PSS NEWS

An On-Line Publication for COPE Continuing Education in Optometry

Primary Care Evaluation of the Young Child

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Learning Objectives:

1. *To discuss the major elements comprising a complete examination of a young child.*
2. *To obtain a relevant history for a young child*
3. *To describe practical techniques required to examine a young child*

Suggestions for Examining Young Children

1. Be prepared and flexible: Depending on behavior, you may need to change your testing order. Starting with acuity may be difficult for shy children. Begin with cover test, motility and retinoscopy to build a rapport and make the child feel more comfortable. Additionally, these objective findings give you an idea what to expect during subjective testing.
2. Time of day: Infants perform better in the morning and become drowsy after feeding. Acuity, retinoscopy and motilities require an alert child, while binocular indirect ophthalmoscopy (BIO) may be easier on a drowsy child. The other factor to consider here is that children often become drowsy after dilation, which may facilitate BIO.
3. Toys: Interactive and stimulating fixation targets facilitate the exam. Toys that make noise are used to maintain attention during covertest and motilities, but non-auditory toys are used when assessing acuity. You should periodically ask questions about the targets to maintain attention.

History

A pointed history leaves a clinician with a differential diagnosis and an order of testing to prove or disprove the tentative diagnosis. (Table 1) This is important when examining young children who may be unable to sit through a long examination. Unlike the adult examination in which you ask open-ended questions, the pediatric history will frequently have yes or no answers.

Ask questions relevant to the age of the child. Younger children require more questions concerning birth history, while older children may be asked about school concerns. Do not ignore the child (especially if >3 years), direct questions towards them and their parents by repeating a question twice with slightly different wording. If a child has a complaint, investigate if the parent is aware of the problem.

Table 1: Components of a Pediatric History

Component	Comments
Chief Complaint	Probe behaviors suggestive of visual problems (i.e. squinting). Ask specific questions, "can you see the television?" instead of "do you have problems with your distance vision?"
Ocular History	Previous exams, Surgery, Patching, Lazy eye, Glasses, Eye drops. "Has the child received any medical attention concerning their eyes, why?"
Family Ocular History	Strabismus, Amblyopia, Glasses (what age?), Blindness or Ocular problems
Birth History	Complications, Full term or Premature, Birth Weight, Illnesses or Drugs during pregnancy
Medical History	Medications or health problems, Pediatrician and last exam
Developmental	Milestones (eye contact, sitting up unsupported, walking, talking)
School History	Reading performance, Specialized testing

Visual Acuity

Communication skills and willingness to cooperate determines the type of acuity measure to obtain.

Infants and Toddlers

Measuring acuity in preverbal children is conducted with different expectations than other age groups. An interocular difference rather than the threshold level may prove more valuable.

Although several different methods exist, most are not suited for a primary care setting. Preferential looking with Teller Acuity Cards and electrophysiological tests such as Visually Evoked Potentials are valuable,[3,4] but require substantial economic and time investments. The primary care clinician should be aware of these methods and refer to a specialist if unexplained reduced VA is suspected.

The most commonly and easily employed method of assessing acuity in this population is "Fix, Follow and Maintain (FFM)." Although the usefulness has been debated,[5-7] it has value as a default method of indirectly measuring acuity in preverbal or difficult to test children and is suited to a primary care setting (Table 2).

Table 2: Fix, Follow and Maintain

Fix and Follow (Monocular)
1. Occlude patient's eye with hand or thumb, while moving toy into cardinal positions of gaze. 2. Observe ability to fixate and accurately follow the object. 3. Repeat procedure while covering other eye. 4. Compare ability of each eye to fix and follow the object into all positions with no preference during occlusion (patient does not object when one eye is occluded).
Maintain (Binocular)
10-PD Fixation Test[7] 1. Hold target 40 centimeters in front of patient. 2. Interpose 10-PD loose prism base-down in front of one eye, creating diplopia. 3. Observe if patient alternates between eyes to fixate the diplopic image. 4. If no alternation, switch prism to other eye to assess whether true fixation preference exists or prism induced. 5. Interpretation • Normal response: alternate fixation between eyes or slight fixation preference for dominant eye • Abnormal response: Anything

	greater than slight fixation preference

Preschool Aged Children

In addition to FFM, the communication skills of a preschool age child allow the examiner to conduct an assessment resembling Snellen acuity. Lea symbols, based on a logarithmic scale, 3 meter testing distance, crowded letters and a matching card are effective in the 3-5 year old population[8]. Alternatively, the Broken Wheel Test,[9] incorporating the Landolt C, offers a forced-choice testing format and may benefit certain children in which the matching paradigm is unsuccessful. With these two tests, it is possible to obtain acuity in the majority of preschool age children. If assessment is not reliable at the first visit, give the child/parent a copy of the symbols to practice at home before the next evaluation.

