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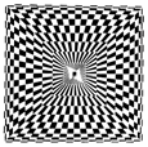

Pediatric Eye Evaluations

I. Screening
II. Comprehensive Ophthalmic Evaluation

AMERICAN ACADEMY OF OPHTHALMOLOGY
The Eye M.D. Association

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As a service to its members and the public, the American Academy of Ophthalmology has developed a series of guidelines called Preferred Practice Patterns that **identify characteristics and components of quality eye care.**

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All Preferred Practice Patterns are reviewed by their parent panel annually or earlier if developments warrant and updated accordingly. To ensure that all guidelines are current, each is valid for 5 years from the "approved by" date unless superseded by a revision.

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INTRODUCTION

The Preferred Practice Pattern® (PPP) guidelines have been written on the basis of three principles.

- Each Preferred Practice Pattern should be clinically relevant and specific enough to provide useful information to practitioners.
- Each recommendation that is made should be given an explicit rating that shows its importance to the care process.
- Each recommendation should also be given an explicit rating that shows the strength of evidence that supports the recommendation and reflects the best evidence available.

In the process of revising this document, a detailed literature search in Medline and the Cochrane Library for articles in the English language was conducted on the subject of pediatric eye evaluation for the years 2001 to 2006. The results were reviewed by the Pediatric Ophthalmology/Strabismus Panel and used to prepare the recommendations, which they rated in two ways. The panel first rated each recommendation according to its importance to the care process. This "importance to the care process" rating represents care that the panel thought would improve the quality of the patient's care in a meaningful way. The ratings of importance are divided into three levels.

- Level A, defined as most important
- Level B, defined as moderately important
- Level C, defined as relevant but not critical

The panel also rated each recommendation on the strength of evidence in the available literature to support the recommendation made. The "ratings of strength of evidence" also are divided into three levels.

- Level I includes evidence obtained from at least one properly conducted, well-designed randomized controlled trial. It could include meta-analyses of randomized controlled trials.
- Level II includes evidence obtained from the following:
  - Well-designed controlled trials without randomization
  - Well-designed cohort or case-control analytic studies, preferably from more than one center
  - Multiple-time series with or without the intervention
- Level III includes evidence obtained from one of the following:
  - Descriptive studies
  - Case reports
  - Reports of expert committees/organizations (e.g., PPP panel consensus with external peer review)

The evidence is that which supports the value of the recommendation as something that should be performed to improve the quality of care. The panel believes that it is important to make available the strength of the evidence underlying the recommendation. In this way, readers can appreciate the degree of importance the committee attached to each recommendation and they can understand what type of evidence supports the recommendation.

The ratings of importance and the ratings of strength of evidence are given in bracketed superscripts after each recommendation. For instance, "[A:II]" indicates a recommendation with high importance to clinical care [A], supported by sufficiently rigorous published evidence, though not by a randomized controlled trial [II].

The sections entitled "Orientation" and "Background" do not include recommendations; rather, they are designed to educate and provide summary background information and rationale for the recommendations that are presented in the Care Process section. A summary of the major recommendations for care is included in Appendix 1.

The Pediatric Eye Evaluations PPP has two parts. The first section focuses on pediatric eye and vision screening. It is intended to be used by pediatricians, family practice physicians, physicians, nurses, other health care professionals, and trained lay people involved in screening. The second section is the comprehensive pediatric ophthalmic evaluation. This section is designed to be used by ophthalmologists who perform comprehensive medical eye evaluations for children.

ORIENTATION

ENTITY

Childhood screening examination performed by a pediatrician, family practice physician, other physician, nurse, orthoptist, other health care professional, or trained layperson for detection of eye and vision problems.

PATIENT POPULATION

Newborns and children through age 18 years.

ACTIVITY

Pediatric eye and vision screening.

INTENDED USERS OF THE GUIDELINE

Pediatricians, family practice physicians, other physicians, nurses, orthoptists, other health care professionals, and trained lay persons.

PURPOSE

To identify children who may have eye or visual abnormalities, or risk factors for developing eye or vision problems, and refer them for a comprehensive pediatric ophthalmic evaluation.

GOALS

- Describe techniques for periodic eye and vision screening examinations for children, documentation of which includes the following information:[1]
  - Risk factors for eye and visual abnormalities
  - Level of vision in each eye individually
  - Assessment of ocular alignment
  - Assessment for the presence of ocular structural abnormalities
- Communicate screening results and follow-up plan to family/caregiver
- Refer all children who fail screening (refer to Screening Examination section) or who cannot be successfully screened at their second attempt[2]; physicians or other practitioners providing ongoing care of the child should verify at the next visit that the recommended comprehensive eye examination has taken place
- Educate screening personnel

BACKGROUND

EPIDEMIOLOGY OF CHILDHOOD OCULAR CONDITIONS

In newborns and early infancy, structural abnormalities such as congenital cataract, retinopathy of prematurity, congenital glaucoma, and retinoblastoma (a vision- and life-threatening malignancy), are the most severe vision-threatening eye problems. Other childhood ocular problems include strabismus, amblyopia, and refractive problems. Table 1 lists prevalence and incidence data for childhood ocular conditions.

Strabismus is any ocular misalignment. The most common types of strabismus are esotropia (inwardly deviating eyes, or crossed eyes) and exotropia (outwardly deviating eyes, or wall-eyes).

Amblyopia refers to an abnormality of visual development characterized by decreased best-corrected visual acuity not fully attributable to a structural abnormality of the eye. Amblyopia may be unilateral or bilateral and is best treated in early childhood. However, recent data show that amblyopia may be treated even in the teenage years.[3] The prevalence of amblyopia varies by race/ethnicity. Approximately half of amblyopia is secondary to strabismus (mainly esotropia) and the other half is from other causes such as high refractive errors, anisometropia (asymmetric refractive errors), or structural ocular problems.[4-7] Amblyopia is unusual in children with intermittent exotropia.[8] The prevalence of amblyopia in children with developmental delay is sixfold greater than in children who were healthy, full-term infants.[9,10] Over 6 million Americans have amblyopia, and it is responsible for loss of vision in more people under the age of 45 than all other causes combined.[11]

TABLE 1 CHILDHOOD OCULAR CONDITIONS

Condition	Frequency
Congenital cataract	0.06%[12] (prevalence)
Retinopathy of prematurity	52%[13] (incidence in infants <750 g at birth) 32%[13] (incidence in infants 750-799 g at birth) 15%[13] (incidence in infants 1000-1250 g at birth)
Congenital glaucoma	0.01%[14] (prevalence)
Retinoblastoma	0.005%[15] (incidence in children <15 years)
Strabismus	4%[16,17] (prevalence)
Amblyopia	2% to 3%[7,18-22] (prevalence)
Refractive errors	
Myopia	9%[23] (prevalence in children aged 5 to 17 years)
Hyperopia	13%[23] (prevalence in children aged 5 to 17 years)
Astigmatism	28%[23] (prevalence in children aged 5 to 17 years)

Visually important refractive errors include high hyperopia, moderate astigmatism, moderate to high myopia, and asymmetric refractive errors. An estimated 5% to 7% of preschool children have visually important refractive errors.[24] Twenty-five percent of children between the ages of 6 and 18 years would benefit from corrective lenses for refractive error or other reasons.[25] During the school years, visual difficulties such as those caused by uncorrected refractive errors may interfere with school performance.

