



**Microcorneas and corneal scarring**

Photo: Murray McGavin

keratomalacia. Either keratoplasty or optical iridectomy before dense amblyopia develops is worth trying.

## Conclusion

To conclude, we would like to emphasize that all the children who are likely to be admitted into blind schools should be thoroughly examined by an ophthalmologist. The eye specialist should have a background of working with children and a knowledge of amblyopia and the use of low visual aids. With this approach, and if simple low visual aids are introduced early in life, the quality of education and life can be significantly improved.

blindness and accounts for 12% of admissions to blind schools.

One more condition which could be treated surgically is corneal opacity of late onset due to acquired pathology such as

## References

- 1 Eckstein M, Vijayalakshmi P, Killedar M, Gilbert C, Foster A. Aetiology of childhood cataract in South India. *Br J Ophthalmol* 1996; **80**: 628-32.
- 2 Rahi JS, Sripathi S, Gilbert CE, Foster A. Childhood blindness in India: causes in 1318 blind school students in nine states. *Eye* 1995; **9**: 545-50.
- 3 Jain IS, Pillai P, Gangwar DN, Gopal L, Dhir SP. Congenital cataract: management and results. *J Pediatr Ophthalmol Strabismus* 1983; **20**: 243-6.
- 4 Droste PJ, Archer SM, Halveston EM. Measurement of low vision in children and infants. *Ophthalmology* 1991; **98**: 1513-8.
- 5 Robb RM, Petersen RA. Outcome of treatment for bilateral congenital cataracts. *Ophthalmic Surgery* 1992; **23**: 650-6.

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## Review article

### Examination of a Child with Visual Loss

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Ophthalmic examination of a child with visual loss aims to confirm the impairment, establish the diagnosis, identify the treatment required and describe the prognosis for the disorder(s) causing visual loss. The examination by ophthalmic professionals is an important component of the broader assessment of visual function and educational needs of the child, which form the basis of the plan of management of that child and her/his family. The benefits of evaluation by a multi-disciplinary team, comprising ophthalmic and paediatric professionals together with educationalists and psychologists, are recognised.<sup>1</sup> Therefore, where the necessary resources exist, visual assessment teams are being increasingly established.

The ophthalmic examination of a child is essentially the same as that of an adult but with the techniques adapted according to the child's age, personality, ability to co-operate, and level of responsiveness. Any other non-ophthalmic disorders the child may have will also need to be taken into account. Thus, the precise content and sequence of the components of the exami-

nation will vary from child to child. Most children can be successfully examined without anaesthesia or sedation, which are generally only necessary on clinical grounds.

#### Taking a History

It should be remembered that the mother of the child is the person who knows the child better than anyone, and if she suspects that her child may not be seeing normally then this should be taken very seriously. It is usually possible to assess the overall level of visual function through a detailed history, taken from the parents, and possibly from other relatives and teachers, as well as from the child, if appropriate. The interview also provides the first opportunity to assess the parents' response and adaptation to their child's visual problems and to establish a relationship between the family and the ophthalmic team.

Information on the age at onset, duration and level of visual loss should be sought. The presence or absence of specific symptoms and signs should be determined: these include eye-poking, photophobia, significant worsening of vision in dim or very bright light, or nystagmus. It is also important to enquire about any family history of ocular or systemic diseases. Questions should be asked about the mother's pregnancy, the birth, including gestation and birth weight, and the neonatal period. It should be established whether the child's

general development is normal or whether there are concerns about hearing, speech, motor or learning abilities. Finally, as appropriate, it may be necessary to ask about specific aetiological agents, such as drugs, infections, nutritional deficiencies or trauma.

#### The Ophthalmic Examination

##### Observing the child

The clinical examination starts during the history taking, through assessment of the child's visual alertness and behaviour: for example, her reaction to changing the lighting, or if someone unknown approaches her. The child should also be observed for any external ocular



**Matching test (Sheridan-Gardner) to measure visual acuity**

Photo: David Taylor



*Portable slit-lamp examination in Chile*

Photo: Clare Gilbert

Young infants can be examined in this way if held up to the slit lamp in the prone 'flying baby' position or, alternatively, by using a hand held slit-lamp. If a slit-lamp is not available, examination is possible using a magnifying loupe and appropriate light source. The organisation, symmetry and clarity of the structures of the anterior segment should be carefully evaluated. The intraocular pressure should be measured

abnormalities, such as ptosis or nystagmus, as well as for other unusual features, such as abnormal head shape.

