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PRACTICE POINTER

How to assess eyes and vision in infants and preschool children

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Children for whom concerns exist about eyes or vision need competent assessment and management. For a young child, however, the general clinician in the community may find mastery of the requisite skills daunting. This article gives practical tips to guide eye assessment in infants and preschool children.

Consider the child's comfort

Waiting and consultation areas should be welcoming and uncluttered. A feed, a recent sleep, and a short wait enhance comfort, cooperation, and the "window of opportunity."

Watch the child enter the room

Read any available salient information before seeing the child. Be friendly, calm, and confident and avoid appearing anxious. Smile as the child and parent(s) enter the room. Look to see if eye contact is returned and, if so, from how far away (table 1). Look at what the child looks at and consider its detail to get an idea of what the child is probably seeing.

Taking the history

Take a brief initial open history of the presenting complaint and then seek salient additional information to help in planning the examination (tables 2 and 3). Next, examine the child while he or she is still engaged, using this to guide subsequent diagnostic history taking.

Examination approach

Have available a few clean, attractive toys. Ask for the child to sit on a parent's lap while the parent leans slightly back, the infant's head supported by the chest and the body cradled by the arms, to minimise imbalance and discomfort (fig 1). A pacifier or bottle can help to soothe a restless child. We recommend attracting and maintaining the child's auditory attention by quietly whistling, humming, or singing a well known nursery song for several seconds before (to engage attention) and throughout the examination. Successful examination can usually be accomplished while the child is enjoying the song, oblivious to your examination.

Start by inspection, then assess visual function and test eye movements. Conditions such as sticky, watering, or red eyes, blepharitis, a swollen lacrimal sac, ptosis, squint, nystagmus, and lack of eye contact may be obvious from the start. Turn the main light off, maintaining dim background lighting. Look for red reflexes at a distance with the direct ophthalmoscope, then gently approach the child to examine the eyes as outlined in the following scenarios.[1]

Table 1 | Approximate maximum distances at which eye contact with a young child can be maintained and "rule of thumb" equivalent visual acuities

Child's age*	Maximum eye contact distance (m)	Approximate Snellen acuity
1-2 days	0.3	6/540
2 weeks	0.75	6/180
6 weeks	1.15	6/90
3 months	1.50	6/60
4 months	1.75	6/45
6 months	2.00	6/36
18 months	3.00	6/18
8 years	6.00	6/6

Derived from maximum distances that children will attend to their reflection in a mirror (double the distance to the mirror),[7] and authors' routine clinical application of this method.
*Provides time line for normal visual development.

Does my child have poor vision?

"Eye to eye" contact between mother and baby typically becomes consistent from 4-5 weeks.[2] A history of lack of eye contact and poor visual attentiveness can be caused by delayed visual maturation (diagnosed retrospectively), ocular or anterior visual pathway disorders, or cerebral visual impairment related to visual pathway or occipital dysfunction.[3]

Estimating visual acuity—Identify the maximum distance at which the child maintains interest in his or her own face in a mirror or looks at your eyes while you smile and gradually move back. This helps in estimating visual acuity (table 1).[4]

Pupil reactions—Dim the lights and use a bright pen torch to seek slow or limited pupil constriction due to dysfunction of retina or optic nerve but not the visual brain. The bright light often makes infants squeeze their eyes shut, but not if vision is poor.

Look for nystagmus—and check whether it beats with the same pattern in each position of gaze when following a toy. If it does not, or if the nystagmus is irregular or unilateral or has a late onset, central nervous system neoplasia is a rare but possible cause.[5]

Visual attention, visual fields, and eye movements—Parents may say that their toddler does not seem to see with "one eye." Cover each eye in turn. Active avoidance by head movement away from the cover on one side suggests poorer vision in that eye. Alternatively, there may be lack of visual attention in one hemi-field obeying the vertical meridian or in the lower visual field, which is sometimes seen in ex-premature neonates with evolving cerebral palsy.[6] Bring a