Premature birth is a major risk factor for severe visual impairment and blindness in childhood. The most common ocular problem in preterm infants is retinopathy of prematurity (ROP). The frequency and severity of ROP is inversely related to gestational age. Preterm infants also have higher rates of amblyopia, strabismus, refractive error, optic atrophy, and cortical visual impairment. Years later, these children may develop glaucoma and retinal detachments.[26,27] The visual impairment is often accompanied by cerebral palsy, epilepsy, and other motor and mental handicaps.[27]

RATIONALE FOR PERIODIC SCREENINGS

Amblyopia meets the World Health Organization (WHO) guidelines for a disease that benefits from screening because it is an important health problem for which there is an accepted treatment, a recognizable latent or early symptomatic stage, and a suitable test or examination.[28,29] Eye and vision screening is most effective when performed periodically throughout childhood.[30-37] The combined sensitivity of a series of screening encounters is much higher than that of a single screening test, and it is the combined sensitivity that is applicable to the issue of screening effectiveness. Anisometropia and small-angle strabismus are the leading causes of undetected

amblyopia. Because a large percentage of children with amblyopia and strabismus go undetected and untreated,[38,39] most major authorities agree that extending vision screening to all children is extremely important.[1,40,41]

The purpose of periodic eye and vision screening is to detect pediatric eye disorders, especially amblyopia, at a sufficiently early age to allow effective treatment. The earlier amblyopia is detected and properly treated, the higher the likelihood of visual acuity recovery.[30,42,43] Starting treatment at a young age may also increase the likelihood of compliance and the rate of vision recovery.[44] The Amblyopia Treatment Study demonstrated that more than 75% of amblyopic children younger than 7 years can have significant improvement in the amblyopic eye (to 20/30 or better) as the result of treatment (see Amblyopia PPP[45]).[31,46] Based on studies of amblyopia detected before the age of 6 years but incompletely treated, it appears that the potential for the treatment of amblyopia persists to approximately age 12 years or older, at which time the plasticity of the visual pathways decreases.[3,47] With rare exceptions,[48,49] amblyopia results in lifelong visual loss if it is untreated or insufficiently treated in early childhood.

A discussion of the statistics on eye and vision screening in children is in Appendix 2.

SCREENING PROCESS

The optimal timing and method of pediatric vision screening has not been definitively established and is the subject of ongoing research. Guidelines for pediatric vision screening are evolving as new tests and technologies are introduced and new studies are completed.

Eyes can be examined at any age, and a series of age-appropriate screening examinations is recommended throughout childhood (see section on Screening Examination for the recommended ages for pediatric eye screening). Age-appropriate eye and vision evaluations should be performed in the newborn period and at all subsequent health supervision visits,[A:III] because different childhood eye problems may be detected at each visit and new problems can arise during childhood. In the newborn and early infancy, the examination concentrates on detection of structural anatomical abnormalities. Detection of other abnormalities such as amblyopia and strabismus are added as the child ages.

Children should have their subjective visual acuity assessed using a vision chart.[A:III] Children who **fail** a screening should be referred for a comprehensive ophthalmic evaluation after the **first** screening failure.[A:III] Children who fail to complete subjective visual acuity assessment should be considered **untestable**. Children who are **untestable** on the first attempt should be referred for a comprehensive ophthalmic evaluation **or** a repeat screening should be attempted.[A:III] If a child is unable to cooperate for vision testing at 3 years of age, a second attempt should be made within 6 months.[A:III] If the child is 4 years old, a second attempt should be made within the month.[1] Although the child may be rescreened if screening is inconclusive or unsatisfactory, undue delays should be avoided; if retesting is inconclusive, referral for a comprehensive ophthalmic evaluation is indicated.[2] [A:III] Children who are **untestable** on two occasions have been shown to have a higher incidence of pathology than children who pass screening.[2] The Joint Policy Statement of the American Academy of Pediatrics, American Association of Certified Orthoptists, American Association for Pediatric Ophthalmology and Strabismus, and American Academy of Ophthalmology recommends that a repeat screening attempt should be performed within 4 to 6 months for a failed screening at age 3 years and within 1 month at age 4 years.[1]

HISTORY

At a child's first examination by a new primary care provider, a history of risk factors for eye and vision abnormalities should be elicited.[A:III] A detailed family history of eye and vision abnormalities in first-degree family members (mother, father, and siblings) and a history of past and present medical problems should be elicited. Infants detected to be at risk for eye problems because of prematurity, family history of congenital cataract, congenital glaucoma, retinoblastoma, or metabolic or genetic disease should be referred for a comprehensive ophthalmic evaluation as early as possible.[A:III] For children with a family history of congenital or juvenile

cataract, the referral is best made while the baby is still in the newborn nursery. A child with a family history of amblyopia and/or strabismus in a first-degree family member should be referred for a comprehensive ophthalmic evaluation at age 12 to 24 months or sooner if ophthalmic problems are noted. Children with a history of medical problems that are risk factors for development of eye problems should also be referred for a comprehensive ophthalmic evaluation. At each scheduled well-child examination, the primary care provider should ask the parent/caregiver about the baby's visual interactions and possible eye or vision problems. Table 2 lists specific examples of abnormalities or observations that require referral for a comprehensive ophthalmic evaluation.

TABLE 2 INDICATIONS FOR REFERRAL FOR A COMPREHENSIVE PEDIATRIC OPHTHALMIC EVALUATION

Indication	Specific Examples
Risk factors (general health problems, systemic disease, or use of medications that are known to be associated with eye disease and visual abnormalities)	• Prematurity (birthweight less than 1500 grams or gestational age 30 weeks or less) • Retinopathy of prematurity • Intrauterine growth retardation • Perinatal complications (evaluation at birth and at 6 months) • Neurological disorders or neurodevelopmental delay (upon diagnosis) • Juvenile idiopathic arthritis (upon diagnosis) • Thyroid disease • Cleft palate or other craniofacial abnormalities • Diabetes mellitus (5 years after onset) • Systemic syndromes with known ocular manifestations (at 6 months or upon diagnosis) • Chronic systemic corticosteroid therapy or other medications known to cause eye disease • Suspected child abuse
A family history of conditions that cause or are associated with eye or vision problems	• Retinoblastoma • Childhood cataract • Childhood glaucoma • Retinal dystrophy/degeneration • Strabismus • Amblyopia • Eyeglasses in early childhood • Sickle cell anemia • Systemic syndromes with known ocular manifestations • Any history of childhood blindness not due to trauma in a parent or sibling
Signs or symptoms of eye problems by history or observations by family members*	• Defective ocular fixation or visual interactions • Abnormal light reflex (including both the corneal light reflections and the red fundus reflection) • Abnormal or irregular pupils • Large and/or cloudy eyes • Drooping eyelid • Lumps or swelling around the eyes • Ocular alignment or movement abnormality • Nystagmus (shaking of eyes) • Persistent tearing, ocular discharge • Persistent or recurrent redness • Persistent light sensitivity • Squinting/eye closure • Persistent head tilt • Learning disabilities or dyslexia

NOTE: These recommendations are based on panel consensus.

* Headache is not included since it is rarely caused by eye problems in children. This complaint should first be evaluated by the primary care physician.

SCREENING EXAMINATION

The screening examination should include examination of the red reflex to detect abnormalities of the ocular media; external inspection to detect ocular abnormalities; pupil examination; visual acuity on an age-appropriate basis; and, after 6 months of age, the corneal light reflection test (Hirschberg reflex) and cover testing for ocular alignment as well as motility testing.[A:III] When cooperation and pupil size permit, ophthalmoscopy should be used to view the optic nerve and posterior pole.

