Contact lens success in the pediatric aphakic population

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Contact lens success in the pediatric aphakic population

Abstract
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Thesis

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CONTACT LENS SUCCESS IN THE PEDIATRIC APHAKIC POPULATION

BY
TONYA HUBBARD

A THESIS SUBMITTED TO THE FACULTY OF THE COLLEGE OF OPTOMETRY PACIFIC UNIVERSITY FOREST GROVE, OREGON FOR THE DEGREE OF DOCTOR OF OPTOMETRY MAY, 1998

ADVISOR: WILLARD BLEYTHING
CONTACT LENS SUCCESS IN THE PEDIATRIC APHAKIC POPULATION

Tonya Hubbard

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Tonya Hubbard is a 1998 graduate of Pacific University College of Optometry. She completed a Bachelor of Science degree in Molecular Biology from the University of Wyoming in Laramie. Her home town is Sundance, Wyoming. Her future plans include joining a private practice in Casper, Wyoming. Tonya enjoys hiking, fishing, crafts and music.
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ABSTRACT
A retrospective study of twenty patients with congenital cataracts is described. Eleven of these were bilateral and nine were unilateral cataract cases. Twelve patients had cataract extractions with an anterior vitrectomy; of these, six were unilateral and six were bilateral. The surgeries varied in time from one week to four years after birth. The remaining eight patients were either poor surgical risks or waiting for surgery.

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Variable patching regimens were undertaken. Patching generally began with one hour each day while wearing the contact lens. If an eye turn was noticed or visual acuities markedly decreased, this amount was increased to approximately 2-3 hours. This step-wise adjustment continued until a maximum of nine hours was attained. All of the unilateral aphakic patients, including those successful with contact lenses, exhibited some amount of amblyopia and all but one exhibited a lateral tropia and/or a vertical tropia after therapy. Two of the bilateral aphakic patients were without amblyopia or a manifest strabismus.

INTRODUCTION
A mother comes to your office hysterical. She is screaming her baby has a white eye. What is there to do? This is a common scenario today as the incidence of congenital cataract has been estimated anywhere from one in 500 births to one in 10,000 live births in the United States. Congenital and early onset cataracts have been a historical cause of major visual impairment in children, accounting for 10-30% of blindness in infants. Cataracts are often accompanied by other ocular and systemic
anomalies such as glaucoma, posterior hyperplastic primary vitreous (PHPV) and rubella. Early detection and prompt treatment are essential for a good functional outcome to occur. Improved surgical techniques, safer anesthesia for infants and children, safe soft contact lenses, intraocular lenses and the understanding of deprivational amblyopia have greatly increased the prognosis of these patients.

Thanks to Hubel and Wiesel’s pioneering work at Harvard University in the 1960’s, it is widely understood that eyes that suffer from visual deprivation from such sources as congenital cataracts, ptosis, central corneal scars or any other anomaly that affects central vision during the critical period may render that person amblyopic. Hubel and Wiesel found the critical period of a cat to be the first three months of life. Vaegan and Taylor found the human visual system to be most sensitive to manipulation during the first two years of life and the critical period over by age seven to nine.

Considerable work has been conducted in the last twenty years to determine the ideal time frame of congenital cataract surgery and therapy to achieve optimum visual results. For instance, it was found that those with bilateral cataracts taken out before eight weeks show “normally developing vision” as compared to age normed controls. Those operated on after eight weeks show a substantial lag of visual development as well as mental development. Also, a pendular nystagmus was found in those operated on later.

According to Birch et al., 19 studies have been conducted since 1980 that describe outcomes from unilateral congenital cataract surgery. Acuity attained was 20/80 or better in 36.8% of the 362 patients with acuity being highest in those that had early treatment; early surgery being defined as that which occurs before 4.7 months. A survey taken by the American Association of Pediatric Ophthalmology found most members also chose four months as the latest age from which they believed a congenital unilateral cataract surgery would have a good functional outcome. Birch et al. also found that those unilateral aphakics that had very early intervention (1-6 weeks) had better contrast sensitivity and recognition acuity than similar aphakics that had early intervention (surgery from 2-8 months). The results suggest that treatment began before 6 weeks of age gives the greatest opportunity for normal or almost normal visual development.
After the cataract is found and the decision has been made to remove the lens, it must be decided which type of treatment will be best for the child. The three types of optical correction include:

