Complete Summary

GUIDELINE TITLE

Pediatric eye and vision examination.

BIBLIOGRAPHIC SOURCE(S)

American Optometric Association. Pediatric eye and vision examination. 2nd ed. St. Louis (MO): American Optometric Association; 2002. 57 p. [130 references]

GUIDELINE STATUS

This is the current release of the guideline.

It updates a previous version: American Optometric Association. Pediatric eye and vision examination. 2nd ed. St. Louis (MO): American Optometric Association; 1994. 27 p. (Optometric clinical practice guideline; no. 2)

According to the guideline developer, this guideline has been reviewed on a biannual basis and is considered to be current. This review process involves updated literature searches of electronic databases and expert panel review of new evidence that has emerged since the original publication date.

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
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IDENTIFYING INFORMATION AND AVAILABILITY
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SCOPE

DISEASE/CONDITION(S)

Diseases and disorders of the visual system, the eye, and associated structures including:

- Hyperopia
- Astigmatism

- Myopia
- Nonstrabismic binocular disorders
- Strabismus
- Amblyopia
- Accommodative disorders
- Peripheral retinal abnormalities requiring referral or follow-up

GUIDELINE CATEGORY

Diagnosis
Evaluation
Prevention
Screening

CLINICAL SPECIALTY

Optometry
Pediatrics

INTENDED USERS

Health Plans
Optometrists

GUIDELINE OBJECTIVE(S)

- To develop an appropriate timetable for eye and vision examinations for pediatric patients
- To select appropriate examination procedures for all pediatric patients
- To examine the eye health and visual status of pediatric patients effectively
- To minimize or avoid the adverse effects of eye and vision problems in children through early identification, education, treatment, and prevention
- To inform and educate patients, parents/caregivers, and other health care providers about the importance and frequency of pediatric eye and vision examinations

TARGET POPULATION

- Infants and toddlers (birth to 2 years, 11 months)
- Preschool children (3 years to 5 years, 11 months)
- School-age children (6 to 18 years)

INTERVENTIONS AND PRACTICES CONSIDERED

Age-appropriate comprehensive pediatric eye and vision examination, which may include but is not limited to, the following procedures:

1. Patient history
2. Visual acuity
    - Fixation preference tests
    - Preferential looking visual acuity test

    - Lea Symbols chart
    - Broken Wheel acuity cards
    - HOTV test
    - Snellen acuity test
3. Refraction
    - Cycloplegic retinoscopy
    - Near retinoscopy
    - Static retinoscopy
    - Subjective refraction
4. Binocular vision, accommodation, and ocular motility
    - Cover test
    - Hirschberg test
    - Krimsky test
    - Brückner test
    - Versions
    - Near point of convergence (NPC)
    - Positive and negative fusional vergences (prism bar/step vergence testing)
    - Stereopsis
    - Monocular estimation method (MEM) retinoscopy
    - Accommodative amplitude and facility
5. Ocular health assessment and systemic health screening
    - Evaluation of the ocular anterior segment and adnexa
    - Evaluation of the ocular posterior segment
    - Assessment of pupillary responses
    - Visual field screening (confrontation)
    - Color vision testing
    - Measurement of intraocular pressure (IOP)
6. Supplemental testing
    - Electrodiagnostic testing
    - Denver developmental screening test (DDST)
    - Developmental test of visual motor integration (DTVMI)
    - Directionality
    - Visual motor integration

MAJOR OUTCOMES CONSIDERED

- Prevalence of eye and vision disorders in children
- Utility of tests for detecting eye and vision disorders in children

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches using the National Library of Medicine's Medline database and the VisionNet database.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus (Committee)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not applicable

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The Reference Guide for Clinicians was reviewed by the American Optometric Association (AOA) Clinical Guidelines Coordinating Committee and approved by the American Optometric Association Board of Trustees on April 25, 2002.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Examination of Infants and Toddlers

1. **General Considerations**

   Children in this age group (birth to 2 years, 11 months of age) generally perform best if the examination takes place when they are alert. Examination early in the morning or after an infant's nap is usually most effective. Because infants tend to be more cooperative and alert when feeding, it is also helpful to suggest that the parent bring a bottle for the child.

   Age-appropriate examination and management strategies should be used. Major modifications include relying more on objective examination procedures and performing tests considerably more rapidly than with older children.

2. **Early Detection and Prevention**

   Early detection and treatment are essential to preventing vision conditions that have the potential to cause permanent loss of vision. Screening by the pediatrician or other primary care physician is important at birth and during the first 6 months of life when the visual system is highly susceptible to interference. However, screening this population has been problematic, leading to underdetection of strabismus, amblyopia, and significant refractive error. Newer screening techniques such as photorefraction are available, but until they are validated, an eye and vision examination at 6 months of age is the best approach for early detection and prevention of eye and vision problems in infants and toddlers (see Table 3 in the original guideline document).

