
Anterior chamber iris-fixated phakic intraocular lens for anisometropic amblyopia

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We report a child who had implantation of an iris-fixated Artisan phakic intraocular lens (IOL) to correct high unilateral myopia to support the therapy of anisometropic amblyopia. After IOL implantation, the patient continued occlusion therapy to further treat the amblyopic eye. One year postoperatively, the best corrected visual acuity in the amblyopic eye was 1.00 and binocular stereovision had developed. The visual acuity remained stable through 3 years of follow-up. There were no complications, although postoperative endothelial cell loss was significant.

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High unilateral myopia is difficult to treat in young children and often leads to anisometropic amblyopia.^{1–5} Factors such as the depth of the amblyopia and the age of the patient play a key role in the effectiveness of treatment. Success is also frequently hampered by practical problems such as those created by glasses and contact lenses. Thus far, however, patient compliance has been considered the greatest therapeutic impediment.^{6,7} In such cases, refractive surgery with the excimer laser or phakic intraocular lens (IOL) implantation can be a solution. There is, however, limited experience in treating myopic children with these procedures.^{1,2}

As excimer laser corrections are confined to refractive errors of approximately -8.00 to -10.00 diopters (D), effective surgical correction of high myopia in children can only be done with phakic IOLs. Studies of phakic IOLs to correct anisometropic amblyopia in the pediatric population have been reported.^{3–5} Concerns about IOL implantation in young patients include cataract formation, pupil alteration, endothelial cell loss,

postoperative inflammation, and a possible myopic shift as the patient ages.

Artisan phakic IOL implantation is a reliable and safe procedure in adults.^{8,9} Although the IOL is considered experimental in several parts of the world, it has been implanted in patients in The Netherlands since 1991. Thus, when we were confronted with a young anisometropic amblyopic patient with restricted treatment options, we decided to correct his high unilateral myopia using the Artisan phakic IOL. Recently, Chipont and coauthors⁵ reported such a case with an 18-month follow-up. Here, we present a patient with 3-year postoperative results.

Case Report

A 4-year-old boy with high unilateral myopia and distinct anisometropic amblyopia in the right eye presented in February 1997. Thirty minutes after 2 drops of cyclopentolate 1%, the child had a cycloplegic refraction of $-14.00 +3.00 \times 115$ in the right eye and was emmetropic in the left eye. The cycloplegic best corrected visual acuity (BCVA) in the myopic eye was 0.17 (Amsterdam Picture Chart [APK], translated from the Dutch, Amsterdamse Plaatjeskaart). Stereoscopic vision could not be detected. A spectacle was prescribed with a $-10.00 +3.00 \times 115$ correction in the right eye and plano in the left eye along with 2 hours a day of left-side occlusion therapy. A refractive undercorrection was deemed necessary to reduce the effects of aniseikonia.

In June 1997, the BCVA in the right eye, measured with a full correction of $-14.00 +3.00 \times 115$, had improved to 0.83 (APK); however, stereovision remained negative (Lang

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and Titmus fly tests). Nonetheless, the patient reported that glasses were uncomfortable as they were constantly lopsided; he therefore refused to wear them. This lack of cooperation made it difficult to continue the patch therapy, and the BCVA with full correction had decreased to 0.56 (APK). Thus, a toric contact lens of $-11.50 +2.50 \times 110$ was prescribed for the right eye.

After wearing the lens for 2 months and increasing the daily occlusion therapy to 8 hours, the patient had a poor BCVA at 0.50 (APK); however, the Titmus test was positive. Furthermore, during this period, the boy repeatedly lost his contact lens. Considering that neither glasses nor the contact lens had proved to be worthwhile therapy, refractive surgery was considered. The case was discussed thoroughly in our department and with Jan Worst, MD, the creator of the lens. A decision was made to correct the unilateral refractive error with an Artisan phakic IOL and to continue occlusion therapy. Considering the lens had only been studied in adults, the possible short- and long-term complications reported in the literature were discussed with the child's parents, who were told its use in children was experimental. As they were unhappy with their son's varying progress, they agreed to the operation and signed an informed consent. The aim was slight myopia so that both eyes would eventually have about equal refractive errors. The hope was that further changes in error would occur concurrently in both eyes as the patient grew.