1. Intraocular lens implants (IOL)
2. Contact lenses
3. Prescription glasses

According to Sinskey, the complication rates of IOLs are low. IOLs are also more convenient since they are in the eye and one does not have to clean them, worry where they are, and the lens is hard to lose, scratch or tear. IOLs are less prone to infection and can ultimately cost less than contact lenses. Several investigators have also found that the degree of aniseikonia is lowest (2-4%) when corrected with an IOL. This may help patients attain good binocular function and possibly, stereopsis. However, IOLs have one power and this may need to change as the child grows and the eye changes. Some advocate choosing an IOL power that will provide an appropriate correction for when the child has grown to adult size. If the IOL power is drastically wrong another surgery may need to be done at a later date to change the power.

Contact lenses can be quite successful. They are readily available, usually well tolerated by patients and the parameters can easily be changed as the child grows and the refractive error decreases. Contacts are also the most studied modality for aphakics and are thought to be the safest modality by some practitioners. According to Hodur, the five major advantages of contact lenses over spectacle lenses wear include:

1. Stabilization of the retinal image due to reduced prismatic distortion.
2. Magnification similar to an emmetropic eye, which is important where large amounts of anisometropia is present.
3. Increased peripheral field of view, due to lack of frame intrusion.
4. Centered, stabilized optical characteristics, due to elimination of prismatic distortion.
5. Elimination of frame breakage and dislodging.
However, fitting the contact lenses can be difficult, lenses can be lost, infections occur and parental motivation must be high in order to have success.

Glasses are often a last resort when the other modalities fail. They suffer from problems such as aniseikonia, distortions like pincushion and jack-in-the-box effects, weight, scratches and cosmesis. Yet, glasses may be the first choice for older children or those that have bilateral aphakia. And spectacles may be an adjunct treatment to both IOLs and contact lenses.

One factor often not discussed in the literature is unilateral accommodation after a monocular cataract extraction. The aphakic eye obviously cannot accommodate after the surgery, however, the unoperated eye can. This can cause a great visual dysfunction especially when combined with differences in image size and the refraction of near versus distance. The aphakic eye is generally corrected for about two to three feet, which coincides with the infant’s working area. In bilateral aphakes this causes no problem since both eyes are corrected equally, but in a unilateral aphake one eye sees well at distance and one eye sees well for near. This effectively makes a monovision scenario in the infant’s visual system making binocular vision difficult.

METHODS AND SUBJECTS
The medical records of 20 pediatric cataract patients from Oregon Health Sciences University were reviewed. Each of the subjects was a patient of one pediatric ophthalmologist from the years 1986-1997. Of the 20 patients, six had undergone surgery by age 3 1/2 years for monocular cataracts and six for bilateral cataracts by age 4 years. Twelve of the twenty patients met the following inclusion criteria for the contact lens part of the study:
1. congenital cataracts or cataracts that developed by age two
2. cataract extraction and anterior vitrectomy
3. at least one year follow-up care
The subjects were selected randomly from a clinical population at a medical school. With a teaching school/tertiary care clinic there was a preponderance for additional ocular and systemic problems encountered with these children. All children that had cataract surgery were left in the study for a realistic scenario of contact lens and occlusion therapy.

Eleven patients underwent cataract extraction and an anterior vitrectomy at Oregon Health Science University. One patient underwent surgery in Eugene, Oregon, by a private ophthalmologist. After surgery, ten of the patients were fit with Bausch and Lomb Silsoft contact lenses as quickly as time and healing permitted. The two remaining patients were bilateral aphakics who were corrected with spectacles. The Silsoft lens is the most frequently used lens for the correction of pediatric aphakia. It is a 100% silicone lens that is available in the following base curves: 7.5, 7.7, 7.9 mm; powers: +23.00, +26.00, +29.00 and +32.00D; and diameters: 11.3 and 12.5 mm. The lens provides a high oxygen transmissibility and is generally well tolerated by toddlers and infants. The child can also be fit with an adult aphakic Silsoft if needed. The adult series includes the following base curves: 7.5, 7.7, 7.9, 8.1, and 8.3 mm; powers: +12.00 to +20.00D in one diopter increments and a diameter of 11.3 mm.

