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L4

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Visual acuity examination (testing newborn, testing infants)

➢ General Considerations

Children and their ophthalmic needs can differ greatly from the patients and ocular conditions encountered in adult ophthalmology. Each childhood developmental level requires a different examination approach. with proper preparation and a positive attitude.

Examinations are typically more successful when patients are relaxed. The outpatient clinic atmosphere should be welcoming, preferably with dedicated waiting area(s) for children and families.

➢ **The examination begins as the practitioner enters the room and gathers important information via observation about**

- The child's visual behavior
- ability to ambulate
- any abnormal head position
- any dysmorphic features
- familial disorders (note parents and siblings)
- family social dynamics
- A parent's smartphone may contain photos and videos that prove useful in establishing a diagnosis and a condition's progression over time.

➢ **Clinicians should introduce themselves to the child and family and Being relaxed, open, and playful during the examination.**

- Gaining the child's trust enables a faster and better examination
- Easier follow up visits, and greater parental support.
- Family members may also need reassurance; parental anxiety may exacerbate the child's anxiety.
- Asking children easy questions can help them feel confident; a simple joke can relax both child and parent.
- It is important to work with the child's family, enlisting their help and respecting their concerns.

➢ General instructions during the examination

- During the examination, the practitioner should sit at the child's eye level; some children prefer sitting in a parent's lap.
- Describe the examination to children in terms that they can understand. Because cooperation may be fleeting, the examination elements that are most critical for diagnosis and management are best addressed early.
- The most threatening parts of the examination should be performed last.
- A long examination lane with different types of distance fixation targets (including remotely activated videos and mechanical animals 6 meters from the examination chair) is optimal.
- It is best to have a variety of near fixation targets with details that stimulate accommodation (a muscle light is not an accommodative target)

➢ Examination of the Uncooperative Child

- Some combination of rest periods, persuasion, persistence, patience, and rewards is usually successful.
- It is important to engage the child and caregivers in decisions regarding how to proceed.
- If a child is having a bad day, it may be best to stop the examination and schedule another appointment.

➢ Examination: Specific Elements

A pediatric eye examination requires different techniques and devices than an adult examination. Sensorimotor examination should begin with the tests that are least dissociating with respect to binocularity, such as

- stereoacuity testing
- motility testing
- Monocular visual acuity testing and pupil exams are dissociating and should be performed later in the examination, so as not to affect the sensorimotor exam.

✓ Visual Acuity Assessment: Preverbal

To judge vision in the preverbal child:-

- One must rely on the smallest age-appropriate target that will hold attention and on the difference, if any, between the two eyes.
- An appropriate target for a 1-year-old child may be a small finger puppet; but a 1-month-old may fixate only on a human face and do that rather unsteadily.
- Infants are unable to pursue targets smoothly until 6 to 8 weeks of age but instead will track using hypometric saccades.
- Targets with fine detail that require accommodation and focused attention are best for children over age 1, for even though accommodation is appropriate to target distance by age 3 to 4 months, the macula is still immature even at the age of 15 months.

❖ Fixation and following behavior

- In infants and toddlers who are too young to undergo optotype testing, fixation and following (tracking) behavior is tested. Each eye is tested while the fellow eye is occluded. Consistent objection to occlusion of 1 eye but not the other suggests a clinically significant difference in visual acuity between the eyes
- . Fixation behavior and fixation preference testing can be described using the CSM (Cen- tral, Steady, and Maintained) notation. Fixation during monocular viewing is described as central (foveal) or no central (eccentric), and steady (stable eye position) or no steady (roving eye movement or nystagmus). Maintained refers to fixation that is held during binocular viewing after the opposite eye is uncovered during fixation preference testing.

❖ Optokinetic nystagmus

Children with poor fixation to any targets as a result of either poor vision or central nervous system problems can be evaluated for the presence of optokinetic nystagmus (OKN) so long as they are able to generate saccades.

- Optokinetic nystagmus is an involuntary pursuit response to moving stripes filling up most of the visual field, so a response may be seen in infants who are merely uninterested in other targets.
- Response to a standard OKN drum implies vision of finger counting at 3 to 5 feet. One can also assess the damping of the induced vestibule ocular reflex. By spinning the child around, either in your arms or on a swivel chair, a vestibular nystagmus will be induced, despite the level of vision.
- If there is visual input once the spinning is stopped, the nystagmus should damp in 30 to 60s due to the fixation reflex.

❖ Preferential looking tests

- In infants and children who are too young to do optotype testing, quantitative vision can be assessed using forced choice preferential looking techniques.
- The child is shown a card with a black and white grating or vanishing optotype (Cardiff Acuity Test) on one half, and a homogeneous gray area of equal mean luminance on the other the observer notes where the child looks upon being shown the card, then checks to see whether it was toward the stimulus. As the stripes in the grating or figure outline become finer (higher spatial frequency), fixation behavior approaches chance at the child's resolution threshold.