Refraction

Significant refractive error existing during the critical period may result in disruption of visual development and permanent vision loss. Prescribing for refractive error in a young child is typically done for different reasons compared to an adult and requires knowledge of the dynamic nature of the eye during this period of life (Table 3). I.E. astigmatism may be corrected in an adult to improve acuity, but the same philosophy may not be appropriate for a child < 2, due to the possible fleeting nature of astigmatism at this age. However, certain amounts of astigmatism (especially oblique) may be prescribed regardless of the potential risk of interfering with emmetropization because of the stability and the high likelihood of meridional amblyopia. This is one of the most interesting and challenging aspects of providing optometric care for the young child.

Retinoscopy is best accomplished with a lens rack or loose lenses. Young children may not be able to perform a reliable subjective refraction and clinicians must sometimes rely on objective findings when prescribing. This mandates that all steps must be taken to ensure the accuracy of findings. Although non-cycloplegic retinoscopy yields some information, the procedure is complicated by an inability to control the patient's fixation and accommodation. Non-cycloplegic procedures such as the Mohindra technique[14] are advocated by some, but questions exist as to the ability to detect hyperopia.[15] Autorefraction is gaining increased popularity for use in the pediatric population. Although these instruments may provide information for screening, they should not be relied upon for prescribing.

Table 3: Trends in Refractive Error from Birth to Five

Refractive Error	Comments
Hyperopia/Myopia	Wide distribution with +2D average for full term infants, less in premature infants.[11]
Astigmatism	High prevalence of against the rule before age 2, slowly decreases and shifts towards with the rule by age 4.[12] Oblique is rare, but tends to be more stable.
Anisometropia	High prevalence, especially in infants that reduces by age 1.[13]

The best way to ensure an accurate assessment of refractive error is with cycloplegia; two drops of 1% cyclopentolate separated by 5 minutes or 1 drop of .5% cyclopentolate

(infants <1 year). Cycloplegia decreases the importance of the patient maintaining consistent fixation, by minimizing the confounding effects of accommodation. Cycloplegia is the best way to ensure you are not missing latent hyperopia, a key finding in accommodative esotropia and anisometropic amblyopia. Use of cycloplegia is an important part of baseline findings in children.

Binocularity

Eye Alignment

Eye alignment in a young child is best assessed through a combination of cover test, Hirshberg and Brückner. Cover test remains the most useful and versatile test to accomplish this goal. Use your hand instead of an occluder and begin at near with a highly interactive fixation target. Small, detailed, age appropriate stickers placed on a tongue depressor allows the examiner to ask questions about and rapidly switch targets to maintain the child's interest. If the child loses attention, remove and re-introduce or change the target altogether. For infants, a finger puppet can be placed on top of a transilluminator. Distance cover test is best accomplished with a motorized moving target placed at the end of the room or with the help of another person.

Young children fixate well on a light source, making the Hirshberg and Brückner tests easy to administer. The Brückner test provides information concerning strabismus, refractive error and media opacities. Although not the most sensitive test, its ease of administration and versatility make it a powerful clinical tool. (Table 4).

Table 4: Brückner Test

Procedure

1. Perform in dimmed room with examiner 80-100 cm from patient.
2. Shine ophthalmoscope toward patient to illuminate both eyes simultaneously.
3. Look through the ophthalmoscope and adjust the lenses until the red reflex is in focus
4. Observe
    - Color and brightness of the reflexes and compare OD to OS
    - Corneal reflexes (Hirshberg Test)

A brighter reflex in one eye compared to the other may indicate

- Strabismus in brighter eye
- High refractive error in dimmer eye –or-
- Media opacity in dimmer eye

Sensory Fusion

Options are limited when assessing sensory fusion in infants. The only currently available test is the Stereo Smile.[18] Testing stereopsis in this population presents specific challenges and is not part of the routine ocular evaluation.

