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Rigid Gas Permeable Contact Lens Management of Infantile Aphakia Status-Post Cataract Extraction

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Infants born with congenital cataracts require cataract extraction to prevent lifelong visual impairment resulting from deprivational amblyopia. After lensectomy, two optimal corrective treatment options exist: intraocular lens implantation or contact lens correction. This case presentation describes the etiology, treatment, and successful management of a patient with unilateral infantile aphakia with a rigid contact lens. The seven-week-old patient with a congenital cataract of the right eye was referred to our clinic for a contact lens fitting prior to cataract extraction. Surgeons often do not elect to manage aphakia with artificial lens implantation because the correct intraocular lens parameter is difficult to infer in a rapidly growing child, and surgical complications may occur. While glasses are important for when contact lens wear is not indicated, the high prescription required by these aphakic individuals results in significant visual distortion and aniseikonia. Contact lens correction has shown to be a safe and visually effective alternative to treating infantile aphakes. Various material options exist, including rigid gas permeable and soft lenses. While soft hydrogel lenses may appear more comfortable and less intimidating to a parent, limitations exist including restricted parameter availability for commercially produced lenses and reduced oxygen permeability for custom soft lenses. Rigid contact lenses provide optimal visual correction due to their extensive customizability while also offering high oxygen permeability. This lens modality, in conjunction with proper follow-up monitoring and ophthalmological co-management, provided for successful aphakia treatment in our patient.

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INTRODUCTION

Congenital cataracts are the leading cause of deprivational amblyopia. Early surgical intervention is required to remove the visual insult, followed by prompt optical correction to ensure proper neuronal stimulation during the patient's critical years of development.¹ Contact lens correction offers improved flexibility to safely treat infantile aphakia.

CASE PRESENTATION

The patient is a male who was born one month premature at 35 weeks and 4 days with a weight of 2.715 kilograms and an Apgar score of 9.0. The patient's mother reported that a prenatal ultrasound revealed an opacity of the patient's right eye. Examination after delivery revealed that the infant was systemically healthy except for a visible opacity of the right eye. The mother denied any relevant ocular family history, including no history of cataracts in her five other children.

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Ocular examination by a pediatric ophthalmologist at eight days old revealed normal external eye movements and pupillary function in both eyes. Both eyes had healthy lids, lashes, conjunctiva, sclera, corneas, and anterior chambers. Lens examination of the right eye revealed a dense, central congenital cataract with diminishing opacification into the periphery. The left lens was clear and unremarkable. Dilated fundoscopy with one drop 1.0% Cyclopentolate Hydrochloride/Phenylephrine Hydrochloride ophthalmic solution revealed a normal vitreous, optic disc (0.1 cup-to-disc ratio), macula, vasculature, and peripheral fundus of the left eye. The lenticular opacity resulted in a poor view of the right fundus; therefore, a B-scan was performed. No retinal detachments nor masses of the right eye were viewed on the scans. Cataract extraction of the right eye was scheduled for the following month at nine weeks and four days old. The pediatric ophthalmologist referred the patient to our contact lens clinic for an evaluation prior to the surgery to ensure expeditious optical correction after extraction, as when treating amblyopia, early intervention is vital to increase visual potential as brain plasticity decrease with time.¹

The 7-week-old male presented with his mother and father to our clinic for evaluation. He appeared alert with normal affect and his parents denied any current medications or allergies. The patient showed a normal binocular fix and follow response but was resistant to left eye occlusion. Hand-held slit lamp examination was remarkable for a dense congenital cataract of the right eye, with a dull reflex. After extensive education with the parents about the advantages, disadvantages, and availability of each contact lens modality (rigid gas permeable (RGP), silicone elastomer, soft), RGP lens treatment was selected.

As an initial starting lens, *+32.00sph, 7.30mm Base Curve, 9.30 Diameter, 8.5mm/0.2mm Peripheral Curve 1, 10.5/0.30mm Peripheral Curve 2*, was chosen. While some surgeons provide axial length and/or keratometry values which can be helpful in the selection of lens power and base curve, this data was not provided for the patient. Instead, corneal curvature was estimated based on age.² By analyzing the resulting fluorescein pattern of a selected rigid lens with a known base curve, the provider can estimate the patient's corneal curvature and adjust the fit accordingly. A Burton Lamp and sodium fluorescein dye was used to observe uniform central green fluorescence with slightly excessive pooling at the lens periphery indicating a well aligned central fit with mildly flat edges. Typically, retinoscopy is performed over the trial lens to determine the best power; however, in this case the cataract did not allow for refractive assessment, so power was estimated based on age.² The estimate considered an over-correction of +2.50 to +3.00 diopters since the patient lacked accommodation and his world was very proximal.² Young infants who do not locomote require a relatively close focal point to view their caretakers and perform close tasks. Maintaining a low myopic prescription in the aphakic eye provides this appropriate focusing distance and encourages the infants to use this eye during their daily tasks, assuming normal refractive and binocular findings in the sound eye. Our patient showed a