THE BOTTOM LINE

- Observation from the moment of arrival may reveal conditions such as watery or red eyes, blepharitis, a swollen lacrimal sac, ptosis, squint, or lack of eye contact§
- Appropriately positioning the child on the parent's lap and using recognisable auditory distraction (whistling, humming, or singing) just before and during eye examination make assessment much easier
- Estimate visual acuity by checking the distance at which the child maintains eye contact
- Identify a squint by shining a light at the child's eyes and checking the symmetry of the "corneal reflexes"

Table 2 | Conditions commonly managed in the community without referral

Condition	Comment	Management
Congenital nasolacrimal duct obstruction	Apply fluorescein 1% to the eye. Seek disappearance 5 minutes later. If dye remains in the eye, the duct is obstructed. In more than 90%, spontaneous resolution occurs within 18 months	Manage conservatively. Refer for possible probing of the nasolacrimal duct at 1-2 years of age if not resolving
Conjunctivitis (if no signs suggesting neonatal gonococcal conjunctivitis, which requires immediate referral (see table 3)	Swab discharge for microscopy and culture and, in the neonate, PCR for *Chlamydia* or *Neisseria gonorrhoea*[1]	Treat according to culture or PCR results. Chlamydia requires referral of parents to genitourinary clinic for contact tracing, investigation, and treatment. Gonococcal conjunctivitis requires immediate referral
Chalazion	Chalazia in young children resolve spontaneously	Conservative. Eyelid hygiene (and a single dose of oral azithromycin if infected)
Transient eye misalignment in newborn infant	A history of the eyes turning in or out for a few seconds during the first three months of life is common and benign	Reassurance
Early delayed visual responsiveness before 6 weeks of age	The newborn infant is described as not returning eye contact, but pupil reactions to light and dark and fundus red reflexes are present. Normal infants return smiles by 4-5 weeks and fix and follow bright targets by 2 months	Review in 2 weeks if pupil reactions and red reflexes are normal, and refer if lack of visual responses persists

PCR=polymerase chain reaction.

Table 3 | Conditions requiring referral

Condition	Comment	Recommended referral
Eyelid haemangioma	Rapid tumour enlargement during the first few weeks of life can cause amblyopia	Within 2 weeks
Gonococcal neonatal conjunctivitis*	Manifests within 2-5 days. Aggressive course, with injection, chemosis, firm eyelid swelling, and purulent discharge	Immediate
Retinoblastoma, cataract, and other causes of a white pupil (leukocoria)*	A white pupil, with lack of a red reflex in one or both eyes	Immediate
Neonatal seizures*	Lack of visual responsiveness may be the presenting complaint for an infant with infantile spasms	Immediate, to paediatric neurology
Neonatal strabismus	Manifest convergent or divergent strabismus from birth. Check for red reflexes.	Absent red reflex(es): immediate. Otherwise: within 2 weeks
Intermittent or constant convergent strabismus in a young child	Hypermetropia is the most common cause, and the child needs cycloplegic refraction	Within 4 weeks, for refraction and strabismus assessment. (Initial optometry referral for refraction is an option in some centres)
Divergent strabismus in a young child	Intermittent divergence	Routine
	Manifest divergence from an early age is commonly associated with developmental disorders	Within 4 weeks
Congenital glaucoma*	Enlarged eyes, often of different sizes. Photophobia and eye watering if severe	Immediate
Nystagmus	Multiple causes, including chiasmal and brain stem tumours	Routine if onset within 8 weeks of birth. Immediate if late onset
Unusual eyes	Size: small or large. Cornea: small, hazy, white. Iris: absent, partially absent, translucent	Within 2 weeks

*Rare conditions that must be diagnosed and managed straight away.

Fig 1 | This child is being cradled in a comforting and secure way to assist in performance of an effective examination

toy into view in each quadrant in turn, seeking a head or eye turn. Quickly introduce a second toy in another quadrant. Look for a fast eye movement (saccade). Move the first toy out of sight as the attention switches. This is normal behaviour in children aged over 3 months. Lack of eye movement to switch attention to the left or right suggests a hemianopic visual field or a hemi-attentional deficit.