3. **Examination Sequence**

   The eye and vision examination of the infant or toddler may include, but is not limited to, the following procedures (see Appendix Figure 2 in the original guideline document):

   a. **Patient History**

      A comprehensive patient history for infants and toddlers may include:

      - Nature of the presenting problem, including chief complaint
      - Visual and ocular history
      - General health history, including prenatal, perinatal, and postnatal history and review of systems
      - Family eye and medical histories
      - Developmental history of the child

The collection of demographic data generally precedes the taking of the patient history. Having the parent(s) fill out a questionnaire facilitates obtaining the patient history. Responses to questions related to the mother's pregnancy, birth of the child, and the child's general and vision development will help direct the remainder of the examination.

b. **Visual Acuity**

Assessment of visual acuity for infants and toddlers may include these procedures:

- Fixation preference tests
- Preferential looking visual acuity test

See the original guideline document for a full discussion of these tests.

If clinical evaluation of an infant or toddler by indirect visual acuity testing, refraction, and ocular health assessment indicates any problem with visual acuity, forced-choice preferential looking with the Teller acuity cards or electrodiagnostic testing should be considered to obtain a more precise measure of baseline visual acuity. Consultation with an optometrist or ophthalmologist who has advanced clinical training or experience with preferential looking assessment or electrophysiological evaluation of visual acuity may be warranted.

c. **Refraction**

Traditional subjective procedures for the assessment of refractive error may be ineffective with infants or toddlers because of short attention span and poor fixation. As a result, the examiner will need to rely on objective measures of refraction. The two most commonly used procedures are:

- Cycloplegic retinoscopy
- Near retinoscopy

It is important for the examiner performing cycloplegic retinoscopy in an infant or toddler to take several precautions:

- Select the cycloplegic agent carefully (e.g., fair-skinned children with blue eyes may exhibit an increased response to drugs and darkly pigmented children may require more frequent or stronger dosages).
- Avoid overdosage (e.g., children with Down syndrome, cerebral palsy, trisomy 13 and 18, and other central nervous system disorders in whom there may be an increased reaction to cycloplegic agents, 1% tropicamide may be used).
- Be aware of biologic variations in children (e.g., low weight infants may require a modified dosage).

Cyclopentolate hydrochloride is the cycloplegic agent of choice. One drop should be instilled twice, 5 minutes apart, in each eye, using a strength of 0.5% for children from birth to 1 year and 1% for older children. (Note: Every effort has been made to ensure that drug dosage recommendations are accurate at the time of publication of this Guideline. However, treatment recommendations change due to continuing research and clinical experience, and clinicians should verify drug dosage schedules with product information sheets.) Spray administration of the drug appears to be a viable alternative to the use of conventional eye drops for routine cycloplegic retinoscopy in the pediatric population. The child is asked to keep his or her eyes gently closed while the examiner sprays the cycloplegic agent on the child's eyelids. As the child blinks, enough of the drug is delivered to the eye to provide adequate cycloplegia. This technique has two advantages: (1) The child has less of an avoidance response, and it may be less traumatic for the child and the parent observing the procedure. (2) A single application can achieve both cycloplegia and pupillary dilation when a mixture of 0.5% cyclopentolate, 0.5% tropicamide, and 2.5% phenylephrine is used. To maintain sterility, it is best to have this spray mixture prepared by a pharmacist. Retinoscopy may be performed 20-30 minutes after instillation. The use of loose lenses or a lens rack is recommended for retinoscopy.

A study comparing retinoscopy in infants using near retinoscopy, cycloplegia with tropicamide 1%, and cycloplegia with cyclopentolate 1% found that tropicamide may be a useful alternative in many healthy, nonstrabismic infants.

Near retinoscopy is another objective method of estimating refractive error in infants and toddlers. However, it has not been found reliable for quantification of the refractive error.