low hyperopic prescription with +0.75 D OS, and normal accommodation with retinoscopy; in cases with abnormal refractive findings, proper optical correction of the phakic eye is essential for a balanced visual response. As children mature and begin to walk, their world becomes more distant which prompts a reduction in the over-correction. Once the child has reached school age, the full distance prescription is incorporated into the contact lens and bifocal glasses with an appropriate Add are worn for nearwork.² Based on the above assessments, the final lens parameter to order was determined: *+32.00sph, 7.25mm Base Curve, 9.30 Diameter, 8.00mm/0.20mm Peripheral Curve 1, 9.5mm/0.30mm Peripheral Curve 2, minus lenticular design*). To promote stability, the central base curve was steepened by 0.05mm and the first and second peripheral curve radii were steepened by 0.5mm and 1.0mm, respectively. The high DK (200) fluoroxyfocon A material was selected. A minus lenticular design was requested to reduce the lens mass and minimize lens dropping and dislocation.

The patient returned to the referring ophthalmologist for successful cataract extraction of the right eye. The patient was placed on Neomycin/Polymyxin B/Dexamethasone ophthalmic suspension, one drop four times per day in the right eye.

Three weeks later, the patient returned for his dispensing visit. Examination findings were remarkable for aphakia of the right eye. The ordered trial lens was well centered with good coverage and 1mm of movement on blink. Mild apical clearance was seen centrally, with good alignment peripherally and adequate edge lift. Retinoscopy revealed an appropriate -3.00 D over-refraction, and the eye was able to follow a target. The patient had a positive affect and tolerated the lens well.

Insertion and removal training was initiated with the patient's mother and father. First, the two-person method was taught: the mother laid the child in her arms with his head to the mother's right to allow for easier access of the right eye. The patient's left arm was secured behind the mother's back, and she held his right arm down, away from his face. The lens was cleaned with multi-purpose rigid gas permeable solution and the father was instructed to hold open the top lid, insert the lens, and open the bottom lid. Instructions on how to ensure proper lens centration was given, as well as demonstration on how to gently manipulate the closed lid to massage a decentered lens onto the central cornea. To remove the lens, the infant was secured in the same position and the father was instructed to utilize two index fingers to open the eyelids wider than the lens diameter, and then slowly push the lids together to meet the lens edge and lift the lens off the eye. Proper disinfection and cleaning with multi-purpose gas permeable solution was explained. Training was deemed successful when both parents were able to perform insertion and removal at least two times.

Next, the one-person method was demonstrated. The patient was placed on a clean blanket, lying on his back with his head towards his mother and his arms out in a T-shape. The mother sat on the floor with the child's head in her lap and legs secured over the baby's arms. This tech-

nique allowed for successful one-person insertion, without worrying about interference by the child's arms. The mother was instructed to hold the cleaned lens in her dominant hand, while using the other hand to hold open the top and bottom lids. The lens was placed on the cornea and was checked for proper centration. Removal of the lens with the child secured in the same position was successful using both index fingers to manipulate the upper and lower lids.

Once confidence on the handling of the lens was achieved, the lens was dispensed for daily wear with emphasis on importance of nightly removal. Proper cleaning with multi-purpose solution was reviewed. Since the patient was very young, a strict maximum napping time of two hours while wearing the lens was permitted. The lens was to be removed if any redness or adverse events were noted. Bathing with the lens was prohibited. The parents were instructed to instill the first and last medication drops prior to lens insertion and after lens removal. When instilling drop medications, close attention upon instillation was required to ensure the lens did not float off the eye. The importance of discouraging eye rubbing was discussed to minimize lens loss.

The family returned one month later and reported that the patient was tolerating the lens. The mother reported good compliance with the four-hour-per-day patching regimen of the phakic eye as prescribed by the ophthalmologist. She also reported the antibiotic/steroid medication was tapered and then discontinued as directed by the ophthalmologist. Slit lamp exam findings remained stable to the previous findings and the contact lens showed a good fit and over-refraction. A spare duplicate lens was ordered for the patient in case of lens loss.

