

**Eye Care Skills: Presentations for Physicians
and Other Health Care Professionals Version 3.0**

Understanding and Preventing Amblyopia

Speaker Notes

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A GUIDE TO PRESENTING

Understanding and Preventing Amblyopia

Approximately 2% to 4% of the general population has amblyopia, defined as a decrease in best-corrected visual acuity in one or both eyes, with no apparent ocular abnormality on physical examination. Amblyopia is the most common cause of monocular visual impairment in children and young adults. The greatest visual risk lies in the chance of subsequent loss of vision in the better-seeing eye from an unrelated ocular disorder or trauma.

With early detection, amblyopia can be successfully treated and normal visual development can be expected. Although the ophthalmologist is responsible for its treatment, detection of amblyopia is the charge of the primary care physician, who is often the first health professional to encounter a child with a potential eye condition.

The skills and tools for the detection of amblyopia are simple. *Understanding and Preventing Amblyopia* aims to enable primary caregivers to help reduce the incidence of amblyopia by providing them with an understanding of its predisposing factors, common presenting features, methods of early detection, and guidelines for referral to an ophthalmologist. Treatment rationale and methodology are also discussed; compliance with treatment is crucial to successful outcome, and primary caregivers are in an excellent position to help ensure their young patients (and the affected child's parents) can maintain the treatment regimens they are given.

Approximate Running Time

45–60 minutes

Suggested Audience

- Pediatricians
- Family physicians
- Internists
- Medical students, interns, residents
- Public health nurses and school health screeners
- State and local meetings of national medical societies such as AAFP, AAP
- Any primary care provider, including nurse practitioners, etc.

UNDERSTANDING AMBLYOPIA

SLIDE

1

Amblyopia is not a new problem. It was described by Hippocrates and has been recognized for over 2,000 years. For normal visual system development, an infant's visual cortex must receive input from each eye that is of equal clarity and of the same object of regard. If something prevents this from taking place, reduced visual acuity in one or, less commonly, both eyes may result. This resultant poor visual acuity is called amblyopia.

SLIDE

2

Amblyopia can be defined as a decrease in best-corrected visual acuity in one or both eyes, with no apparent ocular abnormality on physical examination. Traditionally, amblyopia was thought to have no underlying organic cause. Actually, a predisposing factor is always present, but it may not be apparent clinically without the benefit of a complete ophthalmologic examination. Strictly speaking, amblyopia occurs in an eye that is otherwise physically normal. In practice, the term is used to include reduced visual function that results also from structural ocular abnormalities, such as cataracts, corneal opacities, or eyelid ptosis.

Understanding Amblyopia

**When the doctor sees nothing
and the patient sees nothing,
the diagnosis is
αμβλυωπια.
– Hippocrates, 450 BCE**

Understanding Amblyopia

AMBLYOPIA: DEFINITION

- Abnormal visual development
- Decreased best-corrected visual acuity
- Unilateral or bilateral
- Apparently normal physical exam, but may also result from recognizable structural abnormalities

Amblyopia is the most common cause of monocular visual impairment in children and young adults. Approximately 2% to 4% of the general population has amblyopia. Commonly, only one eye is affected. The greatest visual risk lies in the chance of subsequent loss of vision in the better-seeing eye from an unrelated ocular disorder or trauma. In such cases, the individual must rely on the reduced visual acuity of the amblyopic eye. An amblyopic eye is a poor source of vision to be held in reserve. Bilateral amblyopia, although rare, may occur, for example, when both eyes have such high refractive errors that focused, clear images cannot be maintained and delivered to the developing visual cortex. Educational and vocational goals may be profoundly limited for individuals with bilateral amblyopia.

Four main factors make screening for amblyopia significant to the busy primary care physician.

1. Amblyopia can be prevented or treated in most circumstances.
2. Early detection is the key to effective treatment.
3. Life-threatening disorders may present as amblyopia.

The responsibility of screening for amblyopia rests with the primary care physician

AMBLYOPIA: SIGNIFICANCE

- 2%–4% of U.S. population affected
- Commonly unilateral
- Bilateral amblyopia (rare) may mean permanently decreased visual acuity

SCREENING: IMPORTANCE

- Amblyopia is usually preventable or treatable
- Early detection is key to effective treatment
- Life-threatening disorders may present as amblyopia
- Screening responsibility rests with primary care physician

SLIDE

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Amblyopia can be prevented or treated in most circumstances if detected early enough. Specific predisposing factors for amblyopia can be identified, including ocular media opacities such as cataract; significant refractive errors; and strabismus, or misaligned eyes. Attention to the underlying cause will prevent the development of permanent visual loss.