In February 1998, the patient had a -15.00 D Artisan phakic IOL (model 206w; 5.0 mm optic) implanted in the right eye under general anesthesia. The surgical procedure and the IOL power calculation were performed according to standard protocol. The patient received gentamicin ointment 1 day before the procedure. Pilocarpine 4% drops were applied the morning of and 30 minutes before surgery. A beveled 5.5 mm corneoscleral incision was made at 12 o'clock, and 2 paracenteses were placed at 10 o'clock and 2 o'clock. The anterior chamber was opened and filled with sodium hyaluronate 1% (Healon®) to maintain its depth. After the IOL was implanted with a DO2-72 forceps (Ophtec), it was fixated to the iris with enclavation needles (model OD125, Ophtec). At the end of surgery, a slit iridotomy was performed, the corneoscleral wound was closed with a running suture, and the viscoelastic material was manually irrigated. Gentamicin ointment was applied to the eye.

The early postoperative period was without complications. Occlusion therapy was continued for 8 hours a day. Four months postoperatively, the cycloplegic subjective refraction was $-1.50 +1.00 \times 135$ in the operated eye and -1.00 in the left eye. Snellen BCVA (E chart) was 0.65 and 0.80, respectively. At 29 months, the cycloplegic subjective refraction was $-0.75 +0.75 \times 155$ in the operated eye and -2.00 in the left eye. Stereovision had improved (positive Lang Test of 600" repeated 4 times; TNO plates I and II). The Snellen BCVA (E chart) was 0.70 and 1.00 in the right eye

and left eye, respectively. At 26 months, the refraction remained unchanged but the BCVA was 1.00 in both eyes.

Three years postoperatively, the slitlamp showed a healthy crystalline lens with a clear, well-centered phakic IOL. The cycloplegic refraction in the right eye was plano $+0.75 \times 160$ and in left eye, $-2.75 +0.25 \times 35$. The patient now wears spectacles to correct the refractive error. The Snellen BCVA (numerical chart) is 1.2 and 1.0 in the operated eye and unoperated eye, respectively.

Although the patient was initially too young and uncooperative for a preoperative endothelial count, the cell density was 3196 cells/mm² (SP-2000-P specular microscope, Topcon) 1 year postoperatively and 3111 cells/mm² at 19 months. At the final examination, the endothelium showed normal hexagonal cells (Figure 1); however, the cell density had decreased by 11.9% to 2741 cells/mm². A comparison of the cell count with that in the unoperated eye measured on the same day (3302 cells/mm²) showed a 17% difference. Before this, no endothelial cell counts in the left eye had been performed.

Discussion

Treating high anisometropic amblyopia is frequently disappointing. Amblyopic treatment is encumbered by several problems.^{6,7} Although children are usually capable of compensating for aniseikonia caused by high anisometropia, full spectacle correction is not generally prescribed. Glasses have practical hindrances such as prismatic effects. In addition to our patient's

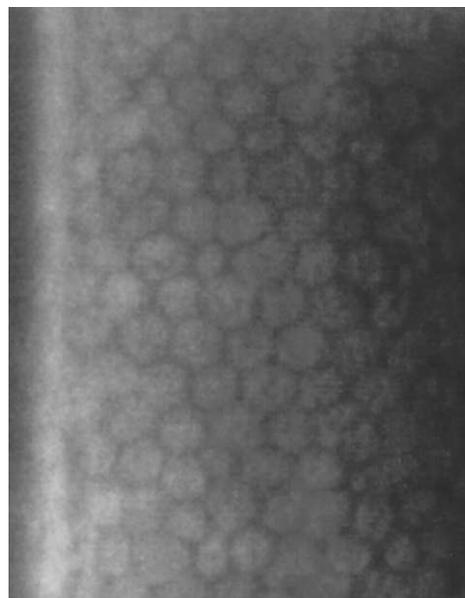


Figure 1. (Saxena) Endothelium in the operated eye 3 years postoperatively. The cells have maintained a normal hexagonal shape and have a mean cell density of 2704 cells/mm² \pm 118 (SD).

complaint of the glasses being lopsided on his face, there are cosmetic issues and glasses provide far from ideal binocular vision. Contact lenses minimize the magnification differences between the eyes but can be difficult to manage in young children.¹⁰ Therefore, resistance to spectacles and contact lenses may negatively influence the treatment of amblyopia in many cases. However, even after a young patient's refractive error has been surgically corrected, one must always emphasize that patch therapy must be diligently continued.

