



# Visual disorders in Children with Down syndrome - Part 2

by Robyn Brady

## Checking your child for visual problems: a developmental approach

This is the second in a series of three articles about visual disorders in children with Down syndrome. The first article looked at the types of visual disorders that are commonly associated with the syndrome, focusing mainly on understanding what is meant by various diagnoses, and how these conditions are generally managed.

This article looks at the development of vision in infancy, and what parents and care-givers can and should look for at various stages in order to identify problems as early as possible. For each visual milestone the average age of acquisition for non-Down children is given, followed by the range for children with Down syndrome. Potential problems which may interfere with the expected milestone, and some exercises and ideas to maximize potential despite various visual obstacles, are also given.

The final article in the series will deal with some practical aspects of managing visual disability in Down syndrome, such as spectacle and contact lens use.

## Why check vision? The concept of critical periods for development.

Although infants at birth can recognize light sources and turn towards them, the complex retinal networks that allow detailed vision develop only when the infant looks at the patterns and movements of the world around him, and the brain and eyes are forced to try to make sense of those images. There is a critical period, or window of opportunity, for this nerve network development to occur. Thus if an eye cannot see, for example because a congenital cataract is blocking the light, the brain and eye will not be stimulated to develop the nerve pathways for complex vision, and the eye will not ever be able to develop the ability to see well unless that cataract is removed within the first few months to a year.

There is also a critical period for developing binocular vision (depth perception), which requires not only that both eyes see clearly but that they are "locked on" to the same object. If the image from one eye is less clear, whether because of corneal or lens problems or a focusing (refractive) disorder, the brain will not support the visual development and connections to that eye. The result is that even if the disorder is corrected, unless this is done within the critical period of the first 6-12 months, the eye will have some degree of amblyopia (poorly developed vision), and the images from the two eyes will not fuse ie the brain will not perceive depth of field, but will have to estimate this from other clues such as relative object size.

Lastly, vision is critically important as a medium for learning about and connecting with one's environment. Infants see their mother's face while feeding, develop eye contact, smile with the pleasure of mutual recognition, and accelerate mutual bonding. They see their hands and feet and watch them move, and "learn" by trial and error, with continuous visual feedback, how to control these movements. They then refine these movements to achieve various goals related to other things they see: to bat a mobile or grasp a toy, or pick up a small sweet. From six months or so, the see-touch-taste routine is the infant's major method of learning about his/ her immediate physical environment. Later, the observations a child makes of facial expressions and the body language of the people in her environment "teach" her how to act in social situations. In each of the above examples, vision is the initiating mechanism for learning, and defective vision may not only delay such things as fine motor coordination and body language comprehension, but may limit the subtlety with which these are performed even if vision is corrected later.

It is obvious from the above that maximizing good vision in the first year of life should be a goal. Since up to 45% of children with Down syndrome have a disorder affecting vision to some degree, it is important that parents and medical practitioners reviewing these children assess vision regularly. Newborns with Down syndrome should be screened for cataract by a doctor, and the infant should be reviewed by an ophthalmologist within the second half of the first year or earlier if concerns arise. Before and after this review, the following checklist will help parents be aware of potential visual problems.

It is important to be aware that the range of acquisition of milestones for children with Down syndrome is quite wide, and that many other factors such as co-existent cardiac or respiratory disease, hypotonia, and environmental opportunities for stimulation may affect this acquisition. The critical periods in which the bulk of visual nerve pathway development are also critical periods for many other developments, and they occur during a time at which a family may be overwhelmed with multiple medical concerns, as well as the intense process of adjusting to family life with a child with Down syndrome. However the minimum recommendations of a visual check at birth and an ophthalmologic review at 6-12 months, should be adhered to.



## Checklist of visual development

**Newborns:** Eyes should appear basically normal and symmetrical. If one looks at their eyes with a torch one should see the "red reflex" ("red-eye" in flash photographs) that is the unobstructed retina. The red reflex will be blocked by overlying cataract.