Conversely, testing stereopsis in pre-school aged children is easily accomplished with several different methods. The Random Dot E (RDE) and Randot Preschool Stereoacuity Test are among those suitable for a primary care setting. The RDE is recommended for its ease of administration and versatility. A forced choice method, the child is presented with two cards and indicates which contains the "E". The test is administered at .5 meters and 1.5-2 meters. In contrast to many other commercially available stereo tests, the lack of monocular cues and high spatial frequency pixel content of the RDE target lend the test for additional uses. Specifically, it may serve as a tool to detect bilateral refractive error and amblyopia when tested at 1.5-2 meters.[19]

Additional Testing

Motility: Pursuit testing can be accomplished by choosing a high interest target with sound. Saccade testing can by performed by alternating presentation of two different toys held behind your back when not presented.

Color Vision: More important as a child enters preschool or kindergarten, with learning likely

to be centered on color naming. Although several different color vision tests are available, the Waggoner HRR Color Vision Test may be most suitable for testing young children in a primary care setting. It is extremely easy to use employing simple pictures instead of numbers or letters, can be easily modified to use matching and is effective at detecting color vision deficiencies.[20]

Confrontational Visual Fields: Can be attempted by switching between several high interest targets to maintain central fixation, while employing the use of a helper or parent to introduce a hand puppet from behind the child into different visual fields. This is a gross assessment and if you suspect the child may have a restriction, a referral to a person specializing in this area is warranted.

Ocular Health

Although the prevalence of ocular disease in the pediatric population is rare, structural abnormalities and disease do occur and may result in profound vision loss if undetected. These conditions more commonly occur in high risk populations such as children born with low birth weight or prenatal exposure to drugs or alcohol.

Pupil testing/anterior segment evaluation

Pupil function is easily assessed due to children's positive response to lights. Anterior segment evaluation is ideally conducted using a mounted or handheld slit lamp, but is often not possible due to a child's behavior. External evaluation with a penlight with and without a 20D lens looking at lid and lash position and structure, punctum, iris, conjunctiva and corneal diameter is often the only viable method. Opacities on the cornea or lens may be most easily detected during the Brückner Test. Measurement of intraocular pressure is performed on a case specific basis and is not part of the routine evaluation.

Posterior Segment Evaluation

All children should receive a dilated exam as part of their baseline findings. BIO is the best way to perform the evaluation. A 20D lens allows the examiner to visualize the entire posterior pole in one view. A 14D lens provides more magnification but a decreased field of view and may be used to evaluate the optic disc. Occasionally, peripheral views can be obtained, but any prolonged views of the retina may require anesthesia. If a peripheral retinal problem is suspected, referral to a pediatric ophthalmologist is warranted.

Conclusion

This issue has outlined the major areas to be assessed during an optometric examination of a young child and has recommended some specific tests to accomplish this task. Although most children are well behaved, it is not uncommon to encounter a difficult to test child in which minimal information may be obtained. In this event, the child should be re-scheduled for another evaluation in the immediate future or consider referring to a practitioner that specializes in this area.

Case Presentation

A 3 year old presents for his first eye exam. His mother reports no problems except that he is required to have an eye exam before entering preschool. Upon further probing, the mother notes that he rubs his left eye when watching television. History is otherwise unremarkable.

Visual acuity (Lea): OD20/30 OS 20/70, but then refuses to be tested
Dry Retinoscopy: OD +1.00sph OS +4.00-1.00 x 180
Cycloplegic retinoscopy: OD +2.00sph OS +7.00sph
External and Dilated Internal Health Unremarkable

Discussion

The anisometropia is amblyogenic and is the likely reason the child is resistant to testing of the OS. The overall amount of the hyperopia can be decreased to facilitate compliance with

spectacle wear, but the final Rx must reflect the 5D of anisometropia determined by the cycloplegia and not the 3D determined by dry retinoscopy. Children with this problem are often asymptomatic because they rely on the good eye. Teachers or parents won't be aware that there is a problem because the child is able to function well. It is for this reason that anisometropic amblyopia often goes undetected until the child has a complete eye examination.