Near retinoscopy may have some clinical value in the following situations:

- When frequent followup is necessary
- When the child is extremely anxious about instillation of cycloplegic agents
- When the child has had or is at risk for an adverse reaction to cyclopentolate or tropicamide

The average refractive error in children from birth to 1 year of age is about 2 diopters (D) of hyperopia (standard deviation 2 D). Astigmatism up to 2 D is common in children under 3 years of age. Studies show that 30-50 percent of infants less than 12 months of age have significant astigmatism, which declines over the first few years of life, becoming stable by approximately 2½ to 5 years of age. Low amounts of anisometropia are common and variable in infants. The clinician may choose to monitor these levels of refractive error rather than prescribe a lens correction.

d. **Binocular Vision and Ocular Motility**

The following procedures are useful for assessing binocular function:

- Cover test
- Hirschberg test
- Krimsky test
- Brückner test
- Versions
- Near point of convergence

The cover test is the procedure of choice for evaluation of binocular vision in preverbal children because it is objective and requires little time to administer. If the cover test results are unreliable because of the child's resistance to testing, other methods may be used. In such cases, use of the Hirschberg test is often successful in infants 6 months and younger. Prisms can be used with the Hirschberg test to align the corneal reflections (Krimsky test) and determine the magnitude of the deviation.

The Brückner test is another means of objectively assessing binocular vision, as well as providing an indirect evaluation of refractive error. When both eyes are simultaneously illuminated with the ophthalmoscope beam at a distance of 100 cm, an overall whitening of the red reflex across the entire pupil of one eye indicates strabismus or anisometropic amblyopia. While the absence of a Brückner reflex is not a good indication of alignment, the presence of a Brückner reflex is considered a positive result, and is a good indication of strabismus, even of small amounts. Once detected with the Brückner reflex, the deviation should be quantified with the cover test or Krimsky technique.

Additional binocular testing often can be performed successfully with infants and toddlers. For example, preferential looking techniques can be used to assess stereopsis with some success.

Assessment of extraocular muscle function and concomitancy may involve version testing with an appropriate target. If the infant will follow a penlight, observation of the corneal reflections in all cardinal positions of gaze is possible. When a problem is suspected, the cover test procedure should be used for the position of gaze in question. After performing version testing, the clinician may find it useful to move the penlight or other target toward the child to assess objectively the near point of convergence (NPC).

If a binocular vision disorder or an ocular motility problem is suspected, consultation with an optometrist or ophthalmologist who has advanced clinical training or experience with this population may be warranted.

e. **Ocular Health Assessment and Systemic Health Screening**

An evaluation of ocular health may include:

- Evaluation of the ocular anterior segment and adnexa
- Evaluation of the ocular posterior segment
- Assessment of pupillary responses
- Visual field screening (confrontation)

The diagnosis of eye disease in infants and toddlers presents some unique challenges. Standard procedures such as biomicroscopy, tonometry, and binocular indirect ophthalmoscopy are considerably more difficult in this population.

The cover test and versions, both important binocular vision assessment procedures, are also important for ocular health assessment. For example, the presence of strabismus may indicate any number of disease entities such as neoplasm, neuromuscular disorder, infection, vascular anomaly, or traumatic damage.

The examiner performing external ocular evaluation should gather as much information as possible by gross inspection of the eyes and adnexa. Generally, children up to the age of 6-9 months are sufficiently attracted to lights to permit adequate evaluation using a penlight or transilluminator. With the older infant, it is important to use a variety of interesting targets that can be attached to the transilluminator. Pupil function (direct, consensual, and afferent pupil integrity) should also be evaluated.

A hand-held biomicroscope may be used for evaluation of the anterior segment or the parent/caregiver may be able to position and hold the infant or toddler in a standard biomicroscope. If a corneal problem is suspected, but use of the biomicroscope is impossible, the optometrist may attempt an examination using sodium fluorescein and a Burton lamp. Another simple alternative is to use a self-illuminated, hand-held magnifying lens, or a 20 D condensing lens with a light source.

Thorough evaluation of the ocular media and the posterior segment generally requires pupillary dilation. Recommended drugs and dosages for pupillary dilation in infants and toddlers are one drop each of tropicamide (0.5%) or cyclopentolate (0.5%) and one drop of phenylephrine (2.5%). The spray mixture discussed previously is effective in achieving both dilation and cycloplegia in the pediatric population. Both direct and binocular indirect ophthalmoscopy may be performed after the pupil has dilated. An ideal time for evaluation of the posterior segment is when the infant is in a calm, relaxed, sedated condition (i.e., being bottle fed or sound asleep). When adequate fundus examination is impossible but is indicated by patient history, examination under sedation or anesthesia may be warranted.

Measuring intraocular pressure (IOP) is not a routine part of the eye examination of the infant or toddler. Although it is extremely rare in this age group, glaucoma may be suspected in the presence of a number of signs (e.g., corneal edema, increased corneal diameter, tearing, and myopia). Measurement of IOP is difficult and the results often are unreliable. However, pressure should be assessed when

ocular signs and symptoms or risk factors for glaucoma exist. Measurement of IOP in the pediatric population may be accomplished with hand-held applanation and noncontact tonometers. If risk factors are present and reliable assessment of IOP under standard clinical conditions is impossible, testing under sedation may be appropriate.