SLIDE

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Early detection is the key to effective treatment. Visual acuity develops rapidly from approximately 20/400 at birth to 20/20 within the first year of life and remains quite plastic within the first decade. Amblyopia results when this maturational process is interrupted. Because the degree of visual system plasticity lessens as the system matures, the earlier amblyopia is detected, the more successful treatment will be. Preferably, detection and treatment should occur by the age of 3 to 5 years. The older the age at detection and the more decreased the visual acuity, the less likely visual function is to improve. Nevertheless, recent evidence indicates that amblyopia may be treatable even into a child's second decade.

SLIDE

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Life-threatening disorders may present as amblyopia. For example, the presenting signs and symptoms of retinoblastoma, such as reduced visual acuity or strabismus, may not be clearly distinguishable from amblyopia during a quick screening examination. Any child presenting with such symptoms warrants further examination, because a delay in diagnosis may threaten life or health.

In most circumstances, amblyopia can be prevented or treated.

EARLY DETECTION: IMPORTANCE

- Visual function develops early in life
- Treatment depends on plasticity of visual system
- Treatment less likely to be effective as children age



Decreased vision → retinoblastoma?

The responsibility of screening for amblyopia rests with the primary care physician, who is often the first health professional to encounter a child with a potential eye condition. Ultimately, the ophthalmologist is responsible for its treatment, but the detection of amblyopia is the charge of the primary care physician. The skills and tools for its detection are simple, and early diagnosis may profoundly influence patients' lives.

The ophthalmologist treats amblyopia, but the primary care physician detects amblyopia.

PREVENTING AMBLYOPIA

A better understanding on the part of children's health providers of amblyopia's origin, detection, and treatment may reduce the incidence of amblyopia. Prevention relies on a familiarity with (1) the factors predisposing to amblyopia; (2) common presenting features; (3) methods of early detection; and (4) treatment rationale.

PREVENTING AMBLYOPIA: CONSIDERATIONS

- Predisposing factors
- Presenting features
- Detection methods
- Treatment rationale

Predisposing Factors

Amblyopia develops if the visual image projected on the central retina is constantly unclear or obstructed during the critical period of early visual development. Comparing the eye to a camera, a poor image on the retina can occur as a result of three major factors:

- Poor clarity of the visual system or blockage of the light pathway (eg, ocular media opacities, ptosis)
- Poor focus (eg, refractive error)
- Poor aim (eg, strabismus)

AMBLYOPIA: PREDISPOSING FACTORS

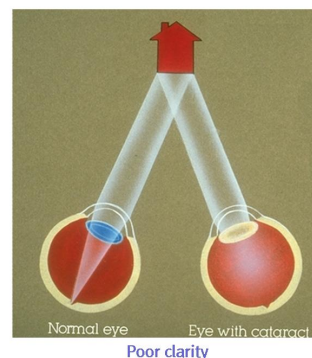
- Poor clarity (media opacities) or blockage of light pathway (ptosis)
- Poor focus (refractive error)
- Poor aim (strabismus)

SLIDE

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Media opacities such as cataract or corneal scar block or irregularly diffuse the light entering the eye. This disruption of light rays results in a poorly focused image on the retina, predisposing the patient to amblyopia. The developing visual cortex “prefers” the focused image from the better-seeing eye, suppressing or ignoring the less-distinct image from the eye with the media opacity. The greater the interference, the longer it is present; and the younger the child, the more rapidly and more deep the amblyopia may become. For instance, cataract removal must be performed at a very early age to allow normal visual development within the first few months of life. An infant born with complete cataracts is unlikely ever to achieve visual acuity better than 20/40 unless removal of the cataracts and optical correction occurs within the first 2 months of life.

Preventing Amblyopia

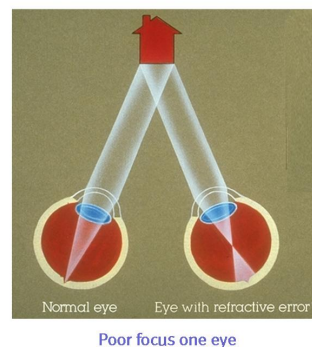


SLIDE

12

Refractive error may lead to amblyopia in one or both eyes. When the refractive errors in the two eyes are not equal (termed “anisometropia”), only one eye can receive a focused image, because the visual system focuses both eyes equally and simultaneously. Amblyopia then develops in the eye that is not in proper focus with the fellow eye.