The European multicenter study of the Artisan phakic IOL in 518 adult eyes established a safety index (postoperative BCVA/preoperative BCVA) of 1.31 and an efficacy index (postoperative uncorrected visual acuity/preoperative BCVA) of 1.03 3 years postoperatively.⁸ We found similar results in our study.⁹ As the lens is safe and has a good, predictable refractive outcome, we decided to use it to correct the patient's refraction even though it has not been extensively tested in children. The child's refusal to wear the glasses and repeated loss of his contact lens were affecting patch therapy compliance. Thus, we believed that the problems created by glasses and contact lenses outweighed the possible risks created by IOL implantation. By correcting the anisometropia with the Artisan lens, amblyopia treatment was facilitated by encouraging the patient to use the highly myopic eye and increasing occlusion therapy compliance. We believe this allowed the patient to develop stereovision. However, different optotypes were used preoperatively and postoperatively. Experience with the methods of visual acuity measurement and increasing patient cooperation may have distorted the amount of visual improvement.

Our patient was too young to allow valid preoperative endothelial cell measurement; however, comparison between the operated and unoperated eye 3 years after IOL implantation revealed a 17% difference. Earlier postoperative cell counts reveal much higher densities, indicating that rapid cell loss occurred after 19 months. We surmise that the child had begun rubbing his eyes, although we could not definitely establish this.

During the multicenter investigation of the Artisan lens in adults, an initial endothelial cell loss of 4.8% was detected, which leveled off to 0.7%.⁸ This rate of decline is not significantly different from that found in the general population. In our own series of adult myopic eyes treated with the Artisan phakic IOL, we observed no

endothelial cell loss.⁹ Basti et al.¹¹ report no difference in short-term corneal endothelial cell loss between adult and pediatric cataract patients, although it is questionable whether this comparison is valid among patients with an anterior chamber lens; in these cases, the endothelial layer can be affected when patients rub their eyes. Therefore, endothelial cell loss remains a cause of concern in pediatric patients with an Artisan IOL.

Although intraocular surgery in children is more delicate and prone to inflammatory reactions, there were no adverse reactions or complications in our case. In a similar case of Chipont and coauthors,⁵ a low degree of uveitis was detected. It is, nonetheless, possible that the complication rate in this younger population is higher as the clearance between the lens and the corneal endothelium can decrease over time.¹² The patient could also become more myopic with age, in which case additional correction with glasses or contact lenses can be prescribed. In more extreme cases, the lens can be exchanged. In our case, the postoperative refractive outcome was still stable at the patient's last examination at 3 years.

Studies in which anisometropic amblyopia was treated with photorefractive keratectomy yielded promising results in children with myopia.^{1,2} Nonetheless, excimer procedures are limited to low and moderate myopia, leaving phakic IOLs as the only feasible surgical option for young patients with high myopia.

BenEzra and coauthors³ and Lesueur and Arne⁴ treated anisometropic amblyopia with phakic posterior chamber IOLs. Although they achieved positive results, posterior chamber IOLs can have serious complications including angle-closure glaucoma, cataract, and chronic inflammation, all of which require fastidious long-term follow-up.^{3,4} One advantage of a posterior chamber IOL is the reduced risk of corneal endothelial cell loss, which is especially beneficial in children prone to rubbing their eyes.⁴ The angle-supported phakic anterior chamber IOL, another alternative to iris-fixated IOLs, can also lead to complications such as retinal changes and pupil ovalization.¹³ Furthermore, eye growth can compromise the stability of the lens, making it an inappropriate choice in developing eyes.

The Artisan lens has not shown early serious complications; however, long-term follow-up results are not available. In our patient, the Artisan phakic IOL was effective in treating anisometropic amblyopia. Although

the IOL can provide viable correction of high unilateral myopia in children, its implantation should be considered only if conventional therapy fails.

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