If during the treatment, the Bausch and Lomb Silsoft lens could not be adequately fit, another lens with a high permeability was chosen, such as a N&N Pediatric Wear lens.

The lenses were fit empirically under general anesthesia using chloral hydrate. A medium base curve was initially fit, and if adequate fit and movement were not achieved, a steeper or flatter base curve was then tried. Each child then was overrefracted using wet distance retinoscopy. The power was then adjusted as necessary. Prescriptive power was achieved by overcorrecting the child by 2-3 diopters to facilitate the visual area to coincide with the child's working area. The contact lenses were worn on an extended wear basis. Direct occlusion therapy began with one hour of patching the non-aphakic eye per day while wearing the contact lens over the aphakic eye.

Follow-up was scheduled for approximately every week for the first month, which coincided with follow-up for the cataract surgery. The lens was then taken out and cleaned at each visit. If an eye
turn was noted or if visual acuities were significantly decreased the patching was increased to two to three hours per day. Visual acuities were taken by measurement of central fixation in preverbal infants and Allen Cards or the “E” game for older children. Krimsky modification of the cover test was used to quantify the lateral and vertical tropia/phorias.

RESULTS
Of the 20 original patients, twelve were selected to have surgery. Of these twelve patients who underwent cataract extraction and anterior vitrectomy, six became unilateral aphakes and six bilateral aphakes. One of the unilateral aphakes also had an additional stalkectomy during the cataract surgery. All six in the unilateral group proceeded to contact lens and amblyopia therapy. Three were deemed successful and three were unsuccessful by the end of the study. Success being set as continual wear, or close thereto, of the contact lens for a minimum of two years. Four became strabismic, one was straight and one had an unknown binocular status. Five were amblyopic (20/80 or greater) and one was unknown.

Two of the bilateral aphake group did not have contact lens therapy; instead they were corrected with glasses. One of these patients was strabismic and amblyopic, the other was neither. The remaining four continued on with contact lens and patching therapy. Two were considered successful. One was unsuccessful and the last only had contact lens therapy between the two surgeries (3 months). Three of these patients became strabismic and amblyopic and one was orthophoric with stereopsis (see results table).

DISCUSSION
In this report, we described 20 children who had congenital or early onset cataracts. These children were chosen exclusively by their cataract status. As seen in the table in the results section, there were considerable systemic and ocular problems that also affected the results. In some cases, the problems were hereditary in nature and the parents were knowledgeable about the condition which hastened the medical involvement.
It does need to be noted that some of the patients did need extensive testing and additional surgeries for the other conditions such as glaucoma, PHPV and retinitis pigmentosa. Each of these conditions most likely did effect the visual outcome of the person who had the condition.

The most important variable in the entire procedure, from diagnosis of cataracts through years of therapy, is the parents. Their understanding and commitment are what is crucial to the development of the child’s visual system. The two cases below illustrate the difference between commitment and understanding of the parent versus noncomprehension and the consequences for the child.

**Case #1:** Patient referred to OHSU from Kaiser HMO. She was five weeks old and had bilateral cataracts. Her father and two siblings also have cataracts. Occasional nystagmus was noted and also a nasal lacrimal duct obstruction. Patient returned the next week for cataract extraction, anterior vitrectomy of the left eye and nasolacrimal duct probe of the right eye. One week later the second cataract was removed. On day 3 of post-operation follow up, a 360 degree choroidal detachment was found which was treated with steroids and pressure patch. One week after the second surgery, the contact lenses were fit. Mother attended every appointment and had a thorough understanding of the procedures. She also stayed home from work to give medications and to monitor therapy. Baby improved greatly and the outcome was a small intermittent esotropia by the end of treatment two years later.