Preventing Amblyopia

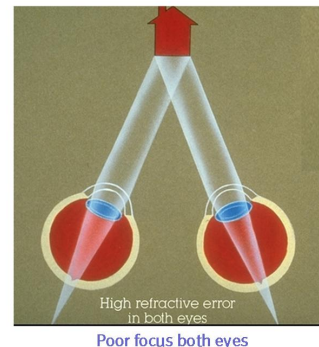


SLIDE

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If both eyes have a high amount of farsightedness, nearsightedness, or astigmatism, the individual may be unable to clearly focus images at any distance. Because the image on each retina is blurred at all times, neuronal connectivity in the visual cortex develops without having received a finely focused image from either eye, and bilateral amblyopia develops. Bilateral amblyopia occurs more commonly with hyperopia (farsightedness) than with myopia (nearsightedness).

Preventing Amblyopia

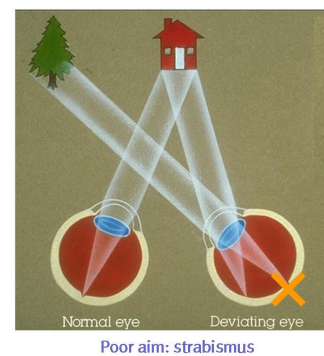


SLIDE

14

Strabismus is the most common cause of amblyopia. Deviation of one eye, such as occurs with constant esotropia, results in suppression of the deviating eye. The foveas of the two eyes are pointed toward different objects. The brain “selects” the object viewed by the straight eye and suppresses or ignores the object viewed by the deviating eye. Amblyopia results as a consequence of this conflicting information. Foveal stimulation is important because the fovea is the region of the retina responsible for critical central vision. When visual input from the deviating eye is ignored, amblyopia develops.

Preventing Amblyopia



Common Presenting Features

SLIDE

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If only one eye is amblyopic, often the child and the parents will be unaware that vision is reduced. The child appears to be seeing normally because vision is unimpaired in the non-amblyopic eye. Unilateral amblyopia commonly becomes noticed through one of four ways:

- Failed vision test
- Strabismus
- Consequence of parental concern
- Concern because of a positive family history of amblyopia or strabismus

SLIDE

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Vision screening examinations are often initially performed on children between 3 and 5 years of age at the primary care physician's office, schools, or day care centers. Such tests are very useful, but they have their limitations because the child may peek or the occluder or patch used during testing may not completely cover the eye. Such poor technique may allow amblyopia to remain undetected. An adhesive patch during testing works best.

SLIDE

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Strabismus is the most common underlying cause of amblyopia. With constant deviation of one eye, reduced vision will occur. Amblyopia is less likely when the deviation is intermittent or when the two eyes alternate fixation.

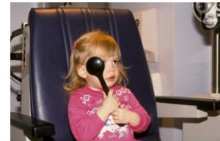
Preventing Amblyopia

UNILATERAL AMBLYOPIA: PRESENTATION

- Failed vision test
- Strabismus
- Parental concern
- Family history of amblyopia or strabismus

Preventing Amblyopia

VISION SCREENING AGES 3-5



May peek around occluder



Adhesive patch works best

Preventing Amblyopia



Strabismus is the most common underlying cause of amblyopia.

When adults develop strabismus, double vision (diplopia) is an associated presenting feature. In infants and children, subjective diplopia is rare. This distinction stems from differences in adaptation of the immature visual system of children compared to adults. A child's brain suppresses the image from the deviating eye; the child effectively sees one image. With constant suppression, amblyopia develops. In adult-onset strabismus, the mature visual system is unable to compensate in this way, leading to perception of a double image with resultant diplopia. Onset of true diplopia in a child may indicate a sudden misalignment of a previously normal visual system and should prompt immediate evaluation and referral. Conditions such as a cranial nerve palsy may be the cause. Other causes of reported diplopia in children include recognition of physiologic diplopia or malingering.

Parental concern may initiate the evaluation for amblyopia. Parents may note that their child's eyes "look different." Careful examination may reveal such serious concerns as a white pupillary light reflex (leukocoria, left) or an abnormally large cornea, indicating possible congenital glaucoma (right). There are many causes of leukocoria, including retinoblastoma, retinal detachment, and cataract.