When strabismus or other neurological problems are suspected, confrontation visual fields should be attempted with infants and toddlers using a variation of the traditional approach. A shift in fixation, head movement toward the target, or change in facial expression of the infant can indicate that the target has moved from an unsighted to a sighted field. The clinician should decide when imaging studies are indicated, independently or in consultation with a neurosurgeon or neurologist, on the basis of risk factors and the observation of ocular abnormalities, or signs such as nystagmus, developmental delay, poor growth, regression of skills, and seizures.

During the ocular health assessment and systemic health screening of infants and children of any age, it is important to remember that health care providers are responsible for recognizing and reporting signs of child abuse, a significant problem in the United States.

Optometrists have a uniquely important role in diagnosing child abuse including Shaken Baby Syndrome (SBS) because external eye trauma, and retinal trauma (hemorrhages, folds, tears, detachments, and schisis) are common ocular findings from child abuse.

In many states, optometrists must report suspected child abuse or neglect to the state child welfare service. Failure to report a suspected case of child abuse puts that child, his or her other siblings, and possibly a parent/caregiver in danger of continued abuse at home.

f. **Assessment and Diagnosis**

Upon completion of the examination, the optometrist assesses and evaluates the data to arrive at one or more diagnoses and establishes a management plan. In some cases, referral for consultation with or treatment by another optometrist, the patient's pediatrician, primary care physician, or other health care provider may be indicated.

Examination of Preschool Children

1. **General Considerations**

Although the vast majority of children in this age group can communicate verbally, it is preferable in most cases for the parent/caregiver to accompany the child into the examination room. It is important to ensure that the child feels relaxed and at ease, which is often best accomplished by beginning the examination with procedures that appear less threatening.

Age-appropriate examination and management strategies should be used with preschool children. Major modifications include reliance on objective examination techniques, limited use of subjective techniques requiring verbal interaction, and performing testing considerably more rapidly than is typically used for older children.

2. **Early Detection and Prevention**

   A common approach to early detection and prevention of vision problems in preschool children is vision screening by pediatricians or other primary care physicians or lay screeners. Screenings for this population are less problematic than for infants and toddlers because some subjective testing is possible; however, screenings are less accurate for preschool children than for older children. Reasonably accurate screening tests are available for the assessment of many visual functions. The problem with many vision screenings, however, is that they are limited in scope. They may detect only visual acuity problems and may fail to detect other important vision problems, leading to parents' or caregivers' false sense of security. A comprehensive eye examination at 3 years of age continues to be the most effective approach to prevention or early detection of eye and vision problems in the preschool child.

3. **Examination Sequence**

   The pediatric eye and vision examination of the preschool child may include, but is not limited to, the following (see Appendix Figure 3 in the original guideline document):

   a. **Patient History**

      A comprehensive patient history for the preschool child may include:

      - Nature of the presenting problem, including chief complaint
      - Visual and ocular history
      - General health history, including prenatal, perinatal, and postnatal history and review of systems
      - Family eye and medical histories
      - Developmental history of the child

      The collection of demographic data generally precedes the taking of the patient history. Having the parent(s) or caregiver(s) complete a questionnaire in advance of the examination facilitates obtaining the patient history.

   b. **Visual Acuity**

      An assessment of visual acuity usually includes one of the following procedures:

      - Lea Symbols chart
      - Broken Wheel acuity cards

- HOTV test

By 3 years of age, most children have the necessary behavioral and psychological development to allow subjective acuity testing. However, specially designed tests are still useful to limit the amount of verbal interaction needed. The 3-year-old child can easily match simple forms and responds well to learning through demonstration and imitation of tasks. Visual acuity tests for this age group ideally involve a matching task or a forced-choice task, such as pointing to the correct response.

Refer to the original guideline document for a complete discussion of visual acuity tests for preschool children.

c. **Refraction**

Measurement of refractive error may involve:

- Static retinoscopy
- Cycloplegic retinoscopy

With two important modifications, standard static (distance, non-cycloplegic) retinoscopy can usually be performed in preschool children. A modern video projection system is a valuable means of controlling accommodation and fixation at 6 meters. Using a lens rack or loose lenses and fogging glasses rather than a phoropter enables the clinician to see the child's face and observe when the child loses fixation at 6 meters.

