

# Multifocal Toric Intraocular Lens for Traumatic Cataract in a Child

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## Keywords

Multifocal toric intraocular lens · ReSTOR Toric intraocular lens · Astigmatism · Traumatic cataract · Children

## Abstract

A child suffering from traumatic cataract and corneal astigmatism of 2.14 D had a phacoemulsification operation and implantation of a ReSTOR Toric intraocular lens (IOL) to correct the astigmatism. The primary outcome measurements were the uncorrected distance visual acuity (UDVA), uncorrected near vision at 40 cm, intraocular pressure, spherical equivalent refraction, residual astigmatism, corneal astigmatism, presence of unusual optical phenomena, and use of spectacles. At 7 months postoperatively, UDVA was maintained between 16/20 and 24/20, near vision was between J1 and J3, residual spherical refraction was 0–0.37 D, and residual refractive cylinder was between 0 and 0.67 D. A multifocal toric IOL can provide the possibility of satisfactory vision for both distant and near conditions without the use of spectacles to meet children's needs when studying and doing sports. Additionally, binocular vision can be reconstructed. This intervention, therefore, seems to be a satisfactory alternative.

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## Introduction

Modern cataract surgery is entering the era of refractive surgery, allowing people not only to be able to see but also to be able to see clearly at all distances. It is well known that the presence of astigmatism in the eye in which the multifocal intraocular lens (IOL) is implanted can affect vision [1, 2]. The prevalence of preoperative astigmatism in patients undergoing cataract surgery has been estimated to be between 15 and 29% [3–5]. There are many techniques to correct corneal astigmatism, including corneal limbal relaxing incision [6–10]. Recent studies have shown that the implantation of an astigmatism-corrected IOL is more effective [11]. ReSTOR Toric has the advantages of the multifocal astigmatism correction of an artificial lens, and it can correct astigmatism. Children with cataracts who have lost vision not only need to see clearly at both near and far distances without the use of spectacles to meet the needs when studying and doing sports, but also to reconstruct the binocular visual function. In this case report, the effects and complications of ReSTOR Toric in the eye of a child with traumatic cataract and astigmatism were observed.

## Case History

The boy presented in this case report was 9 years old. His left eye had been hit inadvertently by plastic pellets 2 years prior to surgery. The visual acuity decreased gradually. An ocular examination revealed right-eye visual acuity of 20/20 and left-eye visual acuity of 3/20; intraocular pressure was 15 mm Hg (left eye), the cornea was transparent, the anterior chamber was normal in depth, the iris was clear, and the pupil diameter was 3 mm and sensitive to light reflection. The lens was opaque (upper temporal significant T-shaped porcelain white opacity) with posterior capsular opacity. The fundus could be seen vaguely after mydriasis. Corneal endothelial cell count was 2,332.8/mm<sup>2</sup> (left eye); B-scan ultrasonography detected no obvious abnormalities in the eyes. Axial length (AL) was 23.55 mm, K1/K2 was 41.82 D/43.95 D, and cylinder was –2.13 D at 174° (left-eye corneal topography). The IOL degree was 21.0 D, and AL was also 23.55 mm.

## Case Report

The child's parents wanted the patient to have a chance to see near and far clearly without glasses to meet the needs when studying and doing sports. ReSTOR Toric combines the advantages of an artificial lens with the astigmatism correction of an IOL and the advantages of a multifocal IOL. The diffractive aspect of the IOL optical part is a step height of the diffraction pattern from the centre to the periphery of the optical part. The diffraction pattern is located at the front surface of the IOL. The optical surface is non-spherical, which can improve the contrast sensitivity and compensate for the physiological spherical aberration of the cornea. In cataract surgery, the benefits of using a non-spherical IOL have been widely described in the literature. In most patients, these IOLs can provide a higher visual quality [12, 13]. The patient's eye records were as follows: K1: 41.82 D × 174° (corneal curvature), K2: 43.95 D × 84° (steep corneal curvature), 0.50 D (SIA), 135° (design incision position), and the IOL power was calculated as 21.0 D (SND1T5). The astigmatism axial angle was 77°. The addition of SND1T5 to IOL in the plane is +3.00 D, which corresponds to +2.25 D near vision and corrects +2.0 D astigmatism. Because the child had a history of trauma, a multifo-

cal IOL would not have been implanted if the capsule bag had been torn. The child's parents agreed to the operation.