Table 3 indicates the screening methods to be used at each age and the indications for referral. The earliest screening takes place at the newborn medical examination and is limited to the red reflex, identification of structural abnormalities, and pupil examination. If a structural eye problem or an abnormal red reflex is detected, the baby should be referred on an urgent basis.[A:III] At 6 months of age all infants should be evaluated for fixation preference, ocular alignment, and the health of ocular structures.[A:III]

TABLE 3 RECOMMENDED AGES AND METHODS FOR PEDIATRIC EYE SCREENING

Recommended Age	Method	Indications for Referral to an Ophthalmologist
Newborn to 3 months	Red reflex	Absent, white, dull, opacity, or asymmetric
	External inspection	Structural abnormality
	Pupil examination	Irregular shape, unequal size, poor or unequal reaction
3 to 6 months (approximately)	Fix and follow	Failure to fix and follow in a cooperative infant
	Red reflex	Absent, white, dull, opacity, or asymmetric
	External inspection	Structural abnormality
	Pupil examination	Irregular shape, unequal size, poor or unequal reaction
6 to 12 months and until child is able to cooperate for verbal visual acuity	Fix and follow with each eye	Failure to fix and follow
	Alternate occlusion	Failure to object equally to covering each eye
	Corneal light reflection	Asymmetric or displaced
	Red reflex	Absent, white, dull, opacity, or asymmetric
	External inspection	Structural abnormality
	Pupil examination	Irregular shape, unequal size, poor or unequal reaction
3 years and 4 years (approximately)	Visual acuity* (monocular)	20/50 or worse, or 2 lines of difference between the eyes
	Corneal light reflection/ cover-uncover	Asymmetric/ocular refixation movements
	Red reflex	Absent, white, dull, opacity, or asymmetric
	External inspection	Structural abnormality
	Pupil examination	Irregular shape, unequal size, poor or unequal reaction
5 years (approximately)	Visual acuity* (monocular)	20/40 or worse, or 2 lines of difference between the eyes
	All other tests and referral indications are as in age 3 and age 4 years	
Every 1 to 2 years after age 5	Visual acuity* (monocular)	20/30 or worse, or 2 lines of difference between the eyes
	All other tests and referral indications are as in age 3 and age 4 years	

NOTE: These recommendations are based on panel consensus. Although the child may be retested if screening is inconclusive or unsatisfactory, undue delays should be avoided; if inconclusive on retesting, referral for a comprehensive pediatric ophthalmic evaluation is indicated.[2] [A:II]

* Figures, letters, tumbling E or optotypes, Lea symbols[50] (Precision Vision, Inc., La Salle, IL), vision testing machines.

The red reflex is a test used to identify clarity of the ocular media. It is performed by looking at each eye with a direct ophthalmoscope from a distance of about 18 inches. The examiner must then answer three questions:

1. Is there a red reflex from each eye?
2. Are the red reflexes from each eye symmetrical?
3. Is the quality of the red reflex normal for the individual infant (taking into account skin tone and race or ethnicity)?

If the answer to any of the three questions is no, then the red reflex test is abnormal, and a prompt referral to an ophthalmologist skilled in the treatment of infants and children should be made.[A:III] The See Red Card, a simple visual aid designed to help physicians who perform red reflex testing, can be ordered from the American Academy of Pediatrics (see Appendix 3).

The Brückner test, a binocular red reflex test, is superior to the conventional red reflex test, because a skilled examiner will be able to detect not only abnormalities of the red reflex but also will be able to assess alignment and large and/or asymmetric refractive errors.[51,52] The binocular red reflex test is performed in a dimly lit room with the examiner at a distance of about 30 inches (0.75 meter) from the child.[51] The examiner overlaps both pupils simultaneously, creating a binocular red reflex with the largest circular light of a direct ophthalmoscope set to focus on the ocular surface, usually at zero. The examiner then assesses the quality of the redness seen within the child's pupils. Normally, the red reflex from each eye should be of the same color and brightness. Abnormalities include asymmetric reflexes when one reflex is duller or a different color, a white reflex, a partially or totally obscured reflex, or crescents present in the reflex.

Subjective visual acuity chart testing should be performed for a child at the earliest age that is practical.[A:III] The standard testing distance is 20 feet (6 meters), but testing at 10 feet (3 meters) is more successful in some children.

One study reported that 71% to 75% of children age 3 to 3.5 years were successfully screened with crowded HOTV and Lea symbols visual acuity testing administered by lay screeners.[53] The most sophisticated test that a child is capable of performing should be used.[A:III] When possible, screeners should enlist the assistance of parents/caregivers in the testing process by showing them the figures, tumbling E game, or optotypes before the test so they can help their child understand the test. In decreasing order of cognitive difficulty, possible acuity tests include Snellen letters, Snellen numbers, tumbling E or optotypes, HOTV, and Lea symbols.[1] Because testing visual acuity with isolated targets (figures or letters) may lead to falsely elevated visual acuities,[54] crowded optotypes or linear visual acuity (a row of optotypes) should be used when possible.[A:III] The Vision in Preschoolers Study Group reported that a crowded line of Lea symbols were more accurate for detecting reduced visual acuity.[55] Most Allen figures tests are not crowded and have been shown to be less accurate than other methods.[56] The tumbling E is less frequently used because it has a lower success rate in children compared with picture charts.[57]

When performing visual acuity testing, it is critical to ensure monocular testing. To prevent peeking, the occluded eye should be completely covered. Children should not use their own hand as an occluder. If an occluding paddle or spoon is used, the child should not hold it. The screener should monitor the child for any evidence of looking around the occluder, which could include head turning, peeking, or moving the occluder. Use of an adhesive occluder patch ensures assessment of monocular visual acuity. Special broadly occluding spectacle frames such as Fun Frames (Good-Lite Co., Elgin, IL) are an option if a child will not allow patching. Visual acuity testing of the second eye should be attempted even when the child will not read the largest line with the first eye.

Another adjunctive screening method is stereovision (depth perception) assessment, which can be performed using the Titmus test, the various Randot tests, or other means.

AUTOMATED METHODS

Automated methods of conducting pediatric eye screening include photoscreening, autorefraction, and visual evoked potential. These technologies are continuing to undergo extensive study, evaluation, and innovation. Currently, there is insufficient evidence to recommend available automated methods to replace standard screening techniques and evaluation.[58-61]

Photoscreening is a nonverbal method of eye and vision screening to identify children who have risk factors associated with the development of amblyopia, however, photoscreening cannot detect amblyopia. Photoscreening may be a valuable adjunct to the traditional screening process especially in preliterate children who generally have a limited attention span.[62] Photoscreening is not a substitute for accurate visual acuity measurement, but it can provide information about the presence of sight-threatening conditions such as strabismus, refractive errors, asymmetric refractive errors (anisometropia), media opacities (e.g., cataract), retinal abnormalities (e.g., retinoblastoma), and ptosis. A uniform set of risk factors that should be detected by preschool vision screening has been developed and can be extended to photoscreening (see Table 4).[31] Photoscreening uses off-axis photography and photorefraction to evaluate the corneal light reflection (Hirschberg reflex), the binocular red reflex (Brückner) test, and crescentic dimensions. Readers of these photographs require extensive training to identify amblyogenic risk factors such as strabismus, anisometropia, refractive errors, and media opacities. Photoscreening techniques are still evolving and may become even more useful in the future.

Autorefractive devices have been used occasionally as a surrogate for vision screening or may serve as a valuable adjunct to traditional screening. Autorefraction without cycloplegia in children is inaccurate.[63,64]

Visual evoked potential as a method of vision screening is being evaluated in research studies.[65]

Based on the literature,[36,55,58,66] objective screening techniques such as autorefraction or photoscreening are alternatives to visual acuity testing using charts for very young children. There is no consensus on the preferred method to screen for amblyopia in such children.

TABLE 4 AMBLYOGENIC FACTORS TO BE DETECTED BY SCREENING

Anisometropia (spherical or cylindrical) >1.5 D
Any manifest strabismus
Hyperopia >3.50 D in any meridian
Myopia magnitude >3.00 D in any meridian
Any media opacity >1 mm in size
Astigmatism >1.5 D at 90° or 180° >1.0 in oblique axis (>10° eccentric to 90° or 180°)
Ptosis (1 mm margin reflex distance)*
Visual acuity: per age-appropriate standards†

SOURCE: Donahue SP, Arnold RW, Ruben JB, AAPOS Vision Screening Committee. Preschool vision screening: what should we be detecting and how should we report it? Uniform guidelines for reporting results of preschool vision screening studies. J AAPOS 2003;7:314-6. Copyright 2003. Reprinted with permission from Elsevier. All rights reserved.

D = diopter

* Margin-reflex distance is the distance from the corneal light reflex to the upper lid margin and is a standard objective measurement of ptosis.

