



The Findings and Signs of Visual Impairment in Baby and Child

Burak Turgut^{1*}, Onur Catak² and Tamer Demir¹

Abstract

Severe visual impairment can cause behavioral and developmental disorders and disabilities in the learning, hearing, walking and speaking in children. The disorders causing to low vision or blindness in children usually occur in the first month of the life. It is possible that baby and infants cannot express the visual complaints. The education of the parents on the clinical signs of visual impairment in children is critical because it has been considered that a half of the childhood blindness is preventable. Additionally, all children should be examined by an ophthalmologist first and 6th month after the birth, in 18-24th months, 3 years old and 5-6 years old of age.

Keywords

Blindness; Visual impairment; Visual loss; Baby; Newborn; Child; Parents

Introduction

The vision includes various visual-cortical functions such as visual acuity in near, intermediate and far distances, the ability for color vision and color separation, visual field, adaptation to darkness, motion detection and contrast sensitivity. Thus, visual impairment is not only loss of visual acuity in near, intermediate and far distances. Visual acuity impairment can vary from the level of the loss of light perception to the level of legal blindness. Severe visual impairment or blindness in the children can cause behavioral and developmental disorders and disabilities in learning, hearing, walking and speaking [1-3].

The disorders causing to low vision or blindness in children typically occur before second month of the life. Gross ocular abnormalities causing poor vision at the birth are the congenital cataract, congenital glaucoma, and retinoblastoma. The ocular disorders with nystagmus associated poor vision in a child with normal looking eyes are optic nerve hypoplasia/dysplasia, foveal hypoplasia (isolated, congenital albinism and aniridia), juvenile retinoschisis, toxoplasma chorioretinitis, photoreceptor dystrophies (Leber's congenital amaurosis and congenital stationary night blindness). The causes of poor vision at the birth with normal looking eyes and without nystagmus include severe ametropia, cortical blindness, ocular motor apraxia and delayed visual maturation [1-4]. In summary, blindness or severe visual impairment occur due

to the organic disruption of the visual system caused by congenital anomaly or disease and to the deprivation of visual development. The education of the parents on the clinical signs of visual impairment in children is critical because it has been considered that a half of the childhood blindness is preventable [1].

What are the Blindness and Low-Seeing Eye?

Individuals with a corrected visual acuity level of 10% (20/200) or less in 6 meters and a visual field of less than 10 degrees around the central fixation or 20 degrees in the better eye are considered as legally blind despite glasses/contact lenses and all treatments. However, the level of visual acuity of the child at birth is normally lower than that of the adult: about 5%. The eye which best corrected visual acuity is between 10% and 30% in the well-seeing eye is considered as the eye with low vision [3,5].

What is Necessary for the Development of Good Vision Function in Baby/Child?

For maturation of full and sharp vision, followings are necessary [5-8]:

- The stimulation of the eye with good light and detailed shapes,
- To reach the light and visual stimuli to retina with transmission through the cornea and lens,
- To reach the photochemical impulse formed neurosensory retina to the visual center with the intact optic nerve and visual pathways
- Detecting and processing the incoming image of the brain.

To be providing these stages, eyes must be in alignment; pupillary responses to lighting conditions must be intact; refractive structures (cornea, aqueous, lens, vitreous) must be clear; the shape and thickness of crystalline lens must be adjustable to maintain the optimum refractive curve and accommodation; neurosensory retina must be functional; the optic nerve must have ability for transmitting the image to the visual cortex and visual centers must be intact. If there is a defect preventing the image goes to the neurosensory retina, the eye is at risk for amblyopia. Thus, the period of first 3 months in babies is the critical period for visual impairment [5-8].

Ophthalmologist Aspect: Normal Visual Development

Normal visual maturation begins in the first weeks of life and is completed by the end of the 2nd age. The fovea is immature in the birth and its maturity is completed at approximately 4 years of age. Focusing on faces and objects and smiling the faces of the parents usually start by 4-5 weeks and 6-8 weeks, respectively. Visual fixation can be demonstrated shortly after birth. The most newborns have usually approximately the visual acuity level of 20/400. Stereopsis and binocular visual function develop between 3-7 months old. Color vision develops greatly in 5-6th months. Depth perception is not present at the birth. Three-dimensional visualization with two eyes develops at 5-6th months. The development of the eye is greatly completed at almost age of 3 years. The development of the visual

*Corresponding author: Burak Turgut, Faculty of Medicine, Department of Ophthalmology, Onsekiz Mart University, 17020, Çanakkale, Turkey, Tel: +90 286 218 0018; E-mail: drburakturgut@gmail.com

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centers in the brain is completed at the age of 5-7 years. In the first 6 years, 90% of the visual development occurs. Visual acuity in a child usually reaches the adult level in 3-5 years old [5-10].

The "rule of 8s" is a helpful mnemonic for determining normal visual acuity level according to the age. It shows the critical lines varying with age (36-47 months: 20/50; 48-59 months: 20/40; \geq 60 months: 20/30) for visual acuity in children. It defines that the child's age plus the tens digit in the denominator of visual acuity level should be \leq 8. For example, a 4-year-old with visual acuity should be 20/40 (4+4=8) and it is not necessary to be referred [5].

Parents' Aspect: How Can Parents Determine the Level of Vision in Children Without Vision Problems (In Normal Infants and Children)?

Children can sometimes express the visual complaints. Additionally, laziness in the eye (amblyopia) may have no warning signs. Thus, if the parents observe followings [5,6,8-10], the vision of the baby or child is usually normal:

At the birth

The retina, optic nerve, and visual cortex are immature. However, the baby can be fixed to a point and look at it. Pupillary response to the light (light reflex) is present in term-babies at the birth although it is sluggish. In preterm newborns with the gestational age of less than 29 weeks is absent and it develops at 30-31 weeks of postmenstrual age in preterms. The blink reflex is present almost entirely in term-born babies when shot in the forehead with the tip of the finger [5,6,8-10].