DIPLOPIA IN CHILDREN

- Not a feature of strabismus
- May indicate a serious condition
- Evaluate promptly and refer

PARENTAL CONCERNS



Leukocoria

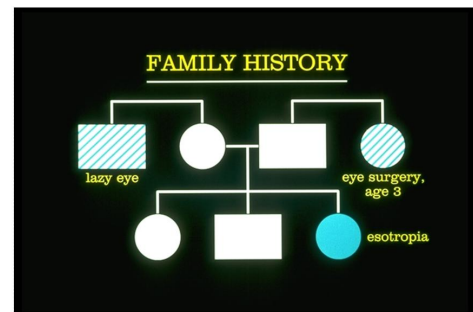


Enlarged cornea

SLIDE
20

Visual problems, including amblyopia or strabismus, in other family members may increase parents' concern for their child's vision. Although strabismus and amblyopia do not demonstrate a specific mode of inheritance, a positive family history is often present in children with amblyopia.

Preventing Amblyopia

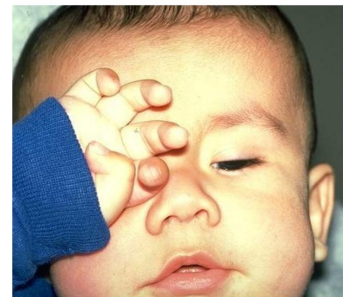


A positive family history is often present in children with amblyopia.

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If both eyes are amblyopic, an infant may present with such features of poor vision as a failure to fix and follow an object, wandering eye movements, rhythmic shaking of the eyes (nystagmus), or unusual habits such as eye-poking or hand-waving. In rare cases, poor vision may present as clumsiness or ataxia in the toddler. In comparison to unilateral amblyopia, bilateral involvement is uncommon; however, any concern warrants immediate referral to an ophthalmologist because of the potentially severe visual loss from bilateral amblyopia.

Preventing Amblyopia



Bilateral amblyopia

Early Detection

SLIDE
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The role of the primary care physician is fundamental to the early detection of amblyopia through careful assessment of (1) the red reflex, (2) visual acuity, and (3) ocular alignment.

Preventing Amblyopia

AMBLYOPIA: EARLY DETECTION

- Assess red reflex
- Determine visual acuity
- Evaluate ocular alignment

Red Reflex Assessment

SLIDE 23

Assessment of the red reflex allows the examiner to evaluate potential causes of amblyopia: media opacities, high refractive errors, and strabismus. The cornea, anterior chamber, lens, and vitreous must all be clear to allow a view of the retina. If the eye is unusually hyperopic or myopic, the red reflex may be very dim unless the ophthalmoscope's high-power lenses are used.

SLIDE 24

An asymmetric red reflex may indicate a significant visual problem, such as strabismus, unequal refractive error, or media obstruction.

SLIDE 25

Step 1. Use an ophthalmoscope with a bright light source, such as a halogen bulb.
Step 2. Dial in a +2 to +4 lens, identified by a black numeral, and select the largest round, white light aperture.

Preventing Amblyopia



Normal red reflex

Preventing Amblyopia



Assymetric red reflex

Preventing Amblyopia



Direct ophthalmoscope

SLIDE

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Step 3. While looking through the instrument, illuminate both eyes simultaneously and examine the eyes for clarity of the red reflex at a distance of 1 to 2 feet. Compare the patient's eyes for dissimilarities in the quality of the reflex. Such a difference may indicate unequal refractive errors, a media opacity, or strabismus. It is important to remember that often it is dissimilarity between the two eyes that leads to unilateral amblyopia.



Direct ophthalmoscope: assessing red reflex

SLIDE

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Step 4. Now direct your attention to each eye separately, using your right eye to examine the patient's right eye and your left eye to examine his left eye. Change the light source to the small, round aperture. As you move closer to the patient, gradually reduce the power of the lens until you are able to see the details of the patient's fundus. It may be necessary to decrease the illumination if the child seems uncomfortable with the intensity of the light.



Direct ophthalmoscope: examining retina

Visual Acuity Assessment

SLIDE

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In assessing visual acuity, it is always important to consider parental input. Parents may be reluctant to volunteer concern that visual function may be poor, but their intuition must be sought. Other relatives, such as grandparents, may have greater experience with children and may provide valuable information. In short, taking a history is an important step in visual acuity assessment.



Can your child see?

Infant visual function is particularly important to assess, since the critical period of visual development occurs within the first year of life. During your evaluation, ask the parent if the baby seems to be seeing; in other words, does the infant fixate on and follow the parents, toys, or other objects of interest? Examine the baby's visual behavior. By 1 month of age, the baby should regard your face steadily without any noticeable constant strabismus. Intermittent strabismus may occur in normal children up to 4 to 6 months of age. Rhythmic shaking of the eyes (nystagmus) or inability to hold fixation, even briefly, is always a concern.