For 3 days before the operation, 0.3% ofloxacin was applied as eye drops. The ReSTOR Toric IOL axial position was labelled with a marking pen after topical anaesthesia, and then the pupil was dilated with Mydrin-P. The operation was performed under general anaesthesia. The corneal incision was made manually using a 2.2-mm keratome and a 0.75-mm side-port blade. The patient underwent continuous curvilinear capsulorhexis, hydrodissection, and phacoemulsification. Phacoemulsification suction was 350 mm Hg, flow was 35 ml/min, and emulsifying time was 17.8 s. After successful removal of the lens cortex, the posterior capsule and anterior capsules were polished. Then, the IOL was placed in the capsular bag. Lens astigmatism axial angle was adjusted to 77°. After successful removal of the viscoelastic agent, the anterior chamber was formatted. The eye was coated with tobramycin dexamethasone ophthalmic suspension and covered with a sterile gauze mask. Postoperatively, the patient was prescribed topical tobramycin dexamethasone eye drops for 4 weeks.

Follow-up was performed at 1 day, 3 days, 1 week, 1 month, 2, 3 and 7 months after surgery. At each visit, the eye was scanned using a dioptre corneal analyser system (Nidek Co., Ltd.) for automatic optometry. A brief questionnaire on the use of glasses was carried out. Questions included 'Do you wear glasses?' and whether there were halo glare, astral glare, ghosting and diplopia, or discomfort phenomena. Each question had 4 options for the answer: never; in some cases; in most cases, and always. The patient reported no halo glare, astral glare, ghosting and diplopia, or discomfort phenomena. The far visual acuity remained between 16/20 and 24/20, and the near visual acuity remained between J1 and J3 without the use of spectacles at any distance during 7 months of follow-up.

## Discussion

In the face of paediatric cataract, many doctors only pay attention to achieving superb surgical techniques and good surgical results and overlook the fact that children who have lost binocular vision also need reconstruction of binocular visual function. To rebuild binocular visual function, the most important problem is how to choose the artificial crystal with the best optical effect, specifically the effect most consistent with human physiology [14]. In most cases, school-age children receive treatments restoring vision in the near distance because their demand for near vision is higher than that of adults. Due to the lack of multifocal capability, single-focus IOLs are far from meeting patients' needs for learning and life. Multifocal IOLs can make far and near objects appear on the retina, thereby meeting the different requirements of vision at the same time. This approach can solve the problem of the lack of adjustment of a single-focus IOL to achieve normal or close to normal vision. Multifocal IOLs have been reported as a good alternative to a monofocal IOL in cooperative children over 4 years of age with unilateral cataract [15]. However, most cataract patients also suffer from astigmatism. In a study of 4,540 patients, 87% patients had various degrees of astigmatism before cataract surgery, 64% of patients were between 0.2 and 1.25 D, 22% of patients were above 1.5 D, and 5 or 6% of patients with astigmatism were even above 2 D. It is well known that the astigmatism of the eye of the diffractive multifocal IOL can impair vision. Therefore, astigmatism of 1 D or higher should be corrected. Many studies have demonstrated the safety and effectiveness of various methods of astigmatism correction after implantation of a multifocal IOL, including laser-assisted in situ keratomileusis and limbal relaxing incision [16, 17]. However, these methods are ineffective, unpredictable, or require two operations.

The multifocal astigmatism-correcting type of IOL has the ability to correct astigmatism in a single operation. AcrySof astigmatism correction [18, 19] has been tested in randomized trials to confirm its safety, effectiveness, rotational stability, optical quality, and subjective patient satisfaction. A clinical study of the 3.00- and 4.00-D IOL confirmed their safety and effectiveness, optical quality, and patient satisfaction [20, 21]. A diffractive multifocal toric IOL reduces astigmatism more than a monofocal IOL and provides more satisfactory near vision [22]. The astigmatism correction was safe and effective and can be expected to remain satisfactory [23], and it also decreased the rate of spectacle use [24]. Because the child's AL was 23.76 mm, greater than 23 mm, we used the SRK/T formula. Negative optical phenomena (halo, glare, astral, ghost, and diplopia) are inherent in a diffractive multifocal IOL design because the different annular zones of the step edges produce these phenomena. However, there were no glare, halo, or discomfort phenomena in our study.

### **Conclusion**

Our results show that the implantation of an AcrySof IQ ReSTOR Toric IOL provided excellent far and near vision in a patient over 6 years of age, offering the pseudophakic patient the possibility of satisfactory vision for both distant and near conditions while reconstructing binocular visual function without the use of spectacles to meet children's needs when studying and doing sports. In this case, the IOL Master showed good repeatability in terms of the corneal topography, AB ultra, and the optometric tests that could be performed. The development of abnormal children with astigmatism in cataract patients with multifocal light IOLs can produce better visual acuity, better stereo vision, and no obvious visual symptoms and complications. This approach allows the pseudophakic eye to function with its fellow eye, which has active accommodation. It may be a good alternative for children over 6 years of age with unilateral cataract.

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### **Statement of Ethics**

The study conformed to the tenets of the Declaration of Helsinki.

### **Disclosure Statement**

The authors have no potential financial conflicts of interest.

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