture removal. The findings of the present study strongly suggest that in children removal of sutures is not required, since ocular astigmatism spontaneously regresses a few months after surgery. This also eliminates the need for the general anaesthesia that is usually necessary for suture removal in children. We recently published similar results[13] in children in whom cataract surgery was performed by a similar technique, except that instead of creating a scleral tunnel we made a corneal incision using scissors. In the previous study,[13] astigmatism decreased from 6.2 D to 1.2 D at 1 week and 5 months after surgery, respectively.

In this study there are some limitations: this is a retrospective study, preoperative astigmatism of the patients was unknown and the subtraction method was used for calculating the astigmatism.

We are currently using a clear corneal incision with foldable IOL, and are comparing the results with those obtained using a corneal incision or scleral tunnel.

Summary

It was reported[3] that mean astigmatism 1 month after surgery in adult eyes operated on through a corneal incision was significantly higher than in eyes operated on through a scleral incision. However, the mean final astigmatism did not differ significantly between these two groups. In our studies this difference between the two surgical techniques was not found. Mean astigmatism 1 week after surgery was 6.2 D and 5.8 D in patients undergoing surgery with corneal incision[13] or scleral tunnel, respectively, but this was not statistically significant ($P = 0.79$). A similar grade of astigmatism was found in both groups at 3 and 5 months post-operatively.

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