- Teller Acuity Cards can be used to measure visual acuity in a preverbal child. If the pattern is visible to the child, the child looks toward the grating; otherwise, the stripes blend into the gray background and the child shows no preference for looking toward the side of the card with the grating.
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✓ Visual Acuity Assessment: Verba

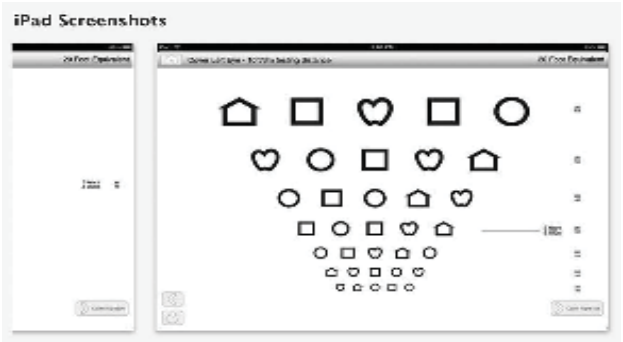
Use of the tumbling E, Wright figures, or HOTV.18 With the "E game," the child is asked to point his fingers in the direction of the "legs on the table." Often, vertical orientations are more readily confused by children than horizontal directions, and this should be taken into account when determining the endpoint

❖ Recognition visual acuity

- In older children, recognition visual acuity is tested using linear letter optotypes whenever possible. Sloan letters, consisting of C, D, H, K, N, O, R, S, V and Z, are ideal because they have been shown to be equally recognizable distance between each optotype is no greater than the width of the optotypes on any given line.

- Younger and/or preliterate children may need to be tested with alternative optotypes, preferably the LEA symbols or the reduced set of 4 letter optotypes known as the HOTV test.

HOTV test



LEA symbols

❖ Visual Field

- First we have to know that the child can perceive moving objects, has motion perception. Rolling first one and then several balls on the floor reveals whether the child's gaze follows the movement of the ball(s) or makes a quick saccade when the ball(s) stop moving. If the child seems to be able to see the moving balls, several balls are rolled at once. When this is repeated several times it is possible to observe whether the child respond symmetrically, i.e. the two half fields function symmetrically or one of them dominates.
- Older children may be assessed with this simple ball game. Rolling balls on the floor is a better technique than throwing balls to a standing child because motor functions may require so much of brain capacity that catching balls in the air is not possible. How well a child can catch a ball, is often more affected by the motor problems than by the child's capability to visually orient in space and see details in it.

❖ Assessment of Color Vision in Children

- The easiest way to screen for color vision defects is with color plates. There are two popular types of plates, which are each useful in specific situations. The Ishihara pseudoisochro- matic color plates work on the principle of color confusion, which is common with dichromats and anomalous trichromats. These plates are extremely sensitive for red-green defects, which are usually congenital. Most acquired color defects show some loss in the blue-yellow range, and the Ishihara plates will miss these patients unless the loss has extended into the red-green range. The advantage of these plates is that they come in an illiterate form with geometric shapes that can be traced with a finger. This design is useful for children who do not know numbers but still requires the comprehension and fine motor skills of a 3- to 4-year-old.

➢ Assessment of Contrast Sensitivity

- **Red Reflex:** Examination of pupil reflections, also known as the red reflex text, can reveal problems in the cornea, lens and sometimes the vitreous, and is particularly useful in young children. These photographs show what can occur in the case of certain major eye conditions, the most serious of which is retinoblastoma.

- **Pupillary Examination:**
- The pupillary light reflex is not reliably present until approximately 30 weeks' gestational age.
- Pupils are usually meiotic in newborns and gradually increase in size until preadolescence.
- Accurate pupil testing in young children is complicated by the smaller pupil and difficulty controlling accommodation.
- Pupil evaluation can be facilitated by careful observation, easily accessible control of room lights to allow continued observation during changes in room illumination, and the use of appropriate distance fixation targets.
- Digital photography can also be useful for observing and documenting pupil size and symmetry.

❖ Intraocular Pressure Measurement

- It is not always easy or possible to perform formal tonometry in children. Accurate to- nometry requires a relaxed patient. Handheld devices such as the Icare tonometer (Icare Finland Oy) or Tono-Pen (Reichert Technologies) can be very useful for measuring intra- ocular pressure (IOP) in children. The Tono-Pen or the Perkins Tonometer (Haag-Streit USA) may be used to test infants when they are sleeping or feeding in the supine position. Digital palpation, though not quantitative, can provide a gross assessment of IOP. Interpretation requires practice and correlation with formal tonometry tests in the same patient.

❖ Cycloplegic and mydriatic agents

- Cyclopentolate hydrochloride (1%) is the preferred cycloplegic drug for routine use in children. Use of a weaker concentration of cyclopentolate (0.2% to 0.5%) is suggested in infants. Tropicamide (0.5% or 1%) alone is usually not potent enough for complete cycloplegia in children. Atropine (1% drops or ointment) is used by some ophthalmologists, particularly in young children with accommodative esotropia or dark irises, but this drug causes pro- longed blurring and is more often associated with adverse effects (see the section "Adverse effects of cycloplegic agents").

Table Common Cycloplegic Agents

Medication	Typical Administration Schedule	Time to Cycloplegia	Duration of Action
Tropicamide	1 drop every 5 min × 2; wait 30 min	20–40 min	4–6 hours
Cyclopentolate hydrochloride	1 drop every 5 min × 2; wait 30 min	30–60 min	1–2 days
Atropine sulfate	1 drop; wait 90 min. Alternatively, 1–3 drops per day × 1–4 days; then 1 drop morning of appointment	45–120 min	7–14 days

❖ Fundus Examination

The funduscopic exam is crucial in the evaluation of children with neuro-ophthalmic disorders; the test can be done by:

- Having the child cradled in the parent's lap, with the child's feet tucked under the parent's elbows, and the head supported by the parent's closed knees.
- If the child does provide some resistance, an assistant can be used to stabilize the head.

The older infant and young child can be persuaded into cooperating for the indirect ophthalmoscopy exam by:

- The first is to use as low illumination as possible.
- Second, avoid manipulating the lids as this usually causes the child to squeeze and results in the Bell's phenomena.
- By using a 20 diopter indirect lens and resting the fingers lightly on the child's forehead for support, the examiner can get an excellent view of optic nerve and macula