**First three months:** The infant should start to develop clear eye contact within this period, that is they should seek their parent's eyes when within arms reach, and follow them as they move ("fix and follow"). This is usually accompanied by social smiling. Although these are usually present by 6-8 weeks in normal children, they should appear by three months in the child with Down syndrome. Nystagmus (wobbly eye movements) is abnormal, and should trigger referral. The infant should show visual interest in such things as lights, facial features, patterned mobiles, and environmental patterns like sunlight through leaves. Visual as well as emotional development will be aided by plenty of opportunities to watch and follow a mother or father's face. Even if a baby is hospitalized it is important to provide stimulating visual material within his close (1m) visual field.

**Three to six months:** As the infant's focusing ability improves, she will be able to take increased interest in her near physical environment. She should find her hands and feet and start to play with them. This is more difficult in the low tone Downs' child, whose hands and feet will not be in their immediate visual field. Bringing the hands in front of the face, and adding bracelets with bells, and brightly coloured mittens, may help support this early eye-hand coordination play. Once an infant starts to sit a much greater range of visual and eye-hand coordination opportunities are open to him. Propping low-tone babies in ways which support their ability to manipulate objects with their hands in front of them will be helpful. If a baby seems to have difficulty seeing objects in front of him, or reaching to the right depth for them, at the six month stage, he should be assessed for refractive or monocular disorders. "Reading" glasses may be of value even at this young age to promote the integration of vision and fine motor skills.

"Squint" in medical parlance refers to in-turning or out-turning of eyes, so that the two eyes do not focus on the same object. There should be no squint by six months, and any suspicion of this from this age on should be referred for ophthalmologic assessment. The extra skin fold (epicanthic folds) at the inner edge of the eyes of children with Down syndrome may make the eyes appear to have turned in towards each other but a light held in front of the infant should be reflected symmetrically in the two pupils. If there is any doubt, referral is recommended..

**Twelve months:** By this stage, a child should be able to focus further into the distance and should be able to recognize a parent in the next room. This outer visual perimeter will continue to extend so that eventually they will be able to distinguish a dog across the road, or a bird in the near sky, but this distinguishing and scanning ability will develop much more slowly in the child with Down syndrome.

Refractive and attentive disorders may interfere with distant vision. Throughout the pre-school years it is helpful to extend the child's ability to recognize significant objects in her close and far world eg with games such as "I spy".

By twelve months the infant's close range discriminating ability, combined with improving eye-hand coordination, should allow her to see small crumbs and grasp them with her hand. Children without Down syndrome will normally use a thumb-finger pincer grip by this stage, allowing much finer precision, but this often takes some years to be refined in Downs' children.

**One to two years:** Over this period your child will be refining focus for close and far distances, and learning to discriminate things in his environment. He should develop an interest in television and picture books. Because of delays in discriminating ability, early picture books should have clear pictures with bright contrast and a minimum of detail. The toddler in this period will also enjoy and learn from social visual games such as peek a boo.

**Pre-school and beyond:** Langdon Down characterized the people in his care, who later were identified by his name, by their imitative ability, their stubborn-ness, and their responsiveness to training. This innate ability to learn continues throughout the life of individuals with Down syndrome, and extends into all areas of skills acquisition; it is a fact that continually, albeit slowly, rewards the steady efforts put in by parents, therapists, teachers, and other care-givers of these children. Although critical windows exist for certain visual capacities, the refinement of visual skills and their integration with other modalities (such as fine motor skills for the development of writing) also continues throughout life. At all times, but particularly in the pre-school and early school years, parents should ask themselves at intervals, how is my child seeing? Is there anything unusual about how his eyes look, or how he holds his head or his books, or how he recognizes me at a distance? A child with Down syndrome may develop a habit of tipping their head back to look at their world through narrowed eyelashes ("squinting" in its lay meaning). This child may be trying to compensate for a refractive disorder, as these lens problems may be minimized by narrowing the amount of lens exposed. This posture may be particularly prominent while watching TV, although poor neck muscle tone may be another cause of the tipped back head, especially if the child is seated below the level of the TV. Other visual problems may be recognized as eye pain or irritability, or the loss of the red reflex. Loss of the red reflex, or the development of squint, are abnormal at any stage and should be referred for assessment.

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