- 1st month: Light reflexes develop exactly at the end of the first month. One-month-old baby starts to make the eye contact and to look at objects that are close to the face.
- 2nd-3rd months: The baby can look at the face of the mother or father in the postnatal weeks of 6-8, can make the marked eye contact, and can smile: This is called as "Social Laughing". The baby begins to follow and to try grasping the objects from the 3rd month. Baby can follow the moving objects with bright yellow in color and striped objects in this period. The development of vertical or up-down movements of the eyes takes 2-3 months. To become parallel of the visual axes may take up to 2 months. As the eyes are not well coordinated in the first two months of life, even if most eyes in babies may seem misaligned or crossed, this is usually normal. In 2-3 month-old, the baby begins to observe own hands while holding them close to own face. In 3-4 month-old of age, infants can watch activity that occurs around them.
- 5-8th months: The development of the horizontal ocular movements starts at the 3rd month and continues approximately to 6 months of age. An infant of 6 months old can observe the surroundings and recognize familiar objects such as toys, persons at a distance. The accommodation to see nearby objects starts at the third month but its completion can reach the sixth month. The baby of 8 months old starts crawling and the development of the eye-hand-foot-body coordination.
- 9-12th months: At 9 months of age, babies begin to pull themselves up to a standing position. At 10 months of age, the baby can grasp objects with own thumb and forefinger. The crawling in most babies with 12 months old develops exactly and they try to walk.

- 12-24 months old: At two years old, the eye-hand-body coordination and depth perception have well developed. Children interest in the exploration of the environment, looking and listening.

Parents' Observation: What are the Signs in Children with the Vision Problem?

Some children having visual impairment might have normal-looking eyes. The parents should be warned admission to an ophthalmologist as soon as possible for the research and management of possible visual impairment if they observe following behavioral and visual findings [4,5,7,10-12]:

- Inability to look at the parents' face and not smiling, not following their faces in 6-8 weeks old.
- Especially in the first 3 months, no ability to the eye to eye contact and not seeing/watching/following the light or objects.
- Inability to fix and follow by 3 months of age.
- Pupils seeming white, whitish-gray, yellow (immediately reflection) or cloudy rather than black (Leucocoria).
- Pupillary asymmetry
- Small or too large or underdeveloped or bulging eye-balls
- Cloudy cornea
- Misaligned or crossed eyes or squint (especially after 4 months, inward crossing or outward drifting).
- Drooping eyelid
- Quick movement from side to side or fluttering, jerking (nystagmus) in the eyes
- Sensitivity in eyes to light. The child's face does not turn to the bright light source or vice versa, and the face is turned to the dark side in the room.
- No ocular movement to search the objects
- Looking at the objects with bringing or holding up closer to the face.
- No seeing objects which are pointing out
- Continuous rubbing the eyes or frequently blinking
- Continuous swinging movement in the body
- Looking at the objects especially in distance with squint
- No distinguishing the difference between day and night
- Watching TV very close or sitting too close to TV
- Avoiding computers, reading or after-school activities.
- Turning or tilting the head or covering one eye when looking at things up close
- Trying after looking at things up close during near activities such as reading, drawing or playing handheld games
- Fallings at night or in the slight darkness
- Impacting to things

- Difficulty in reading the writings on the blackboard
- Jumping the line while reading a book and blurred seeing text.
- Having to close the eye constantly in sunny weather.
- Seeming better during the day than at night.
- Insufficiency in the visual communication and exclusion in the play area.
- Difficulty in communicating with the environment; restricted motion

What are the Effects of Severe Visual Impairment or Blindness?

- Difficulties in behavioral and social performances including playing, talking and communicating with other children [5-10].
- Difficulties in sitting and walking, falling down and clumsiness.
- Poor eye and hand coordination (difficulties with sporting and other activities in classroom, poor handwriting, difficulty throwing or catching a ball, tying shoes or copying schoolwork from the blackboard).
- The decrease in school performance such as difficulty in reading and writing, also in learning to read and write, eye strain (asthenopia), headaches, diplopia, blepharospasm, blurred or distorted near vision.
- When should the first examination and other examinations be carried out?
- At the birth: The first eye examination is usually made by the relevant pediatrician. If not done, the baby should be seen by an ophthalmologist within the first month after birth [13-16].
- 6th month: Eye movements and accommodation are usually fully developed in about 6 months and refractive errors can be measured from 6th month. Thus, 6th month is one of the most suitable times for optimum ocular examination by the ophthalmologist [13-16]. The American Optometric Association (AOA) also recommends ocular examinations in childhood age to begin at the age of six months [13].
- 18-24th months: Intermediate examination. As the presentation age of some malign tumors such as retinoblastoma is in this time span, to perform the ocular examination during this period will be beneficial.
- 3rd year: Ocular development is completed with 90% at 3 years, so the child should be seen again at this age.
- 5-6th years or before the beginning of the preschool: The child should be examined in these ages, even if there is no a suspicion of visual impairment.
- School child: Annually examination.

Conclusion

Additionally, in case of one or more of the above-mentioned symptoms and signs related to visual impairment, the children should

be examined by an ophthalmologist for the detection of the diseases affecting vision and early treatment of amblyopia as soon as possible.

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Conflict of Interest

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Author Affiliation

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¹Department of Ophthalmology, Onsekiz Mart University, Çanakkale, Turkey

²Department of Ophthalmology, Fırat University, Elazığ, Turkey