† American Academy of Pediatrics Committee on Practice and Ambulatory Medicine, Section on Ophthalmology. Eye examination and vision screening in infants, children and young adults by pediatricians. Pediatrics 2003;111:902-7.

REFERRAL PLAN

If eye and vision abnormalities or their risk factors are suspected or identified at a screening examination, an appropriate referral plan should be initiated and recorded.[A:III] Tables 2 and 3 list specific examples of indications for a referral for a comprehensive pediatric ophthalmic evaluation.

The following are examples of some conditions, not a comprehensive list, which may prompt referral for a comprehensive pediatric eye evaluation, with guidance on the urgency of the referral.

- URGENT REFERRAL (contact the ophthalmologist within 24 hours)
  - Abnormal red reflex or suspected abnormal red reflex
  - Any suspected severe eye injury
  - Severe eye pain
  - Sudden loss of vision
- SEMI-URGENT REFERRAL
  - New onset of strabismus or diplopia
  - Visual acuity 20/200 or worse on screening
  - Severe or new onset ptosis
  - Anisocoria
- STANDARD REFERRAL
  - Abnormal visual acuity for age (see Table 3)
  - Children who are untestable
  - Strabismus or suspected strabismus
- IMPORTANT NOTE
  - Only 50% of children identified by abnormal vision screening receive professional eye and vision care[67]
  - Additional research is required to identify and address barriers to follow-up after a failed screening examination[67]

When referrals are made on the basis of screening, all parties involved should recognize that screening for any condition results in false positives and false negatives. The sensitivity and specificity of screening methods vary with the age of the child being screened, the screening modality and conditions, and the skill and patience of the examiner.

For further information on screening, see Suggested Reading and Resources.

PROVIDER AND SETTING

Screening evaluations are performed by a child's primary care physician, nurse, or other trained health professional. Such screenings should be performed in the physician's office during primary health care visits. Auxiliary screenings may be performed in preschool and daycare settings, at schools, or at public screenings. Public and school screening evaluations may be performed by health professionals or trained lay screeners.

The physicians, nurses, and other providers who perform eye and vision screening should be educated and trained in eliciting a history of risk factors for eye and visual abnormalities, detecting structural eye problems, and assessing visual abilities or acuities at every age.[A:III] Screeners should also be trained in the difficulties involved in testing infants, toddlers, and older children.[A:III]

ORIENTATION

ENTITY

A comprehensive pediatric ophthalmic evaluation.

PATIENT POPULATION

Newborns and children through age 18 years.

ACTIVITY

A child is seen for a comprehensive pediatric ophthalmic evaluation.

INTENDED USERS OF THE GUIDELINE

Ophthalmologists.

PURPOSE

A comprehensive medical eye evaluation is performed to evaluate abnormalities detected by screening to identify risk factors for disease, to detect and diagnose sight- and health-threatening disease, and to initiate a plan of treatment as necessary.

GOALS

- Identify risk factors for ocular disease
- Identify systemic disease based on associated ocular findings
- Identify factors that may predispose to visual loss early in a child's life
- Determine the health status of the eye, visual system, and related structures, and assess refractive errors
- Discuss the nature of the findings of the examination and their implications with the parent/caregiver, primary care physician and, when appropriate, the patient
- Initiate an appropriate management plan (e.g., treatment, counseling, further diagnostic tests, referral, follow-up, early intervention services*)

BACKGROUND

The comprehensive pediatric ophthalmic evaluation can uncover abnormalities of a child's ocular and visual system (i.e., refractive errors, strabismus, cataracts, ptosis) that can lead to amblyopia and strabismus, among other disorders. Amblyopia can be treated effectively and permanent visual loss can be prevented if detected in early childhood. A comprehensive ophthalmic evaluation also may detect serious eye disorders such as ocular tumors (i.e., retinoblastoma), the treatment of which may be sight saving and life saving. The examination also can detect congenital eye abnormalities, some of which may be hereditary. Congenital eye abnormalities may indicate the presence of systemic disorders that affect general health or impede normal development. Childhood ocular and visual disorders are important to detect, because other family members or subsequent children may be at risk for the same disorder.

* Under U.S. federal law, early intervention services for children of any age with visual impairments are available from public school districts and regional centers.

CARE PROCESS

The comprehensive pediatric ophthalmic evaluation of children includes history, examination, diagnosis, and initiation of management. Comprehensive pediatric ophthalmic evaluations differ in technique, instrumentation, and diagnostic capacity from child to child, depending on the child's age, mental and emotional development, and ability to interact with the examiner. For example, infants and young children who are not verbal will require different visual acuity assessment techniques from those used in older children.

HISTORY

Although a thorough history generally includes the following items, the exact composition varies with the patient's particular problems and needs:

- Demographic data, including identification of parent/caregiver, and patient's gender and date of birth[A:III]
- Documentation of identity and relationship of historian[B:III]
- The identity of other pertinent health care providers[A:III]
- The chief complaint and reason for the eye evaluation[A:III]
- Current eye problems[A:III]
- Ocular history, including prior eye problems, diseases, diagnoses, and treatments[A:III]
- Systemic history; birth weight; prenatal and perinatal history that may be pertinent (e.g., alcohol, tobacco, and drug use during pregnancy); past hospitalizations and operations; general health and development[A:III]
- Current medications and allergies[A:III]
- Family history of eye conditions and relevant systemic diseases.[A:III] A social history, including racial or ethnic heritage, is germane for certain diagnostic considerations such as sickle cell anemia or Tay-Sachs disease.
- Review of systems[B:III]

EXAMINATION

The eye examination consists of an assessment of the physiologic function and the anatomic status of the eye and visual system. Documentation of the child’s level of cooperation with the examination can be useful in interpreting the results and in making comparisons among the examinations over time. In general, the examination may include the following elements:

- Assessment of visual acuity and fixation pattern[A:III]
- Ocular alignment and motility[A:III]
- Red reflex or binocular red reflex (Brückner) test[A:III]
- Pupil examination[A:III]
- External examination[A:III]
- Anterior segment examination[A:III]
- Cycloplegic retinoscopy/refraction[A:III]
- Funduscopic examination[A:III]

Other tests indicated for selected patients:

- Binocularity/stereoacuity testing
- Sensorimotor evaluation (e.g., strabismus, suspected neurological disease)

Assessment of Visual Acuity and Fixation Pattern

The method of evaluating visual acuity will vary according to the age of the child and level of cooperation. Distance visual acuity should be determined monocularly whenever possible.[A:III] To prevent peeking when a child's visual acuity is tested, the occluded eye should be completely covered.[A:III] The child should not hold the occluder. An adhesive occluder patch is recommended to ensure assessment of monocular visual acuity. Monocular visual testing for patients with

nystagmus may require special techniques such as blurring of the fellow eye; binocular testing also should be performed for these patients.[A:III]

Under ideal circumstances, visual acuity testing conditions should be standardized in each examination room and at each visit so that the same viewing distance and lighting conditions are used. Some children are more amenable to testing at shorter distances. The testing distance, type of optotype, and whether the optotype is presented a line at a time or isolated, should be documented.[A:III] Patients should be encouraged to learn optotype-equivalent tests at the earliest possible age.