Cycloplegic retinoscopy is a valuable procedure for the first evaluation of preschoolers and when static retinoscopy yields unreliable results or professional judgment indicates otherwise. This procedure should also be performed when strabismus or significant refractive error is present. Cyclopentolate (1%) is the cycloplegic agent of choice. Two drops should be instilled, one at a time, 5 minutes apart, in each eye. The use of a spray bottle to administer the drug is also effective for this age group. Retinoscopy may be performed with a lens rack or loose lenses 20-30 minutes after instillation.

d. **Binocular Vision, Accommodation, and Ocular Motility**

The following procedures are useful for assessing binocular and accommodative function:

- Cover test
- Positive and negative fusional vergences (prism bar/step vergence testing)
- Near point of convergence (NPC)
- Stereopsis
- Monocular estimation method (MEM) retinoscopy
- Versions

The cover test is the primary means of evaluating binocular vision in the preschool child. It should be performed in the primary position and, if necessary, in other cardinal positions of gaze to screen for noncomitant deviations. When a deviation is present, estimation of the magnitude or use of a prism bar enables more precise measurement. The results of the cover test can also be combined with version testing to rule out the presence of a noncomitant deviation.

If the cover test suggests a potentially significant heterophoria or intermittent strabismus, fusional vergence testing may be used to help determine whether treatment may be indicated. Fusional vergence can be assessed objectively, using the step vergence procedure. To assess fusional vergence objectively, the clinician uses a hand-held prism bar and carefully observes the patient's eyes, looking for a loss of bifixation as the amount of prism is gradually increased.

The NPC is an excellent test to use with the preschool child because both the break and recovery measurements can be determined objectively. Instead of asking the child when he sees double, the clinician asks the child to keep looking at the target as it is moved closer. The clinician carefully observes the child's eyes and determines when there is a loss of bifixation. The target is then moved away from the child until bifixation is regained. Using this procedure makes it easy to determine the NPC in a preschool child.

Stereopsis testing can generally be accomplished in preschool children, using commercially available stereopsis tests. To increase the ability to measure stereopsis, it is wise to use a matching procedure, in which the examiner constructs a set of figures that correspond to the figures in the stereopsis test booklet and simply asks the child to point to the picture he or she sees in the test booklet.

Objective accommodative testing can be performed in preschool children, using MEM retinoscopy. MEM retinoscopy is easy to perform with children of this age group and provides information about the accommodative response.

To assess extraocular muscle function and concomitancy, it is important to perform version testing in all cardinal positions of gaze, using a high-interest fixation target. When a problem is suspected, the cover test procedure can be used in the relevant position of gaze.

e. **Ocular Health Assessment and Systemic Health Screening**

An evaluation of ocular health may include:

- Evaluation of the ocular anterior segment and adnexa
- Evaluation of the ocular posterior segment
- Color vision testing
- Assessment of pupillary responses
- Visual field screening (confrontation)

With some modification, traditional testing used to assess ocular health in adults can be used in preschool children. Most preschool children will cooperate, allowing the use of the biomicroscope to evaluate the anterior segment. Pupillary dilation facilitates thorough evaluation of the posterior segment. With encouragement and assistance from the parent, to help control fixation, binocular indirect ophthalmoscopy is often successful.

Color vision testing can generally be done with standard pseudoisochromatic plates or, preferably, with tests such as the Pease-Allen Color Test (PACT), the Mr. Color Test, or Color Vision Made Easy, which do not require the child to identify a number. All of these tests are easy to administer and have high testability rates in preschool children.

Measurement of IOP is not a routine part of the eye and vision examination of preschool children, but pressure should be assessed when ocular signs and symptoms or risk factors for glaucoma exist. Hand-held applanation or noncontact tonometers are available for the measurement of IOP in this population. If it is not possible to assess IOP reliably under standard clinical conditions, testing under sedation or anesthesia may be appropriate.

Confrontation visual fields testing should be attempted with preschool children, when indicated, using the techniques described for infants and toddlers. When the results are equivocal or risk factors are present, the clinician should either retest the child or consult with or refer the child to a pediatric ophthalmologist or neurologist for appropriate testing.

f. **Supplemental Testing**

When the preschool child's history indicates a possible developmental lag or a learning problem, the optometrist may administer a developmental visual perceptual screening test to help diagnose and manage visual information-processing problems. The testing can help assess developmental level, detect visual perceptual dysfunction, and enable early identification of children at risk for the development of learning related vision problems.

The assessment of visual perceptual development may include:

- Denver Developmental Screening Test (DDST)
- Developmental Test of Visual Motor Integration (DTVMI)

Recommended for use in this age group, the DDST was designed for use with children from birth through 6 years of age. Another test that can be used for screening children as young as 3 years is the DTVMI. When visual perceptual problems are detected, consultation with an optometrist who has advanced clinical training or experience with this population should be considered. Referral for consultation with the child's pediatrician or other primary care physician or a child

psychologist or psychiatrist should also be considered when problems in language and social development are detected.

g. **Assessment and Diagnosis**

Upon completing examination of the preschool-age child, the optometrist assesses and evaluates the data to establish the diagnosis and to formulate a management plan. In some cases, referral for consultation with or treatment by another optometrist, the patient's pediatrician or other primary care physician, or another health care provider may be indicated.

