Development of visual acuity in infants with congenital cataracts

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SUMMARY The visual acuity of 4 infants with congenital cataracts was measured serially during the first year of life by a preferential looking technique. Two infants with bilateral cataracts and no measurable acuity before surgery showed rapid development of acuity to normal levels for age after surgery and optical correction. In an infant with a unilateral cataract and an infant with a cataract and persistent hyperplastic primary vitreous marked differences in monocular acuities were found after surgery. Acuities became equal in the latter case after occlusion of the normal eye, while the other infant recovered acuity with 'bi-ocular' viewing. These acuity measurements demonstrate the sensitivity of the human visual system to binocular and monocular visual form deprivation in the first year of life.

Clinical experience and results from studies of visual deprivation in young animals1-4 emphasise the need for early surgery and optical correction in infants with congenital cataracts. Advances in surgical techniques and contact lens practice have permitted therapy to be initiated within the first weeks, if not days, of life. However, the visual results of this early treatment are rarely known until after age 2 or 3 years when visual acuity can first be measured with conventional methods. Before this age acuity is usually estimated by assessment of physical signs (e.g., strabismus, nystagmus, clarity of ocular media, and fundus appearance) and by observing the infant's response to a light, striped drum or other large visual target. The adequacy of postoperative optical correction is assumed from retinoscopic findings rather than actually determined by a measure of acuity.

Just as in the routine care of older children and adults with cataracts, it would be valuable to quantify the visual acuity of infants with congenital cataracts before and after surgery and during visual rehabilitation with spectacle or contact lenses. The only previous reports of such a series of measurements are by Enoch and Rabinowicz5 and Enoch et al.6 In these studies optokinetic nystagmus was used to assess acuity in infants with unilateral cataracts. The 'preferential looking technique' is a simple and reliable psychophysical method that has been used to study the development of visual acuity in normal infants.7-10 We have now applied this technique in a clinical setting, and in the present study we report the results of serial measurements of visual acuity during the first year of life in 4 infants with congenital cataracts, 2 with bilateral and 2 with unilateral cataracts.

Subjects and methods

The 4 infants in the present study were patients of ophthalmologists at the Massachusetts Eye and Ear Infirmary, Boston. Before their referral for visual acuity testing and frequently thereafter they had full ophthalmological examinations. At each session for visual acuity testing the infants received a brief eye examination including assessment of ocular motility, retinoscopy, and evaluation of ocular media and fundus appearance by direct or indirect ophthalmoscopy. Cataract surgery was performed on all of them with a 2-instrument technique of irrigation and aspiration-cutting with the O'Malley ocutome.11 The surgeons attempted to remove all the lens material at the time of the first surgery. Keratometry and/or contact lens fitting with trial lenses were usually accomplished under anaesthesia in the early post-
operative course; further refittings were performed with the infant awake.

A fast version of the 2-alternative forced-choice preferential looking technique was used to measure visual acuity. Details of the technique and measures of its reliability and validity have been published elsewhere. Briefly, the technique is based on the discovery that given a choice between a patterned and an unpatterned target, an infant prefers to look at the patterned one. The infant sits on the parent’s lap 50 cm from a black partition containing 2 screens. Back projected on to one screen is a high-contrast, vertically-orientated, square-wave grating, and on the other screen is a homogeneous field of the same mean luminance (34 cd/m²). An observer unaware of the side of presentation of the grating is seated behind the partition and watches the infant’s eye and/or head movements through a peephole. The observer judges which side the infant prefers to look at, and, if this judgment coincides with the side of presentation of the grating, the infant is considered to have made a correct response. The side of presentation of gratings is randomised, and gratings are presented in a staircase from low to high spatial frequencies, that is, from coarse to fine. (Spatial frequency is the number of cycles of a grating, i.e., pairs of black and white stripes per degree of visual angle subtended.) This sequence of gratings always began with 0·38 cycles per degree (c/d), progressed in one-octave steps to 1·5 c/d and thereafter in approximately ½-octave steps to 24 c/d. (An octave change is a doubling or halving of spatial frequency.) Sessions were terminated when a spatial frequency was reached at which the infant fixated the homogeneous field more often than the grating (criteria defined in Gwiazda et al.⁹). The spatial frequency one step lower on the staircase than this termination frequency was taken as the threshold or ‘visual acuity’. Fig. 5 provides examples of staircases obtained using the ‘fast procedure’ and how such results compare with those from a constant stimulus method (see Results of infants B and C for details).