Infant and Preverbal Child

Visual acuity measurement of the infant and preverbal child is limited to qualitative assessment of fixation, fixation preference, and tracking (following) movements of the eyes. These assessments are usually made by drawing the child's attention to the examiner's or family's/caregiver's face (infants under 3 months) or a toy either hand held or at 20 feet (6 meters). Because children resist covering the sound eye when the other has limited vision, the vigor with which the child objects to alternate occlusion of the eyes can be used to judge the relative quality of vision in each eye. Fixation behavior is recorded for each eye as "fix, follows, maintains" or the equivalent "central, steady, maintains." An assessment of equality of vision also can be made by observing the child's ability to maintain fixation when a prism is placed in the visual axis of each eye in turn.[68] Several tests that have been described utilize different amounts of prism and different ways of introducing the prism. In the 10 prism diopter (PD) base-up fixation test, the prism is introduced and the child's fixation preference is observed. It is recorded as alternates or the preferred eye is the right/left and nonpreferred eye holds well, holds briefly, or shows no hold.[68,69] With the 25 PD base-in test, there is equal vision if fixation alternates. This test does not distinguish equal vision from unequal vision in those children whose fixation does not alternate.[70] Both induced tropia tests fail to differentiate amblyopia from fixation preference.[71]

Verbal Preliterate Child

Quantitative visual acuity assessment in cooperative verbal children (at approximately age 3 years) involves recognition of symbols, tumbling E, or letters presented at a standardized distance, generally at 20 feet (6 meters). Linear targets or targets surrounded by crowding bars are preferred because these targets may help identify children with subtle amblyopia by detecting interocular differences in acuity. In such patients, testing with isolated figures may suggest symmetrical acuities or a false negative test.[54,72 [A:III]] The crowding phenomenon is important in amblyopia and may result in inconsistencies in measured visual acuity because of decreased recognition of a target within others. The Vision in Preschoolers Study Group reported that a crowded line of Lea symbols was more accurate in detecting reduced visual acuity.[55] Allen figures are not crowded and have been shown to be less accurate than other methods.[56]

Parents/caregivers can assist in the testing process by showing the child the figures or tumbling E game before the test. The tumbling E is used less frequently because it has a lower success rate in children when compared to picture charts.[57]

Although it is not a measure of visual acuity, stereoacuity testing may detect fusional defects found in small-angle strabismus.

Literate Child

Snellen acuity is routinely tested at distance (about 20 feet or 6 meters) and, when appropriate, at near (about 13 inches or 0.33 meter). In some children, testing at 6 meters cannot be accomplished, but the child can be tested at 3 meters.

Ocular Alignment and Motility

Ocular alignment is assessed by using the corneal light reflection, the binocular red reflex (Brückner) test, or the cover test.[A:III] Cover/uncover and alternate cover tests in primary gaze at distance and near accommodative targets are utilized when feasible; these tests require the patient's cooperation and interaction with the examiner in addition to sufficient vision to fixate on

the target. Ocular versions and ductions should be tested even in the young infant.[A:III] In the inattentive or uncooperative patient, eye movements may be tested using the oculocephalic rotations maneuver (doll's head) or assessed by spontaneous eye movements. Evaluating oblique muscle function in young children is important when examining a child with strabismus, but it may be difficult. When strabismus is suspected or revealed, a strabismus evaluation is warranted (see Esotropia and Exotropia PPP[73]).

Red Reflex / Binocular Red Reflex (Brückner) Test

The red reflex and/or binocular red reflex test should be performed to identify opacities of the ocular media.[A:III]

The red reflex of each eye is assessed by looking at each eye with a direct ophthalmoscope from a distance of about 18 inches. [A:III] The examiner should answer three questions:

1. Is there a red reflex from each eye?
2. Are the red reflexes from each eye symmetrical?
3. Is the quality of the red reflex normal for the individual child (taking into account skin tone and race or ethnicity)?

The binocular red reflex (Brückner) test[51,52] allows an assessment of the clarity of the visual axis and an indirect assessment of ocular alignment as well as large and/or asymmetric refractive errors. The binocular red reflex test is performed in a dimly lit room with the examiner at a distance of about 30 inches (0.75 meter) from the child.[51] The examiner overlaps both pupils simultaneously, creating a binocular red reflex with the largest circular light of a direct ophthalmoscope set to focus on the ocular surface, usually at zero. The examiner then assesses the quality of the redness seen within the child's pupils. Normally, the red reflex from each eye should be of the same color and brightness. Abnormalities include asymmetric reflexes when one reflex is duller or a different color, a white reflex, a partially or totally obscured reflex, or crescents present in the reflex.

Pupil Examination

Even in small infants, the pupils should be assessed for direct and consensual response to light and for the presence of a relative afferent defect.[A:III] This can be done with a penlight, a direct ophthalmoscope, or a transilluminator. Pupil evaluation in infants and children may be difficult due to active hippus or shift in the patient's fixation and accommodative status. In general, amblyopia is not associated with a detectable afferent pupillary defect.[74] If an afferent pupillary defect is present, the examiner should thoroughly review etiologic causes for asymmetric optic nerve function rather than attribute the finding to amblyopia.[A:III]

External Examination

External examination involves assessment of the eyelids, eyelashes, lacrimal apparatus, and orbit.[A:III] The anatomy of the face (including the lids, interocular distance, and presence or absence of epicanthal folds), orbital rim, and presence of oculofacial anomalies should be noted.[A:III] The position of the head and face (including head tilt or turn) should be noted.[A:III] Children with prominent epicanthal folds and normal ocular alignment may appear to have an esotropia (pseudo-esotropia). Distinctive features unusual for the family may suggest the presence of a congenital anomaly and merit an assessment of other physical abnormalities (e.g., ears, hands).

Anterior Segment Examination

To evaluate further opacities of the ocular media, the cornea, anterior chamber, iris, and lens should be evaluated with slit-lamp biomicroscopy if possible.[A:III] Slit-lamp biomicroscopic evaluation is indicated for older children or for younger children who are cooperative. In infants and young children, a hand-held slit-lamp biomicroscope may be helpful. Some children may need to be restrained, sedated, or undergo an eye examination under general anesthesia when apparent abnormalities warrant a detailed examination.

Cycloplegic Retinoscopy/Refraction

Determination of refractive errors is important in the diagnosis and treatment of amblyopia or strabismus. Patients should receive an accurate cycloplegic refraction either by retinoscopy or by subjective refraction.[75] [A:III] Prior to cycloplegia, dynamic retinoscopy provides a rapid assessment of accommodative function and may be helpful in evaluating a child with high hyperopia or possible accommodative insufficiency.[76,77]

Cycloplegia is necessary for accurate refraction in children. Cyclopentolate is useful because it has a rapid onset and produces cycloplegia that approximates the effect of topical ophthalmic atropine but with a shorter duration of action.[78] Cyclopentolate 1% is more frequently used; cyclopentolate 2% is also available. The strength of cyclopentolate should be determined based on the child's weight, iris coloration, and dilation history.[A:III] In eyes with heavily pigmented irides, adjunctive agents such as tropicamide and/or phenylephrine hydrochloride may be necessary to achieve adequate dilation. In rare cases, topical ophthalmic atropine may be necessary to achieve maximal cycloplegia.[78] The use of topical anesthetic prior to the cycloplegic makes the cycloplegic sting less and promotes its penetration into the eye.

Funduscopic Examination

Posterior segment structures should be examined, preferably with an indirect ophthalmoscope.[A:III] The optic disc, macula, retina, vessels, and the choroid of the posterior regions should be examined.[A:III] In the awake child, it may be difficult or impossible to examine the peripheral retina. Examination of the peripheral retinal and scleral indentation, if indicated, may require sedation or general anesthesia (e.g., evaluation for retinoblastoma).

Binocularity / Stereoacuity Testing

Testing for binocular fusion (e.g., Worth 4-dot test) or the presence of stereopsis (e.g., Random-Dot E test or Stereo Fly test) may be useful in detecting ocular misalignment or amblyopia. Fusion and stereoacuity testing at distance (20 feet or 6 meters) as well as near (13 inches or 0.33 meter) may also be helpful.[79]

Sensorimotor Evaluation

A sensorimotor examination is an expanded examination that is beyond the scope of the basic ocular alignment and motility examination. It is useful in evaluating many strabismus patients. It consists of multiple measurements of ocular deviation using prisms in more than one field of gaze at distance and/or at near, along with a sensory test of binocular function in patients who are able to respond.

ADDITIONAL TESTS

Based on the patient's history and findings, additional tests or evaluations that are not routinely part of the comprehensive pediatric ophthalmic evaluation may be indicated to study a particular structure or function. Components that may be included if the child cooperates are color-vision testing, assessment of intraocular pressure (IOP), central corneal thickness measurement, and visual field testing. Photography of structural abnormalities may be helpful for documentation and follow-up.

