Changes in Astigmatism After Congenital Cataract Surgery and Intraocular Lens Implantation

A Comparative Study

Abraham Spierer, MD; Shai M. Bar-Sela, MD

Objective: To evaluate the postoperative changes in astigmatism in the pseudophakic eyes of children who underwent 1 of 3 different types of surgical incisions for congenital cataract extraction with intraocular lens implantation, and in whom astigmatism of at least 3 diopters (D) was recorded 1 week after the operation.

Methods: We retrospectively reviewed the medical records of all the children in our department who had undergone surgery for nontraumatic cataract between 1992 and 2001. Cataract surgery with intraocular lens implantation was performed using 1 of 3 types of surgical incisions: a limbal incision, a scleral tunnel, or a clear corneal incision allowing the use of a foldable intraocular lens. In 28 children (32 eyes) aged 2 months to 11 years (mean±SD, 4.7±3.4 years), astigmatism of 3 diopters or more was found when assessed 1 week after surgery. The refraction was measured and recorded again 3 months and 5 months after surgery. The paired t test was used to compare the outcome variables.

Main Outcome Measures: Refractive error 1 week, 3 months, and 5 months after surgery.

Results: Mean±SD astigmatism 1 week postoperatively was 5.8±2.2 D, 5.1±2.1 D, and 4.0±1.3 D in groups 1, 2, and 3, respectively. Thereafter, the astigmatic component of the refractive error underwent a spontaneous decline, reaching mean±SD values of 0.9±1.0 D, 1.6±1.6 D, and 1.0±0.8 D, respectively, in the 3 groups 5 months after the operation. The difference between the mean values at 1 week and at 5 months in each group was statistically significant (P<.001 in group 1; P=.01 in group 2; and P<.001 in group 3).

Conclusion: Children who underwent extraction of congenital cataract and intraocular lens implantation by different surgical techniques showed a significant spontaneous reduction in astigmatism postoperatively.

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CORNEAL ASTIGMATISM AFTER cataract surgery is a well-documented finding 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 used, suture placement, and postoperative use of steroids. In children as well as in adults, a preoperative existing astigmatism also influences the postoperative refractive error.

In adults, only mild spontaneous changes in the amount of postoperative astigmatism have been described. An effective way to reduce or eliminate the postoperative astigmatism is through the removal of 1 or more interrupted or continuous sutures. This procedure relieves wound compression, thereby altering the corneal curvature. Suture removal is recommended only in eyes with postoperative astigmatism of at least 3 diopters (D).

Recent reports have documented the finding of spontaneous regression in astigmatism after cataract surgery in children. These studies reported the changes in astigmatism that occurred without suture removal after cataract surgery and intraocular lens (IOL) implantation in children with cataract.

METHODS

The medical records of all 73 children (112 eyes) who underwent surgery for congenital cataract between 1992 and 2001 were reviewed. All eyes found to have astigmatism of at least 3 D one week after surgery were included in the study. There were no other ocular or systemic abnormalities in the study population.

All patients had undergone extracapsular cataract extraction and IOL implantation. Three types of surgical incisions were used. The following procedure was common to all techniques. Two paracentesis ports were opened at the limbus at the 2- and 10-o’clock positions. An anterior chamber maintainer (Vis-
The refractive error of the surgically treated eye was measured with a keratometer (Vitoron; Cooper-Vision, Irvine, Calif). The corneal incision was closed with interrupted 10-0 sutures (Mersilene; Ethicon, Edinburgh, England) was used, and capsulorrhexis was performed with an aspirating cannula (Anis, Storz, St Louis, Mo). In some eyes, posterior capsulotomy and anterior vitrectomy were performed with a vitrector instrument (Occutome; Cooper-Vision, Irvine, Calif). The corneal incision was closed with interrupted 10-0 sutures (Mersilene; Ethicon, Edinburgh, Scotland).

In group 1 (27 children, 45 eyes), the following modifications were made. A fornix-based conjunctival flap was formed and a partial-thickness incision was made at the limbus with a No. 64 Beaver blade (Sable Industries, Oceanside, Calif). The corneal incision was enlarged with scissors. In group 2 (24 children, 33 eyes), we modified the method by creating a scleral groove 2 mm from the limbus with a No. 64 Beaver blade. A scleral pocket was constructed with a crescent knife, and dissection was extended for 1 mm into the clear cornea. Using a 3.6-mm keratome (Visitec), the anterior chamber was entered through the scleral tunnel. In group 3 (22 children, 34 eyes), the cornea was entered at the 12-o’clock meridian just anterior to the terminal ends of the conjunctival blood vessels as they cross the limbus. A balance-type IOL (Hanita Lenses, Kibbutz Hanita, Israel) was implanted in the eyes of groups 1 and 2, and a foldable IOL (AcrySof, Alcon, Tex) was used in group 3. In most cases, the IOL was implanted in the capsular bag, but in some cases, it was placed in the sulcus.

All operations were performed by the same surgeon (A.S.), using the same surgical technique modified as described for each group. All patients were treated postoperatively with dexamethasone sodium phosphate and neomycin sulfate eye drops applied 6 times a day for 1 week and then 4 times a day for an additional 2 weeks and with 0.5% tropicamide twice a day for 2 weeks.

The refractive error of the surgically treated eye was measured (as part of a complete eye examination) with a streak retinoscope 1 week after surgery and then, on average, every 1 to 2 months for 5 months after dilution of the pupil with 0.5% tropicamide. In all patients, the refractive error was 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 outcome variables at the different postoperative periods.