The patient was instructed to return for follow-up care to monitor contact lens fit, prescription and corneal health every three months. He was also followed quarterly by his ophthalmologist for his ocular health.

DISCUSSION

Treatment options for aphakia resulting from congenital cataract extraction include surgical intraocular lens (IOL) implantation, spectacle correction, and contact lens correction.

Following cataract extraction, an IOL can be placed to allow for a more permanent corrective treatment. This may be attractive to a parent who is concerned about handling a contact lens or increased risk of infection.³ While there are certain advantages, studies have shown that the surgical risks of implantation may outweigh these benefits.⁴ Firstly, since the infant is in a stage of rapid growth, it is difficult for the surgeon to predict the appropriate IOL power. As a child grows, changes in axial length and corneal curvature vary from patient-to-patient post-operation and thus determination of the patient's stable, adult refractive error is difficult.⁴ The Infantile Aphakia Treatment Study (IATS) was a multi-center, randomized trial comparing the treatment of unilateral congenital aphakia with a primary intraocular lens versus a contact lens.⁵ At one year and 10.5 years of age, the visual outcome was not statistically differ-

ent between the two treatment groups.⁵ While acuity was similar, at one year 77% of patients in the IOL group had an adverse event, compared to only 25% in the contact lens group, with most events relating to complications affecting the visual axis.⁶ The need for additional surgical intervention within the first year of age was 63% in the IOL group compared to 12% in the contact lens group.⁶ Due to these increased risks, alternatives to IOL correction should be explored.

Spectacle correction offers a non-invasive optical treatment for infantile aphakia. While it is important for all children to have a back-up pair of glasses, spectacles are not a practical main treatment due to their disadvantages including reduced optical quality, weight, and visual distortion caused by high powered lenses. Analysis of visual acuity in IATS participants at age 10.5 years showed decreased visual acuity in patients wearing spectacles compared to those who continued with contact lens correction.⁷ Additionally, in children with unilateral aphakia, the large imbalance in image size does not allow for proper binocular fusion. In a study analyzing visual performance with spectacles compared to contact lenses, the unilateral aphakic participants showed reduced visual acuity and ocular alignment in spectacles due to the significant aniseikonia.³

Contact lens correction for aphakia can be customized to each patient based on age, patient and parent comfort, and lifestyle. The treatment allows for clear, comfortable vision without concern of visual distortion. In this case, safe contact lens corrective options, including soft and rigid gas permeable, were discussed with the infant's parents prior to selecting an initial trial lens.

Often, infantile aphakes are fit with silicone elastomer contact lenses due to relative ease of fitting and good comfort. Unfortunately, there is only one manufacturer of the SilSoft™ silicone lenses and at the time of examination this was not a viable option due to manufacturing supply complications resulting in poor lens availability. With the highest oxygen permeability (DK 340), these silicone lenses are approved for extended or flexible wear, which is convenient for parents with sleeping infants. Parents also appreciate the stiffer nature of the silicone material, compared to traditional hydrogel lenses, due to improved handling. Disadvantages of this lens type include limited parameter availability, cost, and dependence on a single company for lens production. The lenses are also prone to significant lipid deposition which interferes with optical quality after prolonged use. In addition to thorough lens cleaning, a more frequent replacement schedule can provide improved comfort and vision; however, it is costly.

Soft hydrogel lenses were another alternative discussed with the parents. Custom lenses allow for flexibility in design of lens size and power; but are relatively expensive. Commercial soft lenses may also be an option, but available parameter limitations exist. The main disadvantage of high plus powered soft lenses is the lower oxygen permeability. Due to risks of edema and neovascularization with prolonged wear in a napping child, this soft lens modality was not selected for the patient discussed in this case.

Ultimately, treatment using an RGP lens was chosen due to the patient's age, availability, and extensive customizability. Material choice with high oxygen permeability was specified to ensure optimal cornea health. Previously, tisi-focon A (DK 163) was the material of choice for pediatric lenses. However, with the recent release of fluoroxfocon A, this new material was selected as it provides the highest available RGP oxygen permeability of 200. RGP lenses have been shown to be an effective and safe treatment of pediatric aphakia, even on an extended wear basis using higher oxygen materials.⁸ While the lenses are prescribed for daily wear, parents can feel assured that limited napping in the lens may be permitted if a high oxygen permeable material is selected. Additionally, the RGPs provide superior optical quality by masking corneal astigmatism and/or irregularities. Compared to soft lenses, RGPs have decreased incidences of infectious and hypoxic adverse events due to increased tear exchange and low water content of the lens.³ Disadvantages to rigid lenses include lens awareness; however, children adapt very quickly. Additionally, high mass rigid lenses are more easily dislodged by children rubbing their eyes, so there is more frequent lens loss and replacement of rigid lenses.⁹ In our patient, discouraging eye rubbing and close monitoring was important to minimize lens loss.