Color-Vision Testing

Color-vision testing reveals abnormalities in approximately 8% of the male and less than 1% of the female populations.[80] Demonstration of color-vision deficits in asymptomatic children is of limited value but may be of interest to parents or teachers.

Intraocular Pressure Measurement

Measuring IOP is not a routine part of the comprehensive ophthalmic evaluation of the infant or child because glaucoma is rare in this age group and, when present, is associated with additional manifestations. In addition, IOP measurement is difficult to perform and frightening for the patient; some children and teenagers may become alarmed at the procedure to the detriment of

important parts of the subsequent examination. Intraocular pressure should be measured whenever risk factors or ocular signs and symptoms of glaucoma exist.[A:III] Because IOP measurement is difficult in young children or those with special needs, a separate examination with the patient sedated or anesthetized may be required. The introduction of more compact instruments such as the Tonopen (Reichert, New York) has facilitated testing of IOP in children.

Central Corneal Thickness Measurement

Central corneal thickness measurement may be appropriate, especially in children suspected of having glaucoma. Several groups of children have been documented to have an unusually thick central corneal thickness measurement compared with adults (e.g., children who have undergone surgery for congenital cataracts, who are at risk for glaucoma).[81-83]

Visual Field Testing

Confrontation visual field testing may be performed in children. Quantitative visual field testing in young children may be difficult to perform, and reliability should be carefully assessed.[A:III]

Photography

Photography in conjunction with the comprehensive pediatric eye examination may be appropriate. Examples of such conditions include external photography to document strabismus, ptosis, or facial structure; anterior segment photography for cataract and other anomalies; and fundus photography for retinal and/or optic nerve head documentation.

DIAGNOSIS AND MANAGEMENT

Evaluation results fall into three general categories: low risk, high risk, and requiring intervention.

Category I: Low Risk

When the evaluation is normal, the ophthalmologist reassures the patient and the parent/caregiver and advises as to the appropriate interval for re-examination. Although this group of patients is considered low risk, periodic eye screening by the primary care provider should be continued (see Table 3).[A:III] Patients should undergo a comprehensive pediatric ophthalmic evaluation if new ocular symptoms, signs, or risk factors for ocular disease develop.[A:III]

Category II: High Risk

When the evaluation reveals risk factors for developing ocular disease or signs that are suggestive of an abnormal condition, the patient is considered to be at high risk. The ophthalmologist should determine an appropriate follow-up interval for each patient based on the findings.[A:III]

Category III: Requiring Intervention

Most patients with abnormal signs and symptoms can be diagnosed and treated solely on the basis of a comprehensive pediatric eye evaluation. Recommendations for appropriate treatment and follow-up will vary with the patient. The Amblyopia PPP[45] and Esotropia and Exotropia PPP[73] contain specific recommendations for management of these conditions.

Eyeglasses

Optical correction should be considered if the visual acuity can be improved, if ocular alignment can be improved, to prevent or treat amblyopia, to treat strabismus, or if the patient has asthenopia.[A:III] The goals when prescribing eyeglasses for young children are to achieve good vision, straight eyes, normal binocular vision, and acceptance of the eyeglasses. Table 5 lists the factors that the ophthalmologist considers when prescribing eyeglasses for young children and provides guidance for the decision.

TABLE 5 CONSENSUS GUIDELINES FOR PRESCRIBING EYEGLASSES FOR YOUNG CHILDREN[A:III]

Condition	Diopters		
	Age 0–1 year	Age 1–2 years	Age 2–3 years
Isometropia (similar refractive error in both eyes)			
Myopia	≥ –5.00	≥ –4.00	≥ –3.00
Hyperopia (no manifest deviation)*	≥ +6.00	≥ +5.00	≥ +4.50
Hyperopia with esotropia†	≥ +3.00	≥ +2.00	≥ +1.50
Astigmatism	≥ 3.00	≥ 2.50	≥ 2.00
Anisometropia			
Myopia	≥ –2.50	≥ –2.50	≥ –2.00
Hyperopia	≥ +2.50	≥ +2.00	≥ +1.50
Astigmatism	≥ 2.50	≥ 2.00	≥ 2.00
Additional Factors			
History of previous amblyopia or strabismus surgery			
Visual acuity			
Acceptance of eyeglass wear			
Possible accommodative esotropia/monofixation syndrome			
Medical comorbidities			
Developmental delay			

NOTE: These values were generated by consensus and are based solely on professional experience and clinical impressions, because there are no scientifically rigorous published data for guidance. The exact values are unknown and may differ among age groups; they are presented as general guidelines that must be tailored to the individual patient.

* May reduce the correction by up to 50% (but no more than 3.00 diopters) depending on the clinical situation.

† In higher hyperopes, reduction of the cycloplegic refraction may be necessary to achieve eyeglass acceptance.

Further information: Miller JM, Harvey EM. Spectacle prescribing recommendations of AAPOS members. J Pediatr Ophthalmol Strabismus 1998;35:51-2.

Harvey EM, Miller JM Prescribing eyeglass correction for astigmatism in infancy and early childhood: A survey of AAPOS members. J AAPOS 2005;9:189-91.

Prescribing eyeglasses in children is both an art and a science. Smaller refractive errors may warrant either optical correction or monitoring depending on the clinical situation. In general, eyeglasses are prescribed for a child either to treat or prevent the following:

- Amblyopia
  - Large refractive errors that are relatively symmetrical (the larger the refractive error, the younger the child who merits eyeglasses)
  - Anisometropia (the greater the interocular difference in refraction, the younger the child who needs eyeglasses)
- Strabismus
  - Accommodative esotropia
  - Intermittent exotropia
- Defective visual acuity due to an uncorrected refractive error
  - Can be myopia, hyperopia, astigmatism, or mixed (the higher the refractive error, the younger the child who merits eyeglasses)

Factors that enable children to successfully wear eyeglasses include a positive attitude on the part of the parent/caretaker, good fit, correct prescription, reasonable cost, and constant positive reinforcement. Children require changes in eyeglasses much more frequently than adults due to head and eye growth and corresponding changes in refraction.

Other Issues

See Appendix 4 for the Joint Policy Statement of the American Academy of Pediatrics, the American Association for Pediatric Ophthalmology and Strabismus, and the American Academy of Ophthalmology on Learning Disabilities, Dyslexia, and Vision. The Refractive Errors & Refractive Surgery PPP[84] discusses prevention of myopia progression, orthokeratology, and visual training exercises.

PROVIDER

A comprehensive pediatric ophthalmic evaluation is best performed by an ophthalmologist. Certain diagnostic procedures may be delegated to appropriately trained and supervised personnel under the ophthalmologist's supervision. For cases in which the diagnosis or management is difficult, consultation with or referral to an ophthalmologist who specializes in the diagnosis and treatment of pediatric patients may be desirable.

COUNSELING AND REFERRAL

The ophthalmologist should discuss the findings and any need for further evaluation, testing, or treatment with the patient’s parent/caregiver.[A:III] The ophthalmologist, in conjunction with the primary care provider or appropriate physician, arranges for treatment and additional evaluation as indicated. The ophthalmologist may also recommend that other family members undergo a comprehensive medical eye evaluation. When a hereditary eye disease is identified, the parent/caregiver may be advised to have other family members evaluated, which may include referral to a geneticist.

APPENDIX 1. SUMMARY OF MAJOR RECOMMENDATIONS FOR CARE

SECTION I. SCREENING

Age-appropriate eye and vision evaluations should be performed in the newborn period and at all subsequent health supervision visits,[A:III] because different childhood eye problems may be detected at each visit and new problems can arise during childhood.