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Limbal Incision (n = 8)</th>
<th>Scleral Tunnel (n = 9)</th>
<th>Clear Corneal Incision (n = 11)</th>
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<tbody>
<tr>
<td>Postoperative astigmatism, D</td>
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<tr>
<td>At 1 wk</td>
<td>5.8 ± 2.2 (3.0-10.0)</td>
<td>5.1 ± 2.1 (3.0-9.0)</td>
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<td>At 3 mo</td>
<td>1.7 ± 1.7 (0.0-4.0)</td>
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<td>At 5 mo</td>
<td>0.9 ± 1.0 (0.0-3.0)</td>
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Abbreviation: D, diopeters.

*Values are expressed as mean ± SD (range) unless otherwise indicated. The P values represent the statistical significance of the astigmatism change during the first 3 postoperative months as opposed to the following 2 months.

†Patients’ astigmatism was at least 3 D.

When examined 1 week after surgery, 32 eyes (28 children [14 boys and 14 girls]) had astigmatic errors of 3 D or more and were therefore included in the study. In 4 patients (1 patient each in groups 1 and 3, and 2 patients in group 2), both eyes were operated on with the same technique. In these cases, the 2 eyes were averaged for the analyses. Thus, 28 cases were included in the study. The children were aged 2 months to 11 years (mean±SD, 4.7±3.4 years). Mean±SD ages in the 3 groups were 6.8±3.6, 3.2±2.8, and 3.5±2.7 years, respectively. In each case, both the surgical and the postoperative course were uneventful, and there were no complications.

The Table presents the mean values and ranges of astigmatism after surgery in the different groups. The eyes in all 3 groups showed a decline in mean astigmatism with time. In all 3 groups, the mean change in astigmatism was greater during the first 3 postoperative months than during the following 2 months (Table). The observed changes in astigmatism between 1 week and 5 months after surgery were statistically significant in all 3 groups (P < .001 in group 1; P = .01 in group 2; and P < .001 in group 3).

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The immediate postoperative astigmatism and its subsequent changes are affected by factors such as the surgical technique, type of suture used, and experience of the surgeon.1-3,13 Cataract surgery in children, with or without anterior vitrectomy, can be done through small limbal incisions.13 For IOL implantation, the incision must be enlarged in accordance with the diameter of the lens to be implanted. Postoperative astigmatism may be affected by the width of the incision constructed in the sclera and the need to suture this cut in children. The relatively small astig-
matism reported after scleral tunnel in other studies may have been attributable to sutureless surgery.\textsuperscript{15-17}

In the present study, postoperative astigmatism showed a spontaneous decrease during the period between 1 week and 5 months after surgery, with most of this decrease seen during the first 3 months. The decline in astigmatism occurred in all patients regardless of the mode of surgical incision. Astigmatism declined in groups 1, 2, and 3 from 5.8 D, 5.1 D, and 4.0 D, respectively, 1 week after surgery to 0.9 D, 1.6 D, and 1.0 D, respectively, 5 months after surgery. Brown et al\textsuperscript{12} recently reported spontaneous relaxation of postoperative astigmatism in children after lens implantation through a 6.25-mm scleral wound. In that study, the mean astigmatism was 6.71 D at 1 to 15 days after surgery and 1.93 D at 31 to 45 days. The authors concluded that surgeons should not hesitate to secure scleral wounds meticulously in children because of fear of a permanent undesirable refractive outcome.

In our patients, the astigmatism decreased more rapidly, on average, during the first 3 months after the operation than during the following 2 months. This decline in astigmatism with time was observed in all 3 groups. Similar findings were reported in adults.\textsuperscript{7,18} In whom surgery-induced astigmatism declined rapidly during the first 1 or 2 months postoperatively. In another study,\textsuperscript{29} the corneal curvature stabilized at 19 weeks after surgery. On the basis of their own results, Talamo et al\textsuperscript{28} concluded that it may be unwise to cut the sutures in patients with early postoperative astigmatism of less than 3 D because of the instability of the corneal astigmatism.

The finding of postoperative astigmatism is important, especially in children, because of its adverse effect on vision development and the risk of amblyopia.\textsuperscript{20} In adults, a few months of delay in correcting the refractive error does not affect the final visual acuity, whereas in children, the optical refraction must be precisely corrected as soon as possible. Accordingly, the refractive error in all of our patients was corrected 1 month after surgery, and any further changes in astigmatism were promptly attended to by changes in the refractive correction. On the other hand, whereas postoperative surgical astigmatism in adults can be corrected by removal of 1 or more sutures in a simple office procedure,\textsuperscript{6,5} in children this procedure usually requires general anesthesia.

Mild spontaneous regression of postoperative astigmatism has been described in adults. Without suture cutting, mean changes of only 0.5 D\textsuperscript{1} and 1.25 D\textsuperscript{2} were reported during the first year after cataract surgery. In our present series of pediatric patients, by 5 months after surgery there was a spontaneous average decline in astigmatism of 4.9 D, 3.5 D, and 3.0 D in groups 1, 2, and 3, respectively (Table). At least 2 factors might have contributed to this marked spontaneous regression. First, the ocular tissues in children exhibit a high degree of elasticity. In adults, wound compression caused by the sutures does not change across time, whereas in children, because of the elasticity of the cornea and sclera, the tissue tension may spread evenly to neighboring areas and reduce the amount of astigmatism. Second, growth of the globe in children (but not in adults) continues 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, suture removal is recommended as a way to correct postoperative astigmatism. The findings of the present study strongly suggest that removal of sutures in children is not required, because the astigmatism regresses spontaneously a few months after surgery. This would eliminate the need for the general anesthesia that is usually necessary for suture removal in children.

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\textbf{REFERENCES}