Hold the child vertically and rotate round in one direction then the other—Look for absence of the normal reflex horizontal flicking eye movements, with instead tonic deviation of the eyes to one side and then the other when rotating to left then right. This indicates saccadic initiation failure, which can resemble blindness because of lack of the typical fast eye movements that normally show that infants are seeing.[1]

Corroboration of the parents' suspicion of any type of impaired vision from an early age requires immediate ophthalmic referral for investigation, spectacle testing, treatment, and early habilitation.

"Something wrong with how the eyes look"

Watery or sticky eyes in the infant

Red, swollen, sticky eyes with discharge soon after birth are swabbed for microscopy and culture seeking the organisms outlined in table 2. Watering eyes due to nasolacrimal duct obstruction is common. Extrusion of mucus by gently pressing a clean little finger on the duct, behind the palpable ridge close to the inner canthus—the anterior lacrimal crest—supports the diagnosis, as does the dye disappearance test. Fluorescein dye placed in the eye disappears down the nasolacrimal duct within five minutes but remains if the duct is obstructed.

Misalignment of a child's eyes (squint or strabismus)

This is a common presenting complaint. Variable, brief, and intermittent squint is often seen during the first three months of life,[7] but persisting eye misalignment requires referral to the hospital eye service to seek poor vision (amblyopia), lack of stereovision, and possible ocular pathology in the squinting eye.[8]

One can accurately identify a manifest squint by shining a light at the child's eyes and observing the location of the small white light reflection—the "corneal reflex." This should be in the centre of the pupils. If it is displaced from the centre in one eye, then a squint is likely (fig 2). Each millimetre of displacement equates to 8° of squint.

If a squint is suspected, cover the apparently "straight" fixing eye while showing the child a toy, then uncover it, looking for one of three responses:

- Movement of the head to avoid the cover indicates low or absent vision in the squinting eye.
- Movement of the uncovered eye to look at the toy confirms the presence of squint, whereas lack of eye movement may indicate absent or very low vision.

(Red reflexes are therefore looked for in all cases of squint.)

- Return of the squinting eye to its original position as the cover is removed indicates low vision in that eye, whereas transfer of the squint to the other eye (alternation) indicates that vision in each eye is likely to be equal.

These observations are negative in pseudo-squint owing to broad epicanthic folds.

An unusual looking eye or eyes

Congenital cataract and retinoblastoma are two important causes of a white pupil (leukocoria) (fig 3).[9] Use a direct ophthalmoscope, set at zero, to view each eye from between 10 and 20 cm to elicit red reflexes. If you see asymmetry or lack of a red reflex, set the ophthalmoscope to +10 or +20 and view the eye from 10 or 5 cm respectively (where these lenses focus clearly). This magnifies the structures at the front of the eye and helps to distinguish cataract from pathology behind the lens.

A keyhole pupil due to a section of missing iris (coloboma), lack of an iris due to aniridia, and red light transilluminating through the iris due to marked albinism can also be seen on red reflex examination.

A white pupil reflex due to light reflecting from the optic disc in flash photographs (fig 2)[10] and racial pigmentation of the retina are common reasons for false positive referral for a questionable pupil reflex. However, all cases in which uncertainty exists need to be referred.

Appearance of large or small eyes and ptosis

A small eye (microphthalmos) is identified using a transparent ruler to estimate the corneal diameters. An interocular difference or a measurement of less than 10 mm is likely to be pathological. Microphthalmos is associated with cataract and can be bilateral.[1]

Ptosis can give the illusion of a smaller eye but is identified by a difference in vertical distance between the corneal light reflexes and the upper lids. Ptosis, especially due to haemangioma, needs careful follow-up to monitor for potential rapid tumour growth, as this can cause amblyopia.[11] Ptosis and a small pupil can indicate Horner's syndrome (fig 4).

A large eye (or eyes) (corneal diameter >11 mm) due to congenital glaucoma is typically but not always accompanied by photophobia, hazy cornea, and watering. A normal eye can falsely appear enlarged owing to contralateral ptosis or microphthalmos.