At a child's first examination by a new primary care provider, a history of risk factors for eye and vision abnormalities should be elicited.[A:III] At each scheduled well-child examination, the primary care provider should ask the parent/caregiver about the baby's visual interactions and possible eye or vision problems.[A:III]

The screening examination should include examination of the red reflex to detect abnormalities of the ocular media; external inspection to detect ocular abnormalities; pupil examination; visual acuity on an age-appropriate basis; and, after 6 months of age, the corneal light reflection test (Hirschberg reflex) and cover testing for ocular alignment as well as motility testing.[A:III]

Children who **fail** a screening should be referred for a comprehensive pediatric ophthalmic evaluation after the **first** screening failure.[A:III]

If a child is unable to cooperate for vision testing at 3 years of age, a second attempt should be made within 6 months.[A:III] If the child is 4 years old, a second attempt should be made within the month.[1] [A:III] Although the child may be rescreened if screening is inconclusive or unsatisfactory, undue delays should be avoided; if retesting is inconclusive, referral for a comprehensive ophthalmic evaluation is indicated.[2] [A:III]

REFERRAL PLAN

If eye and vision abnormalities or their risk factors are suspected or identified at a screening examination, an appropriate referral plan should be initiated and recorded.[A:III] Tables 2 and 3 (see main text) list specific examples of indications for a referral for a comprehensive pediatric ophthalmic evaluation.

SECTION II. COMPREHENSIVE OPHTHALMIC EVALUATION

HISTORY

Although a thorough history generally includes the following items, the exact composition varies with the patient's particular problems and needs:

- Demographic data, including identification of parent/caregiver, and patient's gender and date of birth[A:III]
- Documentation of identity and relationship of historian[B:III]
- The identity of other pertinent health care providers[A:III]
- The chief complaint and reason for the eye evaluation[A:III]
- Current eye problems[A:III]
- Ocular history, including prior eye problems, diseases, diagnoses, and treatments[A:III]
- Systemic history; birth weight; prenatal and perinatal history that may be pertinent (e.g., alcohol, drug, and tobacco use during pregnancy); past hospitalizations and operations; general health and development[A:III]
- Current medications and allergies[A:III]
- Family history of eye conditions and relevant systemic diseases.[A:III] A social history, including racial or ethnic heritage, is germane for certain diagnostic considerations such as sickle cell anemia or Tay-Sachs disease.
- Review of systems[B:III]

EXAMINATION

Documentation of the child's level of cooperation with the examination can be useful in interpreting the results and in making comparisons among the examinations over time. In general, the examination may include the following elements:

- Assessment of visual acuity and fixation pattern[A:III]
- Ocular alignment and motility[A:III]
- Red reflex or binocular red reflex (Brückner) test[A:III]
- Pupil examination[A:III]
- External examination[A:III]
- Anterior segment examination[A:III]
- Cycloplegic retinoscopy/refraction[A:III]
- Funduscopic examination[A:III]

Other tests that may be indicated in selected patients:

- Binocularity/stereoacuity testing
- Sensorimotor evaluation (e.g., strabismus, suspected neurological disease)

DIAGNOSIS AND MANAGEMENT

Category I: Low Risk

When the evaluation is normal, the ophthalmologist reassures the patient and the parent/caregiver and advises as to the appropriate interval for re-examination. Although this group of patients is considered low risk, periodic eye screening by the primary care provider should be continued.[A:III] Patients should undergo a comprehensive pediatric ophthalmic evaluation if new ocular symptoms, signs, or risk factors for ocular disease develop.[A:III]

Category II: High Risk

When the evaluation reveals risk factors for developing ocular disease or signs that are suggestive of an abnormal condition, the patient is considered to be at high risk. The ophthalmologist should determine an appropriate follow-up interval for each patient based on the findings.[A:III]

Category III: Requiring Intervention

Most patients with abnormal signs and symptoms can be diagnosed and treated solely on the basis of a comprehensive pediatric eye evaluation. Recommendations for appropriate treatment and follow-up will vary with the patient. The Amblyopia PPP[3] and Esotropia and Exotropia PPP[4] contain specific recommendations for management of these conditions.

Optical correction should be considered if the visual acuity can be improved, if ocular alignment can be improved, to prevent or treat amblyopia, to treat strabismus, or if the patient has asthenopia.[A:III] The goals when prescribing eyeglasses for young children are to achieve good vision, straight eyes, normal binocular vision, and acceptance of the eyeglasses.

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APPENDIX 2. VISION SCREENING STATISTICS

Because of the high prevalence of amblyopia and the need for early treatment, many state legislatures have mandated public screening programs for preschool children.[85] It has been estimated, however, that only 20% of preschool children are actually screened in these programs.[38,86]

Although a cross-sectional study of pediatric practices in the United States and Puerto Rico reported that vision screening was attempted for 66% of children 3 to 5 years old during health supervision visits, only two-thirds of these children were screened for ocular alignment or stereopsis.[87] Ninety-one percent of pediatricians reported routinely performing vision screening tests during health supervision visits in 1993. Compared with 1988, in 1993 more pediatricians report routinely performing the red reflex and the Hirschberg tests on patients in each age group, more pediatricians were performing the cover-uncover test on very young patients, and more pediatricians were performing the funduscopic examination among 5- and 6-year-olds. But, in 1993, only one-third of pediatricians reported testing patients for visual acuity at 3 years.[88] In a survey of the office practices of family physicians, 36% of 3-year-olds, 58% of 4-year-olds, and 73% of 5-year-olds underwent visual acuity screening, while only 7% of the group underwent stereopsis testing.[89]

APPENDIX 3. AMERICAN ACADEMY OF PEDIATRICS "SEE RED CARD" ORDER FORM

See RED

Order your "See Red Cards" Now!!!

Developed by the AAP Section on Ophthalmology, this fact sheet on red reflex testing is a simple visual aid designed to help pediatricians who perform this vision screening examination. The card also outlines pediatric vision screening guidelines.

See Red Cards can be purchased for a fee of $.**25** per sheet (effective April 1, 2002) by check or by credit card.

Number of **See Red Cards** requested _____ x .**25** = $_____

Add $5.00 shipping charge to orders exceeding 20 cards. _____

Total $_____

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Fax credit card orders to 847/434-8000 – Attn: Niccole Alexander

Credit Card (Visa/MC/Discover/AMEX) # _____

Exp. Date _____/_____ Card Code _____

Please note: for all cards other than American Express, the card code is the 3 digits in signature space.

Name on Credit Card _____

- -

Send payment by check made payable to the "American Academy of Pediatrics" to:

American Academy of Pediatrics
Section on Ophthalmology
141 Northwest Point Blvd
Elk Grove Village, IL 60007

Thank you for your order. For questions, please contact Niccole Alexander at nalexander@aap.org
Visit the Section web site at www.aap.org/sections/ophthalmology

APPENDIX 4. LEARNING DISABILITIES, DYSLEXIA, AND VISION: JOINT POLICY STATEMENT

Learning Disabilities, Dyslexia, and Vision

A Joint Statement of the American Academy of Pediatrics, American Association for Pediatric Ophthalmology and Strabismus, and American Academy of Ophthalmology

Policy
Learning disabilities are common conditions in pediatric patients. The etiology of these difficulties is multifactorial, reflecting genetic influences and abnormalities of brain structure and function. Early recognition and referral to qualified educational professionals are critical for the best possible outcome. Visual problems are rarely responsible for learning difficulties. No scientific evidence exists for the efficacy of eye exercises ("vision therapy") or the use of special tinted lenses in the remediation of these complex pediatric neurological conditions.

Background
Learning disabilities have become an increasing personal and public concern. Among the spectrum of issues of concern in learning disabilities is the inability to read and comprehend which is a major obstacle to learning and may have long-term educational, social, and economic implications. Family concern for the welfare of children with dyslexia and learning disabilities has led to a proliferation of diagnostic and remedial treatment procedures, many of which are controversial or without clear scientific evidence of efficacy. Many educators, psychologists, and medical specialists concur that individuals who have learning disabilities should:

1. Receive early comprehensive educational, psychological, and medical assessment
2. Receive educational remediation combined with appropriate psychological and medical treatment
3. Avoid remedies involving eye exercises, filters, tinted lenses, or other optical devices that have no known scientific proof of efficacy

This policy statement addresses these issues.

