



VISUAL FUNCTION, NORMAL ACUITY, TYPES OF TESTS USED IN VA EXAMINATION

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المرحلة الرابعة

الفصل الأول

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FOUNDATIONAL CONCEPTS FOR PEDIATRIC OPTOMETRY

- ❑ Visual acuity (VA) is just one part of the total visual function
- ❑ Understanding normal acuity requires defining the visual resolution limit.
- ❑ Clinical VA assessment relies on various test types adapted for children
- ❑ these tests are categorized based on patient response and method.

THE CORE VISUAL FUNCTIONS

Vision involves complex several specialized sensory functions

1. Light Sense: the perception and adaptation to illumination levels
2. Form Sense: the ability to resolve fine details, which is measured as VA
3. Color Sense: The ability to distinguish different colors
4. Contrast Sense: the ability to detect subtle differences in luminance (Contrast Sensitivity).

Development of Light Sense and Adaptation



- ❑ Light Sense is present **at birth**, allowing basic detection of light and dark
- ❑ **Rod** function matures **faster** than cone function
- ❑ **Dark** adaptation (adjusting to **dim** light) is **highly efficient** by about **6 months** of age
- ❑ **pupillary** light reflex, which regulates light entry, is somehow **fully** functional even in **newborns**
- ❑ The overall ability to **rapidly switch** between bright and dim conditions (**adaptation range**) reaches **near-adult** levels within the **first year**.

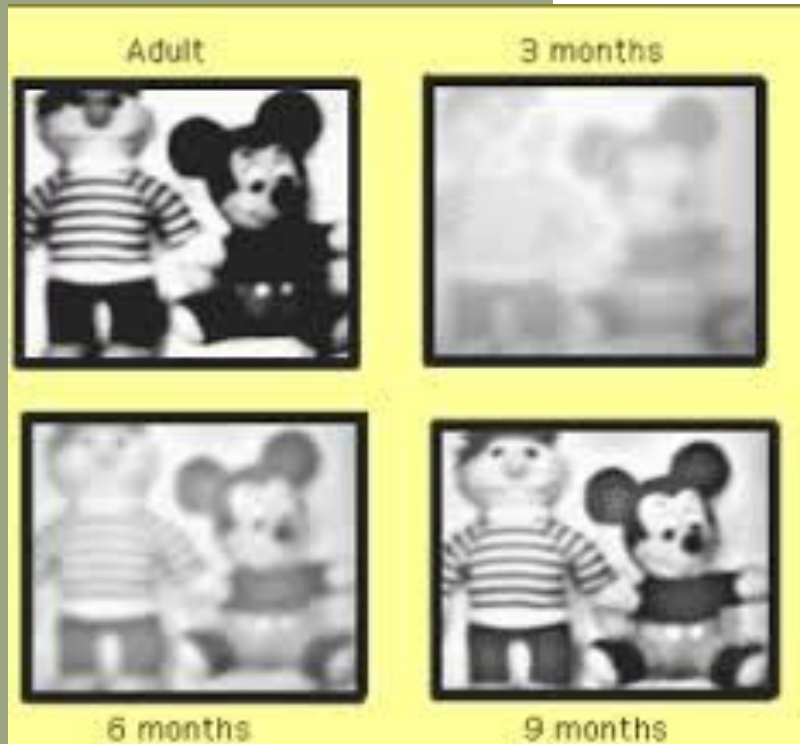
COLOR VISION DEVELOPMENT IN CHILDREN

- ❑ Cones are responsible for color vision
- ❑ They exist at birth but are immature
- ❑ Newborns rely mostly on rods
- ❑ During the first month:
 - ❑ color perception is unreliable
 - ❑ and driven by brightness and high-contrast patterns (e.g., red/black)