Examination of School-Age Children

1. **General Considerations**

Some of the issues relating to infants, toddlers, and preschool children also apply to this population, particularly children younger than 8 years old. Age-appropriate examination and management strategies should be used. Although most of the examination procedures used with this age group are identical to those recommended for adults, age-appropriate modifications of instructions and targets often may be required.

2. **Early Detection and Prevention**

The value of and need for school-based vision screening have been debated for decades. One concern is that the majority of school vision screenings test only visual acuity. Such testing primarily detects amblyopia and myopia, and only high degrees of astigmatism and hyperopia. Although detection of such disorders is certainly a worthwhile objective, screening for visual acuity alone generally detects only about 30 percent of children who would fail a professional eye examination. Visual acuity screening often fails to detect those conditions that would be expected to affect learning. Parents or caregivers of children who pass vision screening may incorrectly assume that their children do not require further professional care.

3. **Examination Sequence**

The pediatric eye and vision examination of the school-age child may include, but is not limited to, the following (see Appendix Figure 4 of the original guideline document):

a. **Patient History**

A comprehensive patient history for the school-age child may include:

- Nature of the presenting problem, including chief complaint
- Visual and ocular history
- General health history, including prenatal, perinatal, and postnatal history and review of systems
- Family eye and medical histories

- Developmental history of the child
- School performance history

The collection of demographic data generally precedes taking the patient history. Having the parent(s) or caregiver(s) fill out a questionnaire facilitates obtaining the patient history. Because of the relationship between vision and learning, special attention needs to be paid to the child's school performance. When a child is not performing up to potential, the optometrist should probe for signs and symptoms suggestive of a learning related vision problem. (Please refer to the *Optometric Clinical Practice Guideline for Care of the Patient with Learning Related Vision Problems*.) Questions can be designed to define the specific nature of the learning problem and to distinguish disorders of visual efficiency from a visual perceptual or nonvisual disorder.

b. **Visual Acuity**

Visual acuity may be assessed with the Snellen acuity chart (modified for children 6-8 years of age). A recommended modification is the isolation of one line, or even one-half line of letters, rather than projection of a full chart.

c. **Refraction**

Measurement of refractive error may involve use of the following procedures:

- Static (distance) retinoscopy
- Cycloplegic retinoscopy
- Subjective refraction

For children over the age of 8, the clinician can usually use traditional assessment procedures to measure refractive error. For patients below age 8, static (distance) retinoscopy may be performed without a phoroptor, using a lens rack or loose lenses and fogging glasses. This procedure allows the practitioner to move with the child and to observe whether the child is fixating properly. Cycloplegic refraction may be necessary in such conditions as strabismus, amblyopia, or significant hyperopia.

d. **Binocular Vision, Accommodation, and Ocular Motility**

Evaluation of binocular and accommodative function and ocular motility may include the following procedures:

- Cover test
- Near point of convergence (NPC)
- Positive and negative fusional vergences
- Accommodative amplitude and facility
- Monocular estimation method (MEM) retinoscopy

- Stereopsis
- Versions

Other than refractive errors, the most prevalent vision conditions in children fall into the category of accommodative and binocular vision anomalies. These conditions may interfere with school performance, causing a number of symptoms, including eyestrain, blurred vision, double vision, loss of place, skipped lines, word movement on the page, inability to sustain attention when reading, and decreased reading comprehension over time. Careful evaluation of these conditions in the school-age population is critical.

Evaluation of accommodation and fusional vergence should involve assessment of both the amplitude and the facility of the response. For accommodation, the evaluation may include assessment of accommodative amplitude, accommodative facility using +2.00/-2.00 D lenses, and accommodative response using MEM retinoscopy.

Binocular evaluation should include the cover test and tests of accommodative convergence/accommodation (AC/A) ratio, fusional vergence amplitude with either the Risley prisms or the prism bar, vergence facility, and stereopsis, using a random dot stereopsis test. Additionally, negative relative accommodation (NRA) and positive relative accommodation (PRA) tests may contribute to an understanding of both accommodation and binocular status. In analyzing these tests, it is important to examine all data and group findings, rather than depending on any one isolated finding, to arrive at a diagnosis.