### **Testing visual fixation and following**

The ability to fix and follow an object should be tested as well as whether fixation is central, steady and maintained.<sup>2</sup> This is particularly important in young infants and in older children with other disabilities who are unable to co-operate with formal tests of vision. However, it should be remembered that fixation and following require normal ocular motor responses and, even when normal, cannot be interpreted as indicating a particular level of vision.

### **Examining pupillary responses**

Assessment of pupil size and their response to a bright light can be difficult, especially in infants, but should be carried out. Abnormal responses are important diagnostic clues. For example, a relative afferent pupillary defect indicates asymmetrical anterior visual pathway disease and a paradoxical pupillary response may suggest retinal disease.

### **Assessing eye movements and strabismus**

The ocular motor system should be assessed by examining the corneal light reflexes, and by the cover-uncover test to detect strabismus. The range of ocular movements should also be tested, especially when a neurological disorder is suspected. Eye movements can be tested to ascertain whether the child can follow a moving object (smooth pursuit system), and whether they can refixate on an object introduced into the field of vision (saccadic eye movements). Children are naturally interested in faces, and the examiner can use her/his own face as the object of interest.

### **Examining the anterior segment**

Wherever possible the cornea, iris, lens, anterior chamber and anterior vitreous should be examined using a slit-lamp.

when there are specific concerns, using methods appropriate to the child's age and level of cooperation. Pulse-air tonometry, if available, is generally more suitable for infants and young children but in older children, applanation tonometry is usually possible.

### **Examining the posterior segment**

Examination of the fundus can be difficult and dilation of the pupils is essential. It is very important to examine the fundus of all children who have reduced vision, as loss of vision may be due to life threatening conditions, such as retinoblastoma. In young infants examination can be made easier if the child is held and fed by a parent while being examined. For older children it may be necessary to wrap the child in a blanket, and have an assistant hold the child's head steady during the examination, after explaining to the parents that the examination is not painful in any way. Wherever possible, direct and indirect ophthalmoscopes should be used. Indirect ophthalmoscopy, if possible using a 28+ or 30+ dioptre lens, provides a good view of the entire fundus whilst direct ophthalmoscopy allows more detailed examination of structures such as the optic disc and fovea.<sup>2</sup>

### **Refraction**

As part of their initial ophthalmic examination, all children should be assessed by cycloplegic refraction for the presence of a refractive error, as this may be the cause of the visual impairment, as well as providing diagnostic clues.

### **Examining the family**

Ophthalmic examination of the parents, siblings and other family members is important whenever the disorder causing visual loss is suspected to be hereditary, even if there is no previously established family history.

## **Measuring Visual Functions**

Measuring visual functions in children is not straightforward. The visual system is relatively immature at birth and development, particularly rapid in the first year of life, continues into late childhood.<sup>3</sup> Therefore, it can be difficult to predict final visual outcome in infants and very young children, including some of those with apparently very poor vision.<sup>4</sup> Acuity is the most frequently measured visual function but others, such as visual fields and binocularity, may be particularly relevant to the overall functional assessment of the child.

### **Acuity**

Despite the development of methods appropriate to different ages, measuring acuity remains difficult in infants, pre-school children and those with other disabilities. In addition, many techniques require special equipment and conditions, making them unsuitable for some settings. Whichever method is used to measure a child's vision, it is important to assess vision corrected for any refractive errors, and to assess the eyes separately as well as together whenever possible.

The acuity of infants may be measured using forced choice preferential looking methods using Teller or Cardiff acuity cards, and by electro-physiological tests of visual evoked potentials. Both techniques are time-consuming, require special equipment and trained personnel, and are costly. Until recently these methods were generally only used in specialised paediatric ophthalmology units.<sup>2</sup> In co-operative children, aged 18–24 months, it is possible to use picture optotype tests (such as Kay pictures) at very short distances. Standard optotype tests, such as the Snellen E chart, can generally only be used in children aged 3 years or above. It is important that testing is carried out at the appropriate distance, and, if possible, using linear optotype systems to ensure the effect of crowding is not overlooked in children with amblyopia.



*The 'flying baby' position for slit-lamp examination*

Photo: David Taylor

With some younger children and those unable to read, a matching test, involving matching letters on the distance chart with those on a card held at near, can be used.