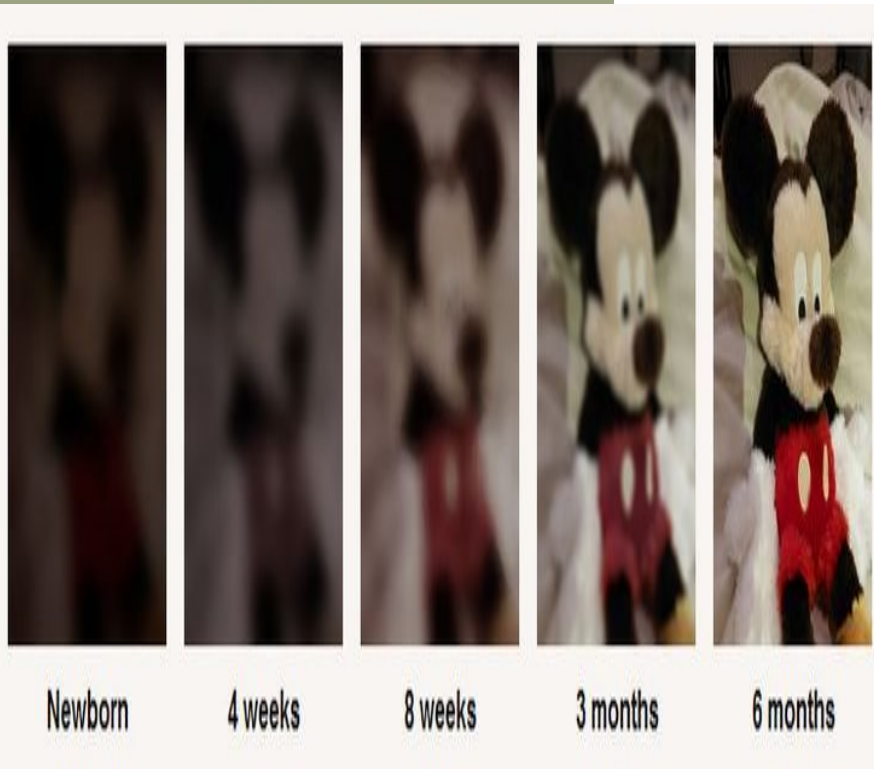
- ❑ The first measurable color discrimination (chromatic response) appears around 6-8 weeks
- ❑ Early discrimination is basic, starting with red vs. gray and then green vs. gray
- ❑ By 4-6 months of age, true functional color vision approaches mature, adult-like levels.

CONTRAST SENSITIVITY DEVELOPMENT IN CHILDREN



- ❑ Newborns initially detect only high-contrast stimuli (e.g., black and white patterns)
- ❑ They have very poor sensitivity to low contrast or subtle gray differences
- ❑ Contrast sensitivity improves rapidly during the first 6 to 9 months
- ❑ Sensitivity for large objects (low spatial frequencies) matures the fastest
- ❑ Contrast sensitivity approaches adult levels for fine details (high spatial frequencies) around 3 to 5 years.

NORMAL VA PROGRESSION: INFANCY (0-1 YEAR)



- ❑ VA at birth is poor, estimated around 6/120 (20/400)
- ❑ This early vision is based on detection and is limited by foveal immaturity
- ❑ VA improves rapidly due to foveal cone density increasing
- ❑ By 6 months, expected VA is often 6/36 (20/120)
- ❑ Testing relies primarily on objective resolution methods (e.g., Teller Cards and optokinetic nystagmus test).

TELLER ACUITY CARDS

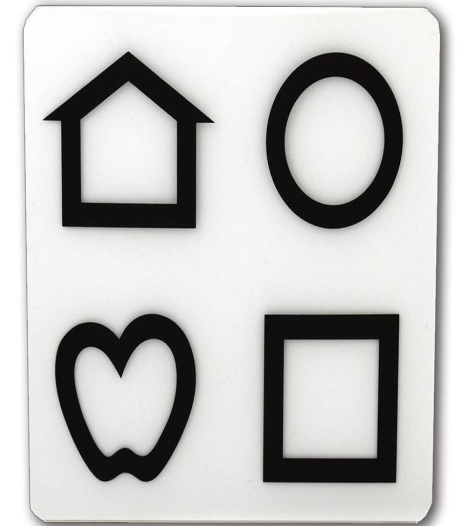
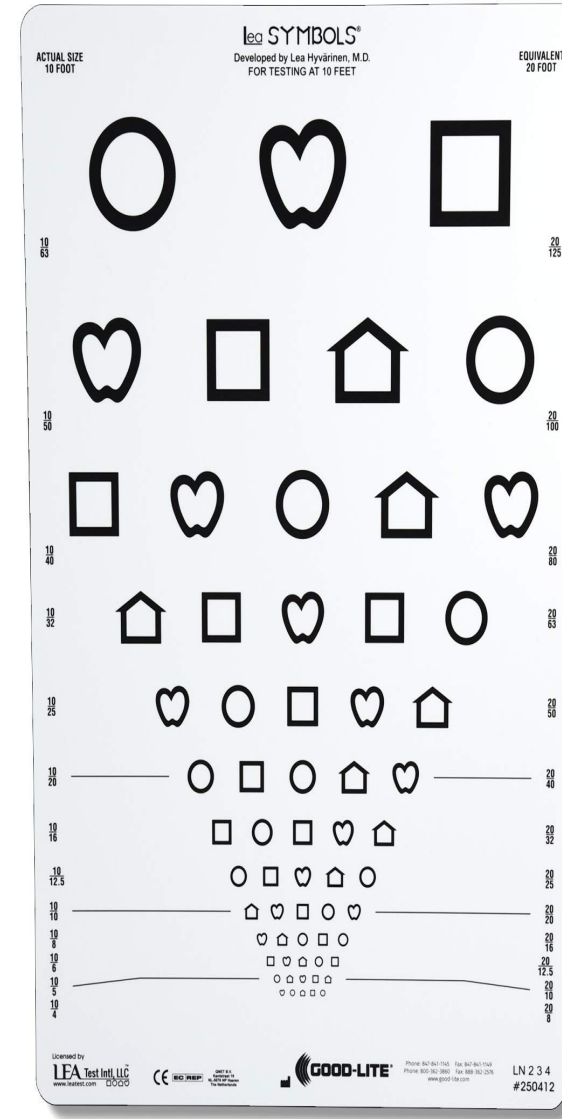