Monocular acuities were measured by a disposable patch occluder over the eye not being tested. The aphyric edges of the infants were corrected during testing with either contact lenses (hard or soft) or spectacles. Correction was always ‘overplussed’ by approximately 2 dioptres and therefore focused for the testing distance. All thresholds reported for aphyric edges have been corrected for magnification due to the spectacle or contact lenses.¹²

Results

Figs. 1–4 show the results of serial measurements of visual acuity in the 4 infants. In all figures visual acuity is plotted on the vertical axis in spatial frequency and age along the horizontal axis in weeks. For readers unfamiliar with visual resolution thresholds expressed in spatial frequency approximate equivalents in Snellen notation are plotted on the right vertical axis of each graph (convention being 6/6 Snellen = 30 c/d²). Development of visual acuity in normal infants as measured with the current method would be expected to proceed from about 0·50 c/d (approximately 6/360) at 1 month of age to 12 c/d (approximately 6/15) at 1 year of age.¹⁰ Clinical details and visual acuity measurements will be discussed for each of the 4 infants.

Case 1

Infant A was noted to have bilateral cataracts at 3 days of age. There was no family history of congenital cataracts, and all investigations to determine the aetiology of the cataracts were inconclusive. On examination the corneas were 10 mm in diameter, pupils reactive, and there was no nystagmus or strabismus. The infant would not fix or follow a light. There were dense nuclear lenticular opacities in both eyes, with a red reflex around the edge of the opacities in the dilated pupil. Fundus detail was obscured by the cataracts, and ultrasonography revealed only the lenticular opacities.

Visual acuity measurements in both eyes preoperatively showed no responses to the lowest spatial frequency grating presented, that is, acuity worse than 0·38 c/d (Fig. 1). Cataract surgery was performed on the right eye at age 3 weeks, and the ocular media were clear enough to discern fundus detail on examination 1 week postoperatively. Visual acuity of the right eye measured at 5½ weeks was 1·8 c/d, while the acuity of the left eye was still not measurable. Cataract surgery on the left eye was performed at age 6 weeks. Some hyphaema was present immediately after operation, and the view of the fundus one week later was moderately clear, obscured only slightly by some opacification on the intact posterior capsule of the lens. Hard contact lens wear was started at age 7 weeks, and visual acuity measured one day later was 4·0 c/d for the right eye and 1·35 c/d for the left eye. Over the next 3 weeks visual acuity increased in both eyes until it reached 8·1 and 4·0 c/d in right and left eyes respectively. The ocular media of the right eye were clear, but some pupillary membrane was noted in the left eye by age 10 weeks. Further measurements of visual acuity at age 22 weeks were unchanged and a slight increase in acuity of both eyes was present at age 26½ weeks, the right eye being 10·8 and the left eye 5·4 c/d (these results were replicated twice for each eye in this session).