What if the child is asleep?

Do not wake a deeply sleeping child; this gives the opportunity to take a history and examine each eye (while gently retracting each eyelid with a finger) and its adnexae. Complete the examination later when the child is awake and cooperative.

Is there a place for restraint?

To avert future fear induced "pavlovian" reactions, do not use restraint to examine a young child's eyes. If the condition is not urgent, arrange for the non-cooperative child to return later. However, parents may need briefly to hold a child with a red irritable eye to enable you to look for a corneal foreign body, abrasion, or dendritic ulcer (after instilling fluorescein dye).

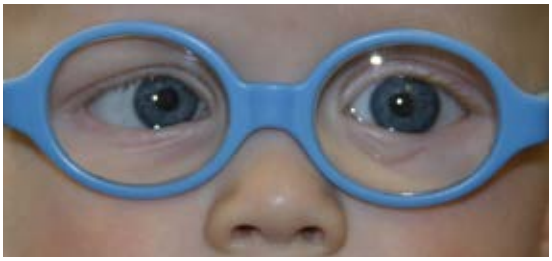

Fig 2 | In this 9 month old baby, the "corneal reflex" is in the centre of the pupil in the left eye but is displaced temporally by 2-3 mm in the right eye. This represents a right esotropia of 16-24°

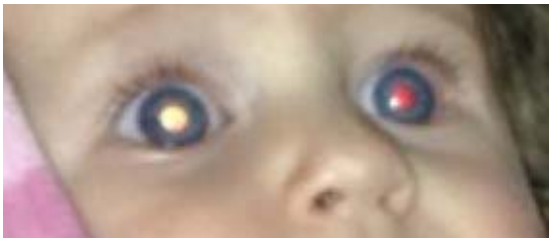

Fig 3 | In this 7 month old child, a white pupil of the right eye was consistently noticed in family photographs. The family doctor made an urgent referral to the local eye department for cataract and retinoblastoma to be excluded. The diagnosis was cataract

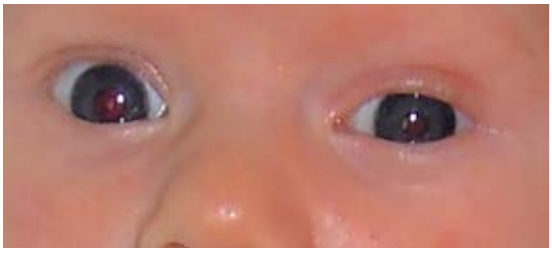

Fig 4 | In this newborn baby, the parents thought that the left eye was smaller than the right. Examination showed symmetrical corneal diameters but with a left sided ptosis and small pupil indicative of Horner's syndrome. Referral to the ophthalmologist was made. Asymmetry of the corneal light reflexes shows the eyes also to be slightly divergent; variable eye alignment for a few weeks following birth is common, and this was the cause here

When to refer

Most eye conditions in children warrant referral to a paediatric ophthalmologist. Urgently refer children with abnormal red reflexes, suspected glaucoma, or apparent lack of vision in one or both eyes. Those with confirmed low vision or blindness need prompt specialist management in the community.

The importance of good communication

The emotional impact of having a child with a significant eye condition or visual impairment is considerable, and parents appreciate empathy, good explanation, and informative correspondence and literature, with referral to appropriate local parent led support groups where available and appropriate.

Patient consent obtained.

WHAT YOUR PATIENT IS THINKING

Never say never about our child

In the latest of a monthly series in which patients and carers set the learning outcomes for readers, Alison Pearson asks healthcare staff to reconsider the concept of offering "false hope." For more information about the series, contact Rosamund Snow, patient editor, rsnow@bmj.com

Statistics can tell you what may happen, but they can never tell you what one individual will do

Until five years ago we were just an ordinary family, with a 3 year old son and a baby on the way. The baby became our daughter Isabel, who is a loving, happy, beautiful little girl much loved by her family and friends.