OKN DRUM



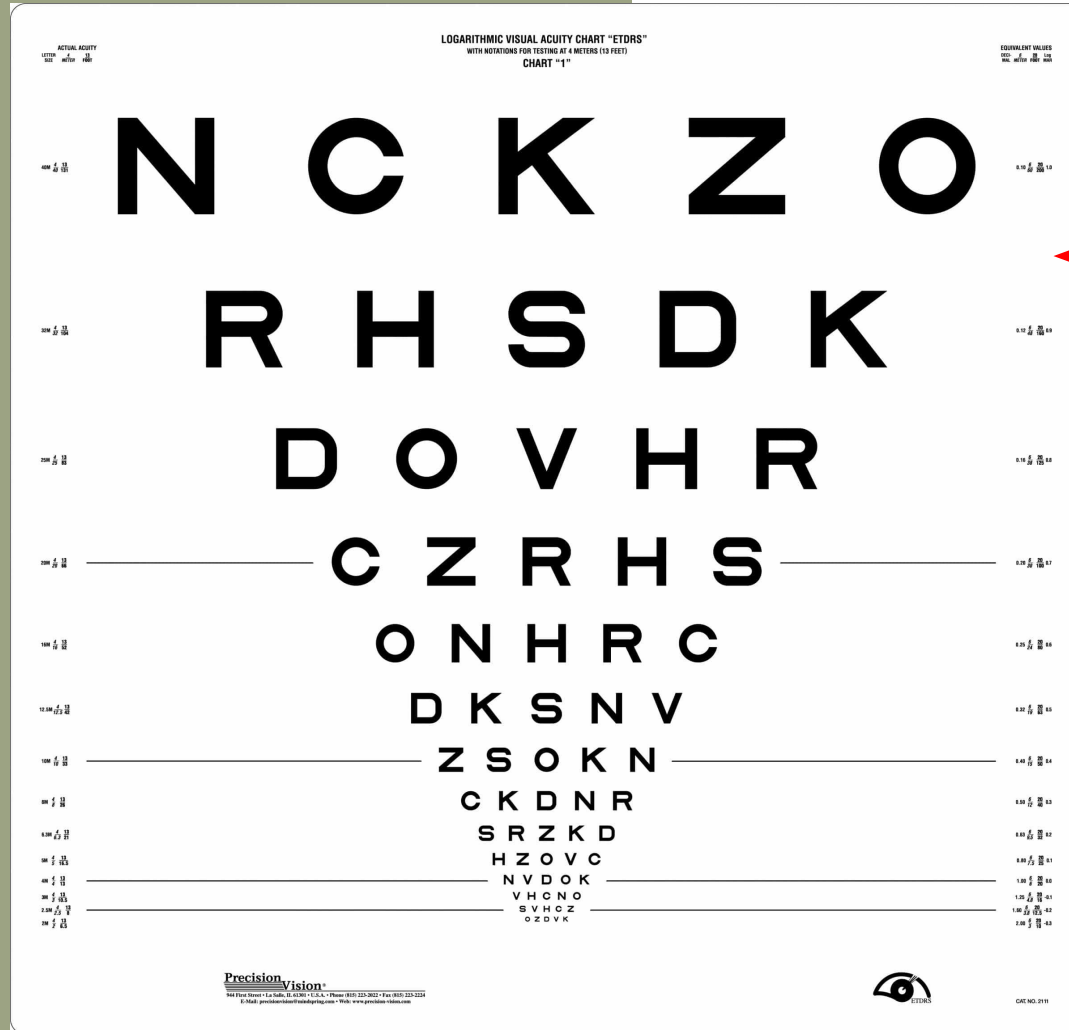
NORMAL VA PROGRESSION: TODDLER & PRESCHOOL (1-5 YEARS)