A discussion of the pupillary membrane in the left eye was attempted at age 27 weeks. Despite an
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apparently satisfactory opening in the membrane at the time of surgery, several days later the opening appeared small, eccentric to the visual axis, and unquestionably inadequate. Visual acuities measured about 4 weeks after this unsuccessful surgery (age 31 weeks) showed a profound difference between the 2 eyes: right eye 13.5 c/d and left eye 1.35 c/d (results replicated twice). By age 35 weeks the acuity of the left eye had decreased further to 0.34 c/d, while the right eye acuity was now 10.8 c/d. A membranectomy was performed in the left eye with the O'Malley ocutome at age 41 weeks. One day postoperatively the left eye showed no response even to the lowest spatial frequency grating despite clear ocular media. This measurement was repeated 3 times during this session with the same result. Visual acuity of the right eye was higher now than previously—16 c/d. One week later occlusion of the right eye as therapy for the asymmetry in acuities was started at 5 hours per day. At 44.5 weeks of age acuity of the right eye had decreased to 5.4 c/d, while that of the left eye had increased to 1.8 c/d. This trend of decreasing acuity in the right eye and increasing acuity in the left eye continued until age 47.5 weeks, when acuities had reversed. The right eye at 4.0 c/d was now 2 octaves lower than the left eye at 16 c/d. Occlusion therapy was then decreased, and it was eventually stopped entirely. By age 50 weeks acuities were equal; both eyes were 10.8 c/d, which is normal for this age.

Case 2
Infant B was born with the rubella syndrome and bilateral congenital cataracts characterised by some opacification apparently in the nucleus of the lens and a clear zone in the lens periphery. Corneal diameters were 8 mm, and there was no nystagmus or strabismus. A full fundus examination was limited by the lens opacities and pupils which would not dilate beyond the mid position, but there were good red reflexes and grossly normal posterior poles. During the first weeks of life the infant's pupils were kept as dilated as possible with topical atropine, and binocular visual acuity measured at 5 weeks of age was 1.5 c/d (Fig. 2). By 7½ weeks of age acuity had increased to 3·0 c/d. At age 9 weeks acuity decreased slightly to 2.25 c/d, and within a fortnight the lenses had become totally opaque. Eye movements became wandering and dysconjugate, and a variable angle esotropia with nystagmus developed. At this time and thereafter until cataract surgery there were no
responses to even the lowest spatial frequency gratings presented when acuity measurements were attempted.

Medical approval for general anaesthesia was not given until age 24 weeks, and cataract surgery then was performed on the right eye. At the end of surgery there was a clear view of the fundus, and a typical appearance of rubella retinopathy was present. Visual acuity of the right eye measured 3 days postoperatively (with clear ocular media) was 2.7 c/d, while the left eye still showed no measurable responses. Results of acuity measurements of the right eye on the 6th and 7th postoperative days (age 25 weeks) and at 28½ weeks of age all had the same threshold—4.0 c/d. Spectacle correction was given to the infant for full-time wear beginning at 27 weeks of age.

Cataract surgery was performed on the left eye at 28½ weeks of age, and, with clear ocular media 3 days postoperatively, visual acuity of this eye was 2.7 c/d. Over the next few weeks visual acuity of the right eye increased to 9.0 c/d, while acuity of the left eye remained at 2.7 c/d. The right eye subsequently decreased in acuity while the left eye increased. At age 40 weeks soft contact lenses were fitted and worn continuously thereafter. Acuities at 41 weeks of age were equal at 5.4 c/d, and by 54 weeks of age, they were 10.8 c/d, which is normal for this age. The infant remains esotropic with alternating fixation and some nystagmus.

At age 66 weeks we had the opportunity to measure at the same testing session the visual acuity of the left eye twice with the 'fast procedure' and also with a constant stimulus method (Fig. 5, left-hand graphs). For this latter method gratings ranging from 1.5 to 18 c/d were presented in randomised sequence. There were at least 20 trials for each of the 8 spatial frequencies presented. The lower left graph in Fig. 5 shows the psychometric function resulting from these data; percentage positive responses are plotted against spatial frequency in this graph. The threshold (70% frequency of seeing) for the constant stimulus method was between 6.0 and 9.0 c/d, while both thresholds when the fast procedure was used were 9.0 c/d. This represents at most about a ½ octave difference between results obtained with the method used in this study and the more conventional method of constant stimuli.

Case 3

Infant C was noted to have a cataract in the right eye at 5 days after birth. No cause for the cataract could be discovered. The corneal diameter of both eyes was 10 mm, pupils were equal and reactive, and the anterior segment of the right eye was normal. The lenticular opacity in the right eye was dense centrally, with a clear zone peripherally. Ultrasonography revealed only the cataract. There was no strabismus, but on occlusion of the normal left eye the infant would not fix or follow a light with the right eye.