In addition to providing the appropriate contact lens services to infant aphakic patients, it is important for the fitting provider to ensure that proper ophthalmologic co-management and amblyopia treatment is in place. In our case, the pediatric ophthalmologist treated the patient's amblyopia and monitored ocular health through quarterly examinations. For unilateral aphakes, occlusion of the sound eye encourages use and visual development of the aphakic eye which promotes improved visual outcome.¹ Re-

sults from the IATS study support occlusion therapy for treatment of unilateral infantile aphakia; however, the precise relationship between patching time and visual outcome is unknown.¹⁰ For our patient, four hours of patching of the left eye was recommended by the ophthalmologist. Encouraging adherence to the amblyopia treatment plan and explaining the importance to the parents at each visit is vital to the child's visual outcome.

CONCLUSION

Overall, treatment of infantile aphakia must be customized to each individual patient. Contact lens correction is an effective means of managing pediatric aphakia that is particularly amenable to the changing curvature and axial length of the maturing eye. RGP correction provided a safe, customizable, and cost-effective treatment in our patient. Continuous monitoring of contact lens wearing children is essential to ensure good ocular health and optimal visual correction.

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None.

ABBREVIATIONS

Intraocular lens (IOL), Infant Aphakia Treatment Study (IATS), Rigid Gas Permeable (RGP)

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REFERENCES

1. Blair K, Cibis G, Gulani AC. Amblyopia. In: *StatPearls*. StatPearls Publishing; 2022.
2. Hom MM, Bruce AS, Sindt CW. Pediatric Contact Lens Fitting. In: *Manual of Contact Lens Prescribing Fitting*. 3rd ed. Elsevier Butterworth-Heinemann; 2006:599-635.
3. Chen J, Sun P, Wei Y, Kang X. Evaluation of eye-related parameters and adverse events of rigid gas permeable contact lens and spectacles correction in infants with monocular aphakia after congenital cataract surgery: a retrospective clinical study. *BMC Ophthalmol*. 2019;19(1):81. doi:10.1186/s12886-019-1088-z
4. Enyedi LB, Peterseim MW, Freedman SF, Buckley EG. Refractive changes after pediatric intraocular lens implantation. *American Journal of Ophthalmology*. 1998;126(6):772-781. doi:10.1016/s0002-9394(98)00247-5
5. Lambert SR, Buckley EG, Drews-Botsch C, et al. The infant aphakia treatment study: design and clinical measures at enrollment. *Arch Ophthalmol*. 2010;128(1):21. doi:10.1001/archophthalmol.2009.350
6. Plager DA, Lynn MJ, Buckley EG, Wilson ME, Lambert SR. Complications, adverse events, and additional intraocular surgery 1 year after cataract surgery in the infant Aphakia Treatment Study. *Ophthalmology*. 2011;118(12):2330-2334. doi:10.1016/j.ophtha.2011.06.017
7. Lambert SR, Cotsonis G, DuBois L, et al. Long-term Effect of Intraocular Lens vs Contact Lens Correction on Visual Acuity After Cataract Surgery During Infancy: A Randomized Clinical Trial. *JAMA Ophthalmol*. 2020;138(4):365-372. doi:10.1001/jamaophthalmol.2020.0006
8. Saltarelli DP. Hyper oxygen-permeable rigid contact lenses as an alternative for the treatment of pediatric aphakia. *Eye Contact Lens*. 2008;34(2):84-93. doi:10.1097/icl.0b013e31811eadaa
9. Russell B, Ward MA, Lynn M, Dubois L, Lambert SR, Infant Aphakia Treatment Study Group. The infant aphakia treatment study contact lens experience: one-year outcomes. *Eye Contact Lens*. 2012;38(4):234-239. doi:10.1097/icl.0b013e3182562dc0
10. Drews-Botsch C, Celano M, Cotsonis G, Hartmann EE, Lambert SR, Infant Aphakia Treatment Study Group. Association Between Occlusion Therapy and Optotype Visual Acuity in Children Using Data From the Infant Aphakia Treatment Study: A Secondary Analysis of a Randomized Clinical Trial. *JAMA Ophthalmol*. 2016;134(8):863-869. doi:10.1001/jamaophthalmol.2016.1365