- This period sees the **transition** from **resolution to recognition** acuity
- VA is expected to reach **6/9 (20/30)** by around **3-5 years** of age
- The **interocular** difference should be **no more than one line**
- Testing uses standardized **symbol** charts (e.g., **Lea Symbols**)



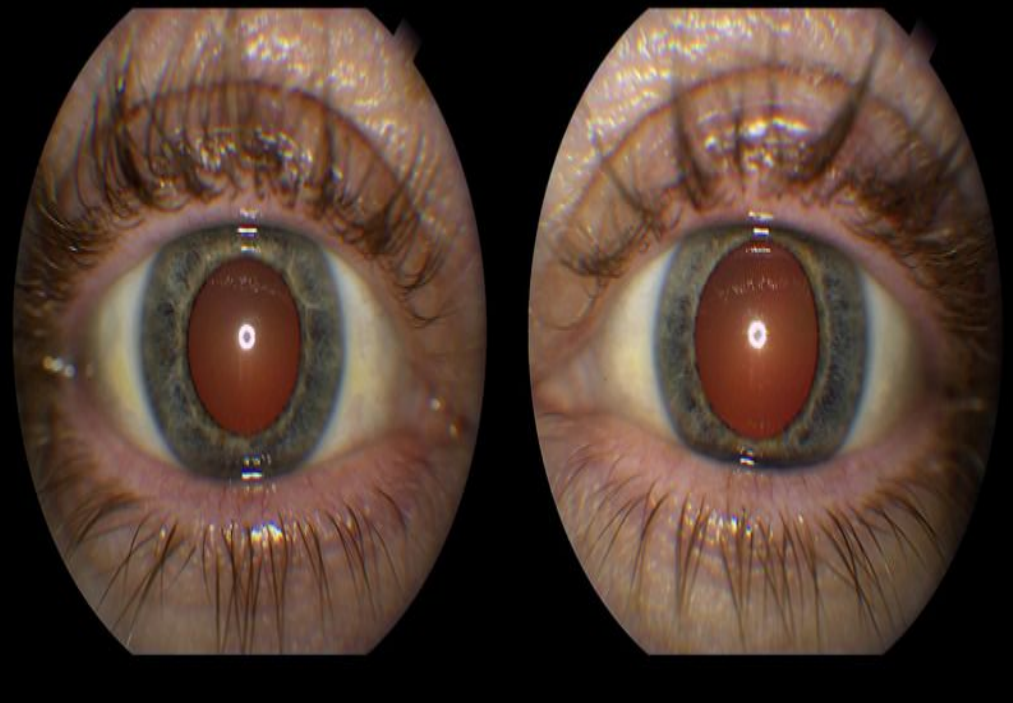
NORMAL VISUAL ACUITY: SCHOOL AGE

- By age 6, VA should consistently reach the adult standard of 6/6 (20/20)
- VA should be measured using standard letter optotypes (e.g., ETDRS)
- Any persistent VA less than 6/9 (20/30) requires thorough investigation
- Best Corrected VA (BCVA) should remain stable throughout childhood
- Unexplained reductions may indicate developing pathology or previously undetected amblyopia.



TYPES OF TESTS USED IN VISUAL ACUITY EXAMINATION IN CHILDREN

TEST TYPES FOR INFANTS (0-1 YEAR):