By the 2-month checkup, each eye should be tested separately for its ability to fix and follow. Ask the parent to hold his or her hand over one of the baby's eyes and then the other, repeating your assessment of the fixation and following response. An interesting target of high-contrast coloration or movement should be used because a baby's visual resolution is still low. As an alternative, you may use your thumb as an occluder, taking care to keep it close to the eye or apply an adhesive patch to assess each eye. The fixation should be steady. Any abnormal movement of the eyes should alert the examiner to possible nystagmus or strabismus, requiring further investigation. Similar examinations should be repeated at the 4- and 6-month checkups.

NORMAL INFANT VISION

- Good visual function
- Fixate and follow with each eye
- Steady fixation



Testing infant vision: Can your child see?

SLIDE

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If the baby has extremely poor vision in both eyes, hand-waving or eye-poking may be first noticed at the age of 6 weeks to 2 months. Poor vision can be confirmed by watching the baby's response to a bright light. Failure to blink the eyes indicates that the baby has profoundly reduced vision. Irregular "roving" eye movements or constant or intermittent nystagmus also indicate reduced visual function.

SLIDE

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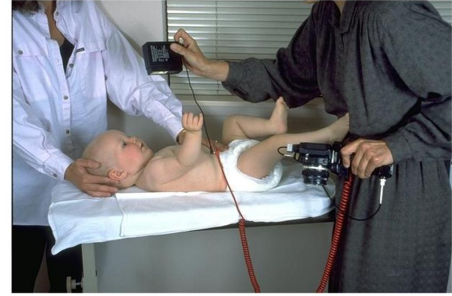
There is no simple test to quantify an infant's visual acuity that is available for use in an office setting. The ophthalmologist may use preferential looking tests or more involved testing methods for such quantification, but these are fairly time-consuming and are not intended as screening techniques for amblyopia.

SLIDE

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Measuring visual acuity in the office becomes possible with patients between the ages of 18 months and 3 years. At this age, acuity generally can be tested more easily at near using a picture chart; however, many cooperative 3-year-olds can be tested with distant targets. Although near testing does not identify the child with myopia, amblyopia will not develop as long as a clear image is being focused on the retina for near objects. The toddler's world is, in large part, within a 5-foot radius, making the early recognition of small amounts of myopia less important.

Preventing Amblyopia



Suspected poor vision: test response to bright light

Preventing Amblyopia



Testing infant vision: Preferential looking test

Preventing Amblyopia



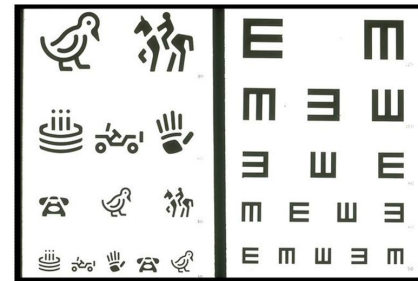
Measuring visual acuity at 18 months to 3 years: picture chart

SLIDE

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Various types of acuity charts are available for the preliterate child at both distance and near. Many children enjoy picture charts, and recognition of one favorite symbol per line makes testing proceed more quickly. The single E chart, also called the preliterate or illiterate E chart, has enjoyed traditional popularity, but it requires gross motor coordination and involves repetition of a single task.

Preventing Amblyopia



Picture chart

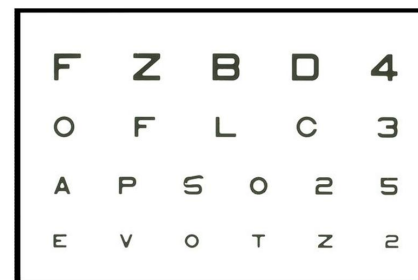
Single E chart

SLIDE

35

The standard Snellen chart may be used successfully with many children in the 4- to 5-year range. Most charts are designed for use at 20 feet, or 6 meters. Children cooperate more readily if the examiner points to specific letters, rather than having the child read the entire line.

Preventing Amblyopia



Snellen acuity chart

SLIDE

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Testing of binocular depth perception is also used as a screening test for amblyopia in some physician offices. However, this should not substitute for visual acuity testing. The depth perception, or stereopsis, test is often difficult for the child of less than 5 years of age to perform. However, some younger children may respond reliably to stereopsis testing.

Preventing Amblyopia



Depth perception (stereopsis) testing