CONTINUING EDUCATION QUIZ

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Continuing Education Quiz

1. Which of the following is *not* part of the routine eye examination of an infant?
   A. Stereopsis
   B. Refractive Error
   C. Dilated Fundus Exam
   D. Ocular Alignment

2. The American Optometric Association recommends that all children should receive a complete eye examination at
   A. 6 years
   B. 3 years
   C. 1 year
   D. 6 months

3. The use of toys with sound are appropriate targets for all of the following *except*?
   A. Motility
   B. Cover Test
   C. Visual Acuity
   D. Central fixation in visual fields

4. Which is *not* a routine question to ask as part of a two year old patient's history?
   A. Complications during birth?
   B. Family history of glaucoma?
   C. Family history of strabismus?
   D. Previous eye exams?

5. FFM describes a technique used to indirectly assess

A. Visual Acuity
B. Visual Fields
C. Stereopsis
D. Pupils

6. Concerning acuity assessment of a preschool aged child, which techniques does *not* play a role in a primary care setting?
   A. FFM
   B. Lea Symbols
   C. Broken Wheel
   D. Visual Evoked Potentials

7. The average refractive error for full term infants is
   A. -2D
   B. -1D
   C. +1D
   D. +2D

8. Concerning refractive error, there is high prevalence of _____ astigmatism before age 2, that slowly decreases and shifts towards _____ astigmatism by age 4.
   A. against the rule, with the rule
   B. with the rule, against the rule
   C. against the rule, oblique
   D. with the rule, oblique

9. Which technique is *most likely* to uncover latent hyperopia in an infant?
   A. Mohindra
   B. Cycloplegia
   C. Autorefraction
   D. Subjective Refraction

10. Cycloplegia is indicated
    A. if amblyopia is suspected
    B. if strabismus is suspected
    C. if significant refractive error is suspected
    D. all of the above are correct

11. A 3 year old presents with a chief complaint of frequent eye rubbing. You perform the Brüchner test and the right eye appears brighter than the left eye? Which is a possible explanation?
    A. anisometropia
    B. strabismus OD
    C. media opacity OS
    D. all of the above

12. Which of the following is *false*?
    A. Stereopsis is easily assessed on infants using the RDE
    B. RDE should be measured at .5 meters and 1.5-2 meters
    C. The RDE uses a forced choice method
    D. The Random Dot E employs a target with a high spatial frequency pixel content

13. Which of the following is *not* part of the routine eye examination of a 4 year old?
    A. Stereopsis
    B. Refractive Error
    C. Dilated Fundus Exam
    D. IOP

14. The Waggoner HRR is used to assess
    A. Visual Acuity
    B. Stereopsis
    C. Color Vision
    D. External Health of the Eye

15. "Fix and Follow" is assessed _____ , while "Maintain" is assessed _____.
    A. in bright light, is dim light
    B. in dim light, in bright light
    C. monocularly, binocularly
    D. binocularly, monocularly

16. Which is *true*?
    A. It is not necessary to perform a DFE on a young child.
    B. When examining toddler and infants, an interocular difference rather than the threshold level may prove to be more valuable.
    C. Direct ophthalmoscopy is the optimal way to assess the posterior pole of an infant
    D. Measurement of intraocular pressure is an essential part of the routine evaluation of all preschool aged children.

17. Anisometropia detected in an infant
    A. typically remains stable and should be immediately corrected.
    B. typically increases and should be immediately corrected.
    C. may not be present by age 1.
    D. None of the above are true.

18. When examining an infant, cornea and lens opacities may be most easily detected using
    A. Fix, Follow and Maintain
    B. Brückner Test
    C. Stereosmile Test
    D. Waggoner HRR

19. The prevalence of ocular disease is higher in
    A. low birth weight infants
    B. infants with prenatal exposure to drugs
    C. both A and B
    D. neither A and B

20. The optimal way to examine the posterior pole of a young patient is
    A. Direct Ophthalmoscopy
    B. Binocular Indirect Ophthalmoscopy
    C. A transilluminator and 20D lens

D. Brückner Test

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