## Visual fields

Formal visual field testing is generally only possible in older children. However, useful information about significant visual field defects, such as hemianopia, can be obtained by testing visual fields using simple confrontation methods.<sup>2</sup>

## Binocular vision

Assessment of the level of binocular vision is primarily important in children with strabismus. However, it can be a useful test in the assessment of a child suspected of having serious loss, as the presence of binocular vision implies good acuity in each eye. There are various clinical stereo-acuity tests, some of which can be used with young children.<sup>3</sup>

## The Child with Very Poor Vision

When assessing a child thought to have very poor vision, methods which can detect

very basic levels of visual function should be used. Examples include assessing whether a child responds in any way to a bright light; or if they respond to a visual threat, such as waving a hand fast in front of the face. In infants a useful test is the spinning test. In this test the child is held at arms length facing the examiner, who spins the child round several times. If, after stopping spinning, the eyes have prolonged nystagmus, this suggests that the child has very poor vision (or cerebellar disease).

All these tests need to be interpreted cautiously, as a normal response depends on motor function as well as visual function. If these tests of basic visual function are abnormal, electro-diagnostic tests (such as electro-retinograms or visual evoked responses) can be used to confirm whether an abnormality is present or not. If these facilities are not available it is advisable to say to the parents that you need to examine the child again in a few months' time, when the tests can be repeated.

## What to Tell the Parents of a Child Thought to be Blind

It is advisable to be cautious about giving a

definite visual prognosis to parents of young children who appear to be blind. As it is difficult to predict the final visual outcome in young children,<sup>4</sup> it is important to avoid judging the child's visual function too early in life. Whilst it is essential that parents are not given unrealistic expectations of their child's future vision, it is important to remember that some children with serious ocular disorders and apparently very poor vision, can achieve better than expected overall visual ability.

## References

- 1 Royal College of Ophthalmologists and the British Paediatric Association. *Ophthalmic services for children. Report of joint working party*. London: Royal College of Ophthalmologists and the British Paediatric Association, 1994.
- 2 Day S. History, examination and further investigation. In: Taylor D., ed. *Paediatric Ophthalmology* 2nd ed. London: Blackwell Science, 1997: 77-92.
- 3 Chandna A. Natural history of the development of visual acuity in infants. *Eye* 1991; 5: 20-6.
- 4 Day S. Normal and abnormal visual development. In: *Paediatric Ophthalmology*, see 2 above: 13-28.

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## Review Article

## Optical Services for Visually Impaired Children

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An estimated 1 in 250 children are visually impaired as a result of eye disease. Some of these children have nearly normal vision, some are totally blind, but the majority fall into a broad range between these two points. Children are said to have 'low vision' or 'partial sight' when they have: (a) a corrected visual acuity in the better eye of <6/18 to 'perception of light' (or a visual field of less than 10 degrees); and (b) the ability to use their residual vision to orientate themselves or to perform tasks.<sup>1</sup> They are identified at eye clinics, school screening programmes, community based rehabilitation (CBR) programmes or special schools for the visually impaired.

The education, employment prospects, independence and quality of life of a child with low vision can all be improved by enhancing vision. Optical devices (spectacles, magnifiers and telescopes) play a key

role in achieving this. Studies carried out in East Africa,<sup>2</sup> South America<sup>3</sup> and West Africa<sup>4</sup> indicate that approximately half of children who have low vision show an improvement in distance and/or near visual acuity with the help of spectacles, a magnifier or both. The majority of magnifiers are prescribed for children who have a visual acuity in the better eye of <6/60 to 1/60.<sup>3,4</sup>

## The Role of Optical Services in the Management of Children with Low Vision

The management of children with low vision requires co-operation between the child, his/her family and eye care educational and social personnel. There are five stages in the management of children with low vision (Fig. 1). Eye care personnel are primarily involved in the assessment and monitoring stages which include: visual acuity measurement (distance and near); eye examination, diagnosis and prognosis; surgical and/or medical treatment; and the provision of optical services.

Sight is a key source of stimulus during a child's development, and so children

with low vision should be motivated to make the maximum use of their residual vision. This can be done using both non-optical and optical methods.

## Enhancing Vision Using Non-Optical Methods

- Move CLOSER, e.g., use an angled reading desk
- Use COLOUR to show objects more clearly
- Use CONTRAST, e.g., eat white rice off a coloured plate
- Pay attention to LIGHTING, e.g., sit near a window in class
- Make objects LARGER, e.g., write with larger letters
- Use a LINE-GUIDE such as a ruler when reading and writing.



*Accurate refraction and spectacle correction help many children with low vision*

Photo: Murray McGavin