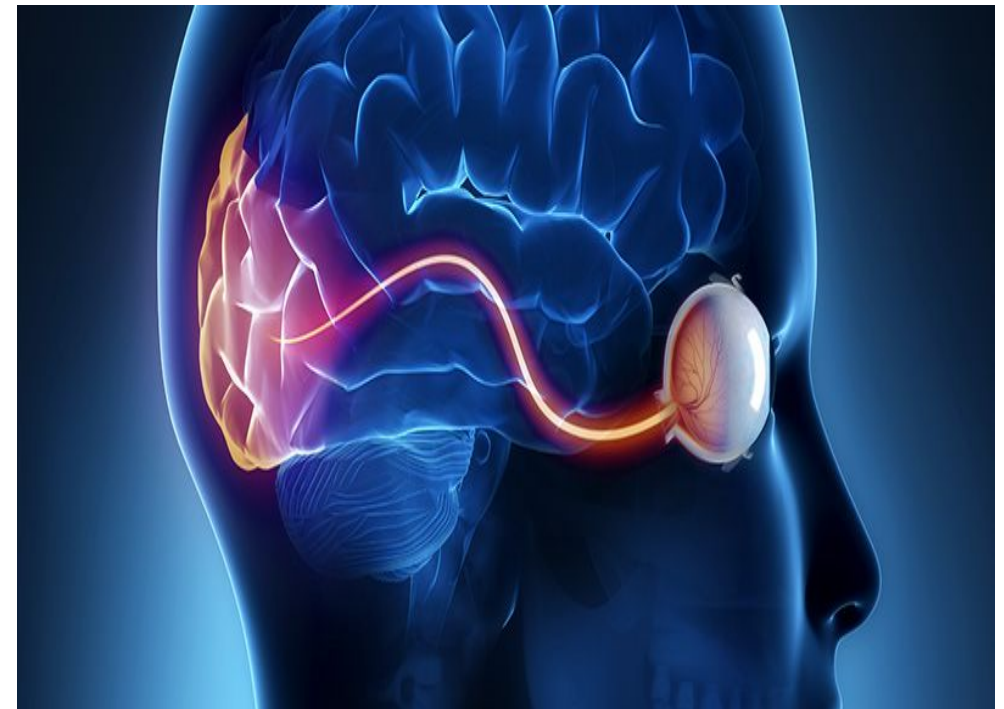
- A. Observational, objective, qualitative tests:
 - 1. Observing spontaneous visual behavior
 - 2. Fixation and follow test
 - 3. Blink-to-light test
 - 4. Objection to Occlusion (O-to-O) test
 - 5. Red reflex (Bruckner's test)
 - 6. Pupillary light reflex (PLR)

TEST TYPES FOR INFANTS (0-1 YEAR):

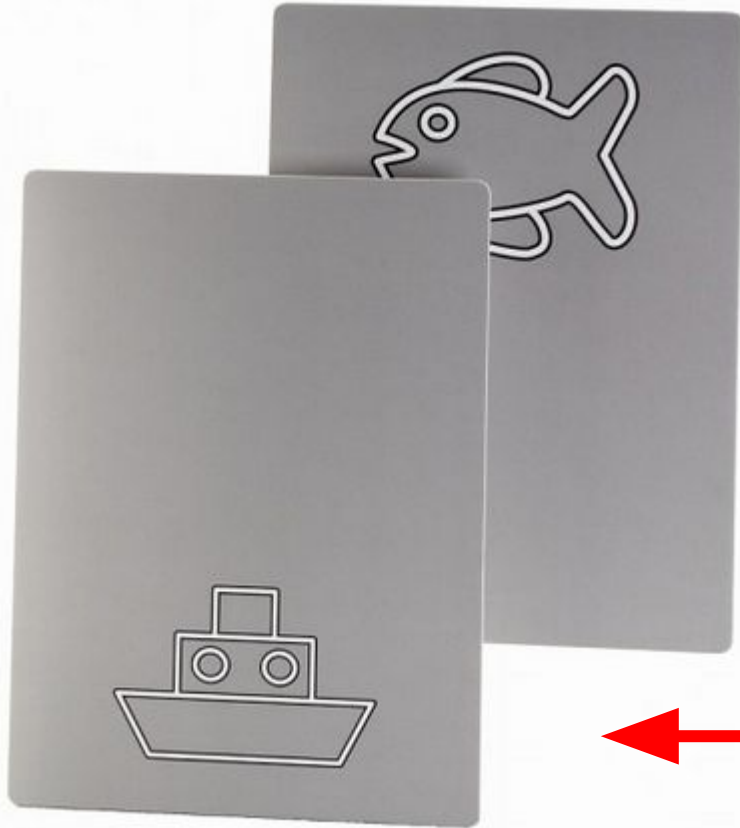


B. **Observational, objective, quantitative** tests:

1. **Forced-choice preferential** looking
2. **Visual evoked patterns** VEP
3. **Optokinetic nystagmus** reflex



TEST TYPES FOR TODDLERS (1-3 YEARS):