Evaluation and Management
Reading involves the integration of multiple factors related to an individual's experience, ability and neurological functioning. Research has shown that the majority of children and adults with reading difficulties experience a variety of problems with language (1-3) that stem from altered brain function and that such difficulties are not caused by altered visual function.(4-7) In addition, a variety of secondary emotional and environmental factors may have a detrimental effect on the learning process in such children.

Sometimes children may also have a treatable visual difficulty along with their primary reading or learning dysfunction. Routine vision screening examinations can identify most of those who have reduced visual acuity. Pediatricians and other primary care physicians, whose pediatric patients cannot pass vision screening according to national standards,(8,9) should refer these patients to an ophthalmologist, who has experience in the care of children.

1. Role of the Eyes. Decoding of retinal images occurs in the brain after visual signals are transmitted from the eye via the visual pathways. Some vision care practitioners incorrectly attribute reading difficulties to one or more subtle ocular or visual abnormalities. Although the eyes are obviously necessary for vision, the brain performs the complex function of interpreting visual images. Currently no scientific evidence supports the view that correction of subtle visual defects can alter the brain's processing of visual stimuli. Statistically, children with dyslexia or related learning disabilities have the same ocular health as children without such conditions.(10-12)

2. Controversies. Eye defects, subtle or severe, do not cause the patient to experience reversal of letters, words, or numbers. No scientific evidence supports claims that the academic abilities of

children with learning disabilities can be improved with treatments that are based on 1) visual training, including muscle exercises, ocular pursuit, tracking exercises, or "training" glasses (with or without bifocals or prisms) (13-15); 2) neurological organizational training (laterality training, crawling, balance board, perceptual training) (16-18); or 3) colored lenses.(18-20) These more controversial methods of treatment may give parents and teachers a false sense of security that a child's reading difficulties are being addressed, which may delay proper instruction or remediation. The expense of these methods is unwarranted, and they cannot be substituted for appropriate educational measures. Claims of improved reading and learning after visual training, neurological organization training, or use of colored lenses, are almost always based on poorly controlled studies that typically rely on anecdotal information. These methods are without scientific validation.(21) Their reported benefits can be explained by the traditional educational remedial techniques with which they are usually combined.

3. Early Detection. Pediatricians, primary care physicians and educational specialists may use screening techniques to detect learning disabilities in preschool-age children but, in many cases, the learning disability is discovered after the child experiences academic difficulties. Learning disabilities can include dyslexia, problems with memory and language, and difficulty with mathematic computation. These difficulties are often complicated by attention deficit disorders. A family history of learning disabilities is common in such conditions. Children who are considered to be at risk for or suspected of having these conditions by their physician should be evaluated by more detailed study by educational and/or psychological specialists.

4. Role of the Physician. Ocular defects in young children should be identified as early as possible, and when they are correctable, they should be managed by an ophthalmologist, who is experienced in the care of children.(22) Treatable ocular conditions among others include refractive errors, focusing deficiencies, eye muscle imbalances, and motor fusion deficiencies. When children have learning problems that are suspected to be associated with visual defects, the ophthalmologist may be consulted by the primary care pediatrician. If no ocular defect is found, the child needs no further vision care or treatment and should be referred for medical and appropriate special educational evaluation and services. Pediatricians have an important role in coordination of care between the family and other health care services provided by ophthalmologists, optometrists and other health care professionals who may become involved in the treatment plan.

5. Multidisciplinary Approach. The management of a child who has learning disabilities requires a multidisciplinary approach for diagnosis and treatment that involves educators, psychologists, and physicians. Basic scientific and clinical research into the role of the brain's structure and function in learning disabilities has demonstrated a neural basis for dyslexia and other specific learning disabilities and not the result of an ocular disorder alone.(4-6)

6. The Role of Education. The teaching of children, adolescents, and adults with dyslexia and learning disabilities is a challenge for educators. Skilled educators use standardized educational diagnostic evaluations and professional judgment to design and monitor individualized remedial programs. Psychologists may help with educational diagnosis and classification. Physicians, including pediatricians, otolaryngologists, neurologists, ophthalmologists, mental health professionals and other appropriate medical specialists, may assist in treating the health problems of these patients. Since remediation may be more effective during the early years, prompt diagnosis is paramount.(20-21) Educators, with specialty training in learning disabilities, ultimately play a key role in providing help for the learning disabled or dyslexic child or adult.

Recommendations

1. For all children, clinicians should perform vision screening according to national standards.(8,9)
2. Any child who cannot pass the recommended vision screening test should be referred to an ophthalmologist, who has experience in the care of children.
3. Children with educational problems and normal vision screening should be referred for educational diagnostic evaluation and appropriate special educational evaluation and services.

4. Diagnostic and treatment approaches that lack objective, scientifically established efficacy should not be used.

Summary

Reading difficulties and learning disabilities are complex problems that have no simple solutions. The American Academy of Pediatrics, the American Academy of Ophthalmology, and the American Association for Pediatric Ophthalmology and Strabismus strongly support the need for early diagnosis and educational remediation. There is no known eye or visual cause for these learning disabilities and no known effective visual treatment.(23,24) Recommendations for multidisciplinary evaluation and management must be based on evidence of proven effectiveness demonstrated by objective scientific methodology.(23,24) It is important that any therapy for learning disabilities be scientifically established to be valid before it can be recommended for treatment.

The recommendations in this policy statement do not indicate an exclusive course for treatment or procedure to be followed. Variations, taking into account individual circumstances, may be appropriate.

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SUGGESTED READING AND RESOURCES

- Eye examination and vision screening in infants, children, and young adults by pediatricians. American Academy of Pediatrics Committee on Practice and Ambulatory Medicine and Section on Ophthalmology, American Association of Certified Orthoptists, American Association for Pediatric Ophthalmology and Strabismus, and American Academy of Ophthalmology. Pediatrics 2003;111:902-7. (http://aappolicy.aappublications.org/cgi/content/full/pediatrics;111/4/902)
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- Vision Screening for Infants and Children. Joint Statement by the American Association for Pediatric Ophthalmology (AAPOS) and American Academy of Ophthalmology. 2007. (http://www.aao.org/education/statements)
- The AAPOS Web site contains a Vision Screening Information page in which the following items can be viewed: (http://www.aapos.org/displaycommon.cfm?an=1&subarticlenbr=103)
  - AAPOS Photoscreening Position Statement: Photoscreening to Detect Amblyogenic Factors. (http://www.aapos.org/displaycommon.cfm?an=1&subarticlenbr=104)
  - Home Vision Screening Test for Parents from Prevent Blindness America: Distance Vision Test for Preschool-Age Children (3 through 5). (http://www.preventblindness.org/children/distance_child.html)

RELATED ACADEMY MATERIALS

Basic and Clinical Science Course

Pediatric Ophthalmology and Strabismus (Section 6, 2007-2008)

Complementary Therapy Assessment

Vision Therapy for Learning Disabilities (2001)

Eye Fact Sheet

Overflow Tearing and Chronic Eye Infections in Infants (2004)

Information Statement

Screening Examinations of Premature Infants for Retinopathy of Prematurity (2006)

LEO Clinical Update Course on CD-ROM

Pediatric Ophthalmology and Strabismus (2003)

Patient Education

Amblyopia brochure (2004)

Eye Safety for Children brochure (2005)

Learning Disabilities brochure (2005)

Personal-Eyes Printable™ Patient Handouts on CD-ROM (some handouts available in Spanish) (2007)

Pseudostrabismus brochure (2006)

Ptosis in Children and Adults brochure (2004)

Strabismus brochure (2005)

To order any of these materials, please call the Academy's Customer Service number, 866.561.8558 (U.S. only) or 415.561.8540 or visit http://www.aao.org/store.

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