Visual acuity of the left eye at 11½ weeks of age was 4.5 c/d, while the right eye showed no responses to even the lowest spatial frequencies presented (Fig. 3). Cataract surgery was performed at this time, and a view of the fundus immediately after surgery revealed no abnormalities. The media were clear 2 days postoperatively, and visual acuity measured in the right eye was the same as preoperatively, that is, without responses to the coarsest gratings presented. Acuity of the left eye was again 4.5 c/d. At 12½ weeks of age acuity of the right eye had increased to 0.34 c/d (replicated twice in this session) and by 17½ weeks it was 2.0 c/d. When the test on the right eye was repeated one hour later the result was 1.4 c/d, representing only about a ½ octave difference between the 2 thresholds. Visual acuity of the left eye was now 12 c/d. A 'continuous-wear' soft contact lens was then placed on the right eye and within one week, visual

Fig. 3 Visual acuity development in an infant with a unilateral congenital cataract.
acuity of this eye increased to 6-3 c/d, while the left eye remained at 12 c/d. This contact lens became ill-fitting and was noted to be decentred at times during the day. Visual acuity was measured at age 21 weeks (with a different contact lens), when the right eye was 4-2 c/d and the left eye, 9-0 c/d. The ill-fitting contact lens had to be continued for a further 2½ weeks for lack of availability of another lens. Three days before the next acuity testing session (at age 23½ weeks) the lens was lost. At this session acuity of the right eye was found to have decreased further to 2-0 c/d (replicated 2 days later), while the left eye was 12 c/d. Another soft lens was placed at this time, and within 5 days the acuity of the right eye had increased to 8-1 c/d. Eventually this soft lens also had to be replaced, this time by a hard lens. By 27 weeks the infant was wearing the hard lens for 12 hours each day, and acuities for right and left eyes were 10-8 and 9-0 c/d respectively. Monocular acuities measured at 29, 32, 35, 40, and 45 weeks of age were within one octave difference of one another.

At 47 weeks of age the acuity of the right eye was measured by both the fast procedure and a constant stimulus method (see similar testing performed on infant B for details). As shown in Fig. 5 (right-hand graphs), the results with the 2 methods were nearly identical, both being approximately 9-0 c/d.

CASE 4

Infant D was noted at birth to have a cataract in the right eye, and the diagnosis of persistent hyperplastic primary vitreous was made about one month later. At 11 weeks of age lensectomy and vitrectomy were performed. A retinal detachment was discovered postoperatively, and treatment with cryopexy was attempted without success. The retina then developed a 180° giant tear, and the patient was referred to Boston for further therapy. At age 13 weeks surgery was performed and the retina was successfully re-attached by an 'open-sky' technique.13 Subsequent examinations under anaesthesia revealed a clear cornea, attached retina, some vitreous membranes adherent to the optic nerve head with traction, but a grossly normal-appearing macula except for some pigmentary changes. At age 31 weeks a contact lens was fitted, and it was worn continuously thereafter. No constant strabismus was noted on many examinations.