Versions can be performed to rule out a noncomitant deviation. Qualitative examination of eye movements involves three distinct steps: assessment of stability of fixation, saccadic function, and pursuit function. Subjective techniques involving observation of the patient's fixation and eye movements have been developed, along with rating scales, to probe these three areas.

e. **Ocular Health Assessment and Systemic Health Screening**

An assessment of ocular health may include:

- Evaluation of the ocular anterior segment and adnexa
- Evaluation of the ocular posterior segment
- Measurement of intraocular pressure
- Color vision testing
- Assessment of pupillary responses
- Visual field screening (confrontation)

Traditional testing procedures utilized for the evaluation of ocular health in adults can be used with school-age children. Most will cooperate and allow use of the biomicroscope to evaluate the anterior segment and binocular indirect ophthalmoscopy to evaluate the posterior segment. Pupillary dilation allows for thorough evaluation of

the posterior segment and may be repeated as needed at subsequent visits.

The measurement of IOP in school-age children is generally successful with either applanation or noncontact tonometry. Although the prevalence of glaucoma is low in this population, a baseline measurement at this age is valuable. Tonometry may be repeated as needed at subsequent visits.

If color vision testing was not administered when a preschool child, it should be performed at this age. As children enter school, it is helpful to know whether a color vision deficiency exists, because severe color vision deficiency may cause mislabeling of a child as learning disabled. Moreover, color vision deficiency may indicate an ocular health problem.

Evaluation of visual fields can be performed in school-age children using confrontation visual field screening.

f. **Supplemental Testing**

Visual information processing function can be evaluated using tests that probe the following areas:

- Directionality
- Visual motor integration

This testing is not routine; however, when the patient history indicates a possible developmental lag or a history of learning problems, a visual perceptual screening is warranted. Two tests available for probing these areas are the Gardner Reversal Frequency Test-Recognition subtest (directionality) and the Developmental Test of Visual Motor Integration. When a visual information processing problem is detected, consultation with an optometrist who has advanced clinical training or experience in this area should be considered. Referral for consultation with the child's pediatrician or other primary care physician, the school system, a child psychologist or psychiatrist, or the state or local Department of Special Education should be considered when problems in other developmental areas such as behavior, language, or social development are detected, or when a full psychoeducational evaluation is indicated.

g. **Assessment and Diagnosis**

Upon completion of the examination, the optometrist should assess and evaluate the data to establish a diagnosis and to formulate a management plan. In some cases, referral for consultation with or treatment by another optometrist, the patient's pediatrician or other primary care physician, or another health care provider may be indicated.

Management of Children

1. **Patient Education**

Discussion and communication with the parents or caregivers and the child should occur at the end of the eye examination to review test findings. The optometrist's primary responsibility in this area is educating parents or caregivers about any eye or vision disorders and vision care. Many parents and caregivers believe the screening performed by the child's pediatrician or other primary care physician or school nurse is sufficient to rule out all significant visual disorders. However, these screenings are limited and were not intended to replace a comprehensive eye examination (see Table 1 in the original guideline document).

The importance of adhering to an eye and vision examination schedule should be emphasized from a preventive standpoint as well. Early detection and preventive care can help avoid, or minimize, the consequences of disorders such as amblyopia and strabismus.

The optometrist can also play an important role by educating parents/caregivers and children about eye safety, particularly regarding sports-related eye safety. Sports and recreational activities accounted for nearly 40,000 of the eye injuries reported in 1991. Baseball injuries were the most frequent cause of eye injuries among children 5-14 years of age. A spectacle lens material equivalent or superior in impact resistance to that of 2mm polycarbonate or trivex is recommended for use with children, except when such lenses will not fulfill the visual requirements of the patient. For those cases in which protective lens materials are not used, the optometrist should obtain informed consent from parents and/or caregivers.

Optometrists should educate parents or caregivers about the importance of early, preventive eye care, including examinations at the age of 6 months, at age 3, before entering first grade, and periodically during the school years. The extent to which a child is at risk for the development of eye and vision problems determines the appropriate re-evaluation schedule. Individuals with ocular signs and symptoms require prompt examination. Furthermore, the presence of certain risk factors may necessitate more frequent examinations, based on professional judgment (see Table below).

Table. Recommended Eye Examination Frequency for the Pediatric Patient

Patient Age

Birth to 24 months

Asymptomatic/risk-free: At six months of age

At risk: At six months of age or as recommended

2 to 5 years

Asymptomatic/risk-free: At 3 years of age

At risk: At 3 years of age or as recommended

6 to 18 years

Asymptomatic/risk-free: Before first grade and every two years thereafter

At risk: Annually or as recommended

2. **Coordination, Frequency, and Extent of Care**

The child's first eye and vision examination should be scheduled at 6 months of age (or sooner if signs or symptoms warrant). When no abnormalities are detected at this age, the next examination should be scheduled at age 3.