**Case #2:** Patient presented to OHSU with a white pupil and strabismic eye with a duration of at least 2 months. Child could not fixate or follow a light. A 30 prism diopter exotropia and dense cataract was present on the left eye. Surgery was performed the following week. One day after surgery, cells and flare were present therefore steroids were prescribed. Patient then returned one week later to be fit with contact lenses. Silsoft lenses were prescribed with four to six hours of patching the non-aphakic eye. Mom returned three days later stating the lens was lost in the past 24 hours. A new lens was given to the patient and they were again told to patch the eye when wearing the contact lens. Patient returned in two weeks for a check-up. Contact lens was gone - mom thinks it may have been lost four days prior to the appointment. No lens was in stock for his power, therefore a prescription was written for glasses until a new contact lens could arrive. Next visit, one
and a half months later, the contact was brought in a case and no patch was present. Mom stated that the child would not wear the glasses but thinks he does well with the contact lens and patch. Patient returned again in one month, child would not wear the glasses. Resident wrote in the chart that “I don’t think by responses the mom has tried very hard.” Two weeks later, mom reported the child would wear glasses for a few hours a day and she patched him about 2 hours a day. Next visit, two months later, mom forgot the glasses and stated that he wore them one hour a day with the patch. A contact lens refit was completed and a new lens was given. Patient returned two months later, mom stated contact lens was not working, nor the glasses, as the child would peek over the glasses to see and the patch irritated his skin. Patient had multiple exams similar to this and the team re-tried contact lenses a few more times. Mom could not insert or remove the contact lens after the two years of the child attempting to wear the correction. Each time the contact came out she would leave it out until the next appointment. Patching was sketchy at best. Mom missed multiple exams and was late to many more. Last appointment in record: came in with patch on but sister reported he does not wear either a patch or glasses at home. He had trouble discerning the 20/400 letter with his left eye and continued to be a large exotrope. He was referred for strabismus surgery. Toward the end of the appointments, it was the father’s 15 year old sister who was bringing the child in for visits in lieu of the mother or father.

From the two examples, it is obvious how much influence the parents have over the rehabilitation process involved in cataract therapy.

One reason for contact lens noncompliance, included the parents incapability to insert or remove the lens. If the eye was red or the lens came out, parents would often wait for an appointment to have someone else remove or insert the contact lens. Initially, when first fitting the lens, the doctors did not want the parents touching the eye, in case they would rupture a suture or cause an infection of the eye so soon after surgery. However, the parents being taught at a later date may have increased patient compliance with the contact lenses.

Even when a good visual acuity after therapy is accomplished, a variety of binocular vision deficits can be noted such as stabismus, diplopia, and nystagmus. The current study confirms this by looking
at the number of post-therapy strabismics and amblyopes within both the bilateral and unilateral aphakic groups.

Amblyopia therapy is often assumed to consist of patching, however, there is some argument in the journals over the amount of patching in unilateral aphakes. Many believe that initial patching of the non-aphakic eye for one hour per day and increasing this amount depending on visual status is the ideal therapy. This was the approach generally used with the patients in this study.\textsuperscript{16-17} Whereas, others believe that occlusion for 90\% of the waking hours is the treatment of choice.\textsuperscript{18-19} Both have considerable justification and no clear selection can be made by the literature alone.

The patient base used in this study is a representative population sample. It includes both those who are extremely motivated and those who are less so. Money is always a factor, as well as time to spend with the child on rehabilitation. Parents who are well informed and well taught could only improve compliance. One example, two of the patients in the study were the children of blind parents. Both parents understood the cataract etiologies and possible treatments, the years of therapy required and the possible outcomes, including the children becoming visually challenged. If needed, they would take a contact lens to church with them, if one had previously came out of a daughter's eye, and ask for help from a neighbor to insert the lens since they could not see the lens or the eye. They tried to help with therapy as much as possible. If all families were this motivated, compliance and positive results could only increase.

\textbf{CONCLUSIONS}

As comanagement continues to grow throughout the United States, optometrists need to know when to refer for cataract surgery in the pediatric population. They also need to be well versed in the possible treatment protocols and the results of each. Whether the therapy calls for intraocular lenses to be inserted by the ophthalmologist or contact lenses to be fit by an optometrist, each regimen needs to be carefully considered on an individual basis for each patient. The truly fine doctor is one which can look at each detail to ascertain the best protocol in light of all the factors. With combined efforts of all health care members, including ophthalmologists and optometrists, working on these special children, the outcome for each can be maximized.
REFERENCES


<table>
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<tr>
<th>Patient</th>
<th>Cataract type</th>
<th>Surgery</th>
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<th>Contact Lenses</th>
<th>CL success</th>
<th>Strabismus</th>
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*Note- Second surgery in bilateral cases followed the next week except patient #13 which followed 2 1/2 years later.