A. Observational, objective, qualitative tests:

Toddlers are often uncooperative, so qualitative observations are crucial

1. Objection to Occlusion (O-to-O)
2. Fixation and follow

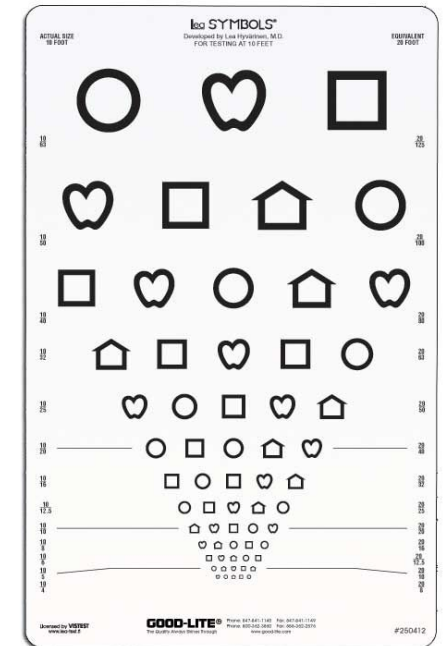
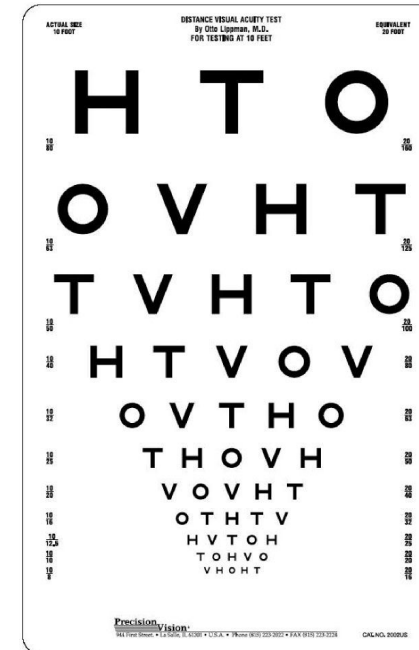
B. Observational, objective, quantitative tests:

✓ Cardiff Acuity Cards test:

- ☐ a picture-based preferential looking test (uses symbols not grating)
- ☐ sometimes suitable for toddlers

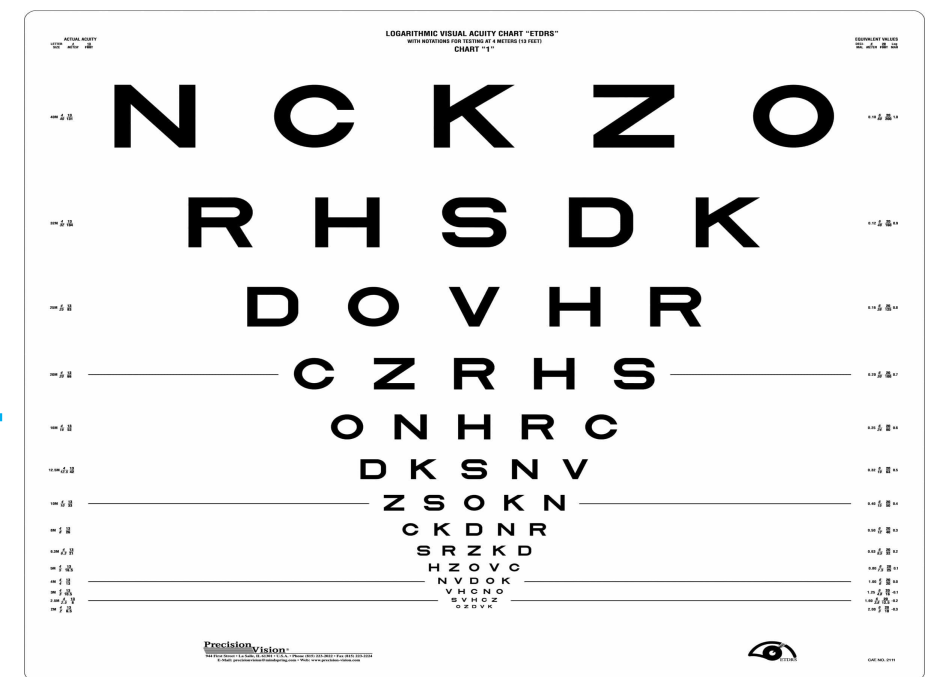
TEST TYPES FOR PRESCHOOLERS (3-5 YEARS): RECOGNITION ACUITY TESTS: (