What makes us a little less ordinary now is that Isabel has Edward's syndrome—she has an extra copy of chromosome 18. The way that medical professionals have responded to this fact has had a major impact on us, in both negative and positive ways. We are lucky; local paediatric doctors treat her as a valued child and focus on her symptoms rather than her syndrome. But we have had some unnecessarily difficult experiences with others, especially in the early days.

Three days after Isabel was born we were given her diagnosis, devastating enough to deal with but made even worse by the fact that it felt as if some of the doctors had stopped viewing her as a child worth helping any more. A particularly negative paediatric consultant told us categorically that Isabel would die within days, or at best weeks, and then gave us no support at all. One of the hardest things we had to deal with was when he told us quite bluntly that it was "not appropriate" to resuscitate Isabel should she need it; a conversation that still horrifies us.

After the initial gloomy prognosis, every subsequent illness at first made us wonder "is this it?" What made this so much harder for us was that in the first two years of Isabel's life we were asked, at every hospital admission, whether she was for "full resuscitation." Our answer then, as it is now, was always "and why wouldn't she be?" Isabel has a fantastic quality of life as an important member of our family. Being asked the resuscitation question so often made us feel that doctors were questioning Isabel's right to live, and to receive treatment, and that maybe they didn't feel she was quite as important as other children. We cannot fault the medical treatment that Isabel received, but we minded very much that we were routinely asked this question. Isabel has no ongoing pain, and nor does she have a progressive degenerative condition. So, is it asked because of her disability, and because she doesn't have a "normal" quality of life? How do you assess this? In any case, many children who are perfectly able have a much worse quality of life for some reason or another.

Isabel has a joyful, shining personality, and she is very determined. We started a daily exercise programme last year and have noticed that this has helped hugely with her strength and development. The thing we focus on is that she is making progress, however slow, and we never say never in our house any more.

We know that Isabel is an exception, and that she is defying the statistics. We hope though that she may be an inspiration for others to accept what our current, wise paediatrician said: "statistics can tell you what may happen, but they can never tell you what one individual will do." For us, where there is life there really is hope, and we would like more doctors to have the "never say never" view too.

THE BOTTOM LINE

- Be aware of your ability to create self fulfilling prophecies. The most dramatic of these is clearly the question of whether a child with an unknown future should have life saving surgery, but it is also easy to limit a child's chances by being pessimistic about what they will or won't be able to do in the future. Isabel is here enjoying life because we ignored the predictions and advice of many medical professionals
- For parents to be asked whether their child should be resuscitated or not is deeply emotive and a decision that has huge consequences. We strongly believe that, if the question does need to be asked, it should be discussed once and then recorded, with parents to agree under what (if any) circumstances they should be asked again. It is definitely not a "tick box" question to be asked routinely at every admission—that in itself trivialises the decision
- In the early days one doctor appeared to think that we were being too positive, so it seemed like he was trying to drum out all of our hope. But hope is what kept us going, kept us able to put one foot in front of another, helped us hold our family together. There is no such thing as "false hope"—hope is today's dream for tomorrow—and whether or not that dream comes true it can help today to be manageable
- Remember that parents need help too, not just babies and children. It is easy to overlook the physical and emotional needs of the parents when a baby is very ill. It helps us when healthcare workers treat Isabel as though she will recover, rather than assuming that she won't; when they acknowledge that she is our beautiful, happy, much loved daughter; and when they are noticeably pleased by her progress, or how well she is recovering from an illness, and let us know about good news as well as bad
- Using terms such as "dysmorphic features" and a "lethal condition," as well as talking about her "end of life pathway" in front of Isabel and her big brother is simply not respectful of us or our situation. We would urge you to think carefully about the words you choose to describe children to their parents, and to be mindful that even quite young siblings may overhear your conversations if they are present, even if they seem not to be listening

Resources for your patients who are looking for peer support

Trisomy Mommies. Facebook. https://www.facebook.com/groups/T18Mommies/

International Trisomy 13/18 Alliance. www.internationaltrisomyalliance.com

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