Note: The child considered at risk for the development of eye and vision problems may need additional testing or more frequent re-evaluation. Factors placing an infant, toddler, or child at significant risk for visual impairment include:

- Prematurity, low birth weight, oxygen at birth, grade III or IV intraventricular hemorrhage
- Family history of retinoblastoma, congenital cataracts, or metabolic or genetic disease
- Infection of mother during pregnancy (e.g., rubella, toxoplasmosis, venereal disease, herpes, cytomegalovirus, or human immunodeficiency virus)
- Difficult or assisted labor, which may be associated with fetal distress or low Apgar scores
- High refractive error
- Strabismus
- Anisometropia
- Known or suspected central nervous system dysfunction evidenced by developmental delay, cerebral palsy, dysmorphic features, seizures, or hydrocephalus

CLINICAL ALGORITHM(S)

An algorithm is provided for pediatric eye and vision examination.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is not specifically stated for each recommendation.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Description of appropriate examination procedures for evaluation of the eye health and vision status of infants and children may reduce the risk of vision loss and facilitate normal vision development.
- *Early detection and intervention*: Because of the rapid development of the visual system in early childhood and its sensitivity to interference, early detection and intervention are particularly important for children. When disorders such as amblyopia and strabismus are undetected, the long-term consequences can be serious in terms of quality of life, comfort, appearance, and career opportunities.
- *Reduced health care costs*: The cost of providing appropriate treatment for longstanding eye and vision disorders may be significantly higher than the cost of detecting and treating these problems early in life.

Subgroups Most Likely to Benefit:

The following factors place an infant, toddler, or child at significant risk for visual impairment:

- Prematurity, low birth weight, oxygen at birth, grade III or IV intraventricular hemorrhage
- Family history of retinoblastoma, congenital cataracts, or metabolic or genetic disease
- Infection of mother during pregnancy (e.g., rubella, toxoplasmosis, venereal disease, herpes, cytomegalovirus, or human immunodeficiency virus)
- Difficult or assisted labor, which may be associated with fetal distress or low Apgar scores
- High refractive error
- Strabismus
- Anisometropia
- Known or suspected central nervous system dysfunction evidenced by developmental delay, cerebral palsy, dysmorphic features, seizures, or hydrocephalus

POTENTIAL HARMS

There is a potential for overdosage of cycloplegic agents.

Subgroups Most Likely to be Harmed:

Children with Down´s syndrome, cerebral palsy, trisomy 13 and 18, and other central nervous system disorders may have an increased reaction to cycloplegic agents.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- Clinicians should not rely on this Clinical Guideline alone for patient care and management. Refer to the listed references and other sources listed in the original guideline document for a more detailed analysis and discussion of patient care information.
- The examination components are described in general terms and are not intended to be all inclusive. Professional judgment and individual patient symptoms, findings, and cooperation may have significant impact on the nature and course of the examination.
- Every effort has been made to ensure that drug dosage recommendations are accurate at the time of publication of this guideline. However, treatment recommendations change due to continuing research and clinical experience, and clinicians should verify drug dosage schedules with product information sheets.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Clinical Algorithm

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Staying Healthy

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

American Optometric Association. Pediatric eye and vision examination. 2nd ed. St. Louis (MO): American Optometric Association; 2002. 57 p. [130 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

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1994 (revised 2002; reviewed 2007)

GUIDELINE DEVELOPER(S)

American Optometric Association - Professional Association

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GUIDELINE COMMITTEE

American Optometric Association Consensus Panel on Pediatric Eye and Vision Examination

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Committee Members: Mitchell M. Scheiman, O.D., M.S. (Principal Author); Catherine S. Amos, O.D.; Elise B. Ciner, O.D.; Wendy Marsh-Tootle, O.D.; Bruce D. Moore, O.D.; Michael W. Rouse, O.D., M.S.

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

It updates a previous version: American Optometric Association. Pediatric eye and vision examination. 2nd ed. St. Louis (MO): American Optometric Association; 1994. 27 p. (Optometric clinical practice guideline; no. 2)

According to the guideline developer, this guideline has been reviewed on a biannual basis and is considered to be current. This review process involves updated literature searches of electronic databases and expert panel review of new evidence that has emerged since the original publication date.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the American Optometric Association Web site.

Print copies: Available from the American Optometric Association, 243 N. Lindbergh Blvd., St. Louis, MO 63141-7881

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on October 15, 1999. The information was verified by the guideline developer as of November 15, 1999. The summary was updated on April 10, 2003. The information was verified by the guideline developer on April 28, 2003.

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