Visual acuity was measured at 32 weeks of age and was 0-34 c/d (Fig. 4). The normal left eye had an acuity of 9-0 c/d. This 4-octave difference between eyes was unchanged when measurements were repeated at 34 weeks of age. To decide on the visual potential of the right eye constant occlusion of the left eye was started at this time. The parents reported that the infant was irritable for 2 days after occlusion was started but then behaved normally for the next 7 days while using the right eye only. After a total of 9 days of occlusion acuities were measured; the right eye had increased to 4-0 c/d, while the left eye had decreased to 3-0 c/d. Repeat acuity measurements on the same visit were 2-7 c/d and 2-2 c/d for right and left eyes respectively (about a ½ octave difference between the 2 sets of results). It is noteworthy that on removal of the occluder the left eye was esotropic and the infant was fixing with the right eye. Occlusion was stopped at this testing session, and on the next day the eyes were straight and acuities were measured once
used in recent years to study the development of visual acuity in normal infants, and there has been good agreement of results from different teams of investigators. Measurements with this method indicate that visual resolution is limited at birth and increases during the first year of life. Similar trends in acuity development have been found by other techniques such as optokinetic nystagmus or the visual evoked cortical potential, although absolute acuity levels differ with different methods. Dobson and Teller recently summarised the literature on normal infant acuity and concluded that the increase in acuity in postnatal life as demonstrated with preferential looking, optokinetic nystagmus and visual evoked potential methods probably reflects the neural maturation of the visual pathway. The patterns of results in the 4 infant patients of the present study are in striking contrast to the normal data. In the discussion that follows these results are used to comment on the effects of visual deprivation in human infants and the clinical management of infants with congenital cataracts. An underlying assumption in this discussion is that our psychophysical measurements reflect neural abnormalities in the developing visual system of these infants. The validity of this assumption, as well as the patterns of results themselves, will obviously need to be confirmed by studying more extensive series of patients with similar and different techniques and with longitudinal follow-up beyond the first year of life.

Binocular visual form deprivation occurred in infants A and B. In infant A this deprivation can be considered to have extended from birth until about 7 weeks of age. In the first 3 weeks deprivation was due to the cataracts; in the next 3 weeks, between operations, the right eye was aphakic without correction and the left eye phakic with cataract; and there was a further week of bilateral aphakia before optical correction was started. The first measured acuities in the right eye and left eye after the respective operations were nearly equal, and there was rapid development of acuity thereafter. The persistent difference in acuities between the 2 eyes throughout the first months of life can probably be attributed to less clear ocular media in the left eye due to early hyphaema and developing pupillary membrane. Two other infants with bilateral congenital cataracts, the same timing of operation (3 and 6 weeks of age), and uncomplicated early postoperative courses have been reported as showing rapid early acuity development in both eyes without any persistent interocular difference in acuity as in infant A. It can be concluded that a period of binocular form deprivation from birth until about 2 months of age certainly had no lasting detrimental effects on the development of acuity.

Discussion

In the present study we used a preferential looking technique to measure visual acuity in the first year of life of infants with congenital cataracts. Many variants of this psychophysical technique have been again. Again the right eye was 4.0 c/d and the left eye 3.0 c/d.

At 38 weeks of age, 3 weeks after occlusion had been stopped, the right eye acuity had decreased to 0-67 c/d while the left eye acuity had increased to 18 c/d. Constant occlusion of the left eye was again prescribed, and after 7 days of occlusion acuity of the right eye was 2.7 c/d and that of the left eye 4.5 c/d (both measurements repeated twice in this session with the same results). Again the parents described a period of irritability in the infant after onset of occlusion (about 2 days), but normal behaviour soon followed. Occlusion was discontinued, and on the next day acuities were measured and the same results were obtained as on the previous day.

Fig. 5 Comparison between results obtained at the same testing session by the fast procedure of measuring acuity (method 1) and a constant stimulus method (method 2). The left-hand graphs are from infant B (left eye), while those on the right are from infant C (right eye). In both infants for method 1 responses to the 0-38 c/d and 0-75 c/d gratings were all correct, although not displayed. Arrows along the horizontal axis indicate the thresholds.
Infant B had about 15 weeks of binocular form deprivation beginning at age 3 months. The deprivation, however, was preceded by some early visual experience with a recorded increase in acuity. Within days of the operation for cataract acuity in the right eye was found to be nearly identical with the highest acuity attained before onset of deprivation. The first measured acuity of the left eye after operation was similar to that first measured in the right eye. After some inequality of monocular acuities, with the right eye higher than left (probably due to the short period of optical correction afforded to the right eye before operation on the left eye), acuities became equal and developed to the level expected in normal infants at 1 year of age. This pattern of results suggests that the period of binocular form deprivation only arrested the development of acuity. An apparent arrest of development has also been noted in acuity measurements obtained on another infant with bilateral cataracts reported by Mohindra et al. Cataracts were present in this infant from birth until about 16 weeks of age, and acuities after surgery were low and more like those of a much younger infant. After operations and optical correction there was a gradual increase in acuity to levels normal for age.

Direct comparison of these results with those of experimental studies of binocular visual deprivation is difficult because of the different modes of deprivation, relatively longer periods of deprivation in animals, and the usual problem of species differences. It is of interest, however, that prolonged bilateral optical blur during development, such as could occur in congenital cataracts or subsequent uncorrected aphakia, has been shown experimentally to decrease the spatial resolution of individual sustentacular type geniculate neurons in cats. The question of recovery from binocular deprivation has been considered by Timney et al. Gradual and nearly complete development of acuity in kittens was found even after 4 or 6 months of dark-rearing, an extreme form of binocular deprivation. These behavioural results and other physiological results, like our findings in human infants with bilateral cataracts, lend themselves to the interpretation that binocular deprivation may simply delay the development of vision. However, a more complex mechanism also must occur, since clinical experience and experimental evidence suggest that the longer the deprivation the less recovery is possible.

Monocular form deprivation occurred in infants A, C, and D and caused marked differences in acuity between eyes. The pupillary membrane in infant A deprived the left eye over a period of months. When the membrane was finally removed, there was no measurable acuity in the deprived eye and at least 5 octaves difference in acuities between eyes. Similarly, infant C had no measurable acuity postoperatively in the right eye after 11 weeks of monocular form deprivation from a unilateral cataract, and there was a 3-octave difference in monocular acuities. Infant D had about 7 months of monocular deprivation, initially due to lens and vitreous opacities and later contributed to by post-surgical eyelid oedema, probable corneal irregularity, and uncorrected aphakia. There were responses only to the lowest spatial frequency when acuity of the deprived eye was first measured, and more than 4 octaves difference in acuities was present between eyes. Two types of recovery from these effects of monocular deprivation were documented. Firstly, recovery in infants A and D occurred as a result of reversing the deprivation, that is, occlusion of the previously open eye while the formerly deprived eye remained unoccluded. The reverse occlusion in infant A was part-time (5 hours per day), while constant occlusion was prescribed for infant D. The effect of reverse occlusion was to increase the acuity of the previously deprived eye at the expense of the acuity of the eye now being deprived. This 'trade-off' in acuities has also been reported in strabismic infants undergoing monocular occlusion as therapy for acuity differences. The increase in acuity of the right eye of infant A between 6 and 9 months of age, during the decrease in the left eye acuity secondary to the pupillary membrane, probably represents another example of a trade-off. The different time courses of recovery with reverse deprivation—over days in infant D and over weeks in infant A—seem to relate to the amount of occlusion used (i.e., constant versus part-time). The second mode of recovery that occurred is exemplified in the data from infant C. Full recovery of acuity in the deprived eye occurred simply by leaving both eyes open—so-called 'binocular recovery' or 'bi-ocular recovery'. Jacobson et al. also noted this form of recovery in a strabismic infant who had markedly different acuities resulting from prolonged occlusion therapy.

In the only other prospective studies of visual development in infants with unilateral cataract Enoch and Rabinowicz and Enoch et al. reported acuities measured serially in 2 infants using an optokinetic nystagmus technique. One infant had cataract surgery at 4 days of age and showed gradual increase in acuity of both eyes over a period of nearly 4 months. Another infant had cataract surgery at 6 months of age, and again, over some 4 months, acuity of the affected eye increased steadily. The normal fellow eye in both these infants underwent part-time occlusion. Despite differences in method of acuity assessment, timing of surgery, and use of occlusion in the normal eye there are general similarities in the
pattern of acuity development in these 2 infants and in infant C.

Monocular deprivation by eyelid suture in animals, including primates, provides an experimental analogue to these human data. In animals monocular deprivation during the ‘sensitive period’ of development causes profound changes in visual cortical physiology and morphology, lateral geniculate nucleus cell size, and behavioural acuity (see reviews). The degree and time course of recovery have been investigated by reverse suture techniques—that is, opening the deprived eye and suturing the lids of the other—the counterpart of the occlusion therapy in infants A and D. In the kitten physiological and morphological recovery can occur in a matter of days after reverse suture begins, a time course similar to that seen in infant D. ‘Bi-ocular recovery’ such as occurred in infant C also has been demonstrated in kittens by serial measurements of visual acuity and by physiological recordings in the visual cortex.

Despite the small sample of patients reported in this study the available data allow for certain comments to be made about management of infant patients with congenital cataracts. Timing of the operation and optical correction is acknowledged to be of great importance in the treatment of both bilateral and unilateral congenital cataracts. Infant A and 2 other infants with bilateral cataracts were operated on at 3 and 6 weeks of age and underwent optical correction at least by 8 weeks of age. All 3 infants showed development of visual acuity which rapidly attained levels normal for age. Although final adult acuities are not known for these infants, the present data suggest that surgical intervention before 3 and 6 weeks of age may be unnecessary. How long surgery can be delayed is a more difficult issue. The results from infant B and the infant with bilateral cataracts until 16 weeks of age reported by Mohindra et al. seem to indicate that successful surgery and prompt, careful optical correction even as late as 4 or 6 months of age is still compatible with acuity development to levels normal for age in the first year of life. The timing of surgery in infant C, our only example of an uncomplicated unilateral cataract, was relatively late compared to reports of surgery within days of birth. Yet, even though surgery was performed at 11½ weeks of age and optical correction started at 17½ weeks, acuity development in the deprived eye was rapid, and both eyes became nearly equal by 27 weeks of age. These early visual results for infant C are especially encouraging in view of the dismal prognosis usually assigned to such cases. About 3 months of age is therefore not too late to begin therapy for unilateral congenital cataract, although earlier therapeutic intervention might in theory be preferable.

The importance of proper optical correction in patients with congenital cataract has been stressed by Enoch . Infant C provides an example of the need for constant and scrupulous attention to this matter. Since occlusion of the normal eye was not used in this infant and there was no strabismus, increases and decreases in acuity of the deprived eye after surgery were most likely due to the effect of optical quality on development of spatial resolution. After an early increase in acuity, an ill-fitting, decentered contact lens led to a decrease in acuity between 18 and 23½ weeks of age. Only after 2 changes of contact lenses was an adequate fit obtained, and thereafter acuity began to increase again.

The clinical value of occlusion therapy is especially well illustrated in the data from infant D. Constant monocular occlusion for 9 days equalised widely different acuities resulting from 7 months of monocular deprivation. Once occlusion was stopped, a rebound occurred; acuity in the affected right eye decreased while acuity in the normal left eye increased again. This strong preference for the left eye is understandable in view of the right eye’s poorer image quality, probable restricted visual field, and probable organic maculopathy. The effectiveness of part-time occlusion is seen in the results of infant A after membraneotomy. In addition the rapidity with which an undesired reversal of acuities can occur during occlusion therapy is illustrated in the data from this infant. There is no question but that during monocular occlusion therapy in the first year of life frequent assessments are essential. Finally, it is worthy of clinical attention that occlusion of the normal eye was not necessary to permit recovery of the affected eye in infant C. The infant visual system is capable therefore of recovering acuity after monocular deprivation when input to the 2 eyes has been equalised. However, a close monitoring of visual acuity development is imperative if ‘bi-ocular recovery’ is to be used in the management of such patients.

In conclusion, the feasibility of making serial measurements of visual acuity in infants with congenital cataracts has been demonstrated. Although astute clinicians in the past have successfully treated such patients without knowing visual acuities, there should be little argument that having this information can only lead to better understanding and better management of these patients. These data also contribute to our increasing knowledge of the effects of monocular and binocular visual form deprivation on the very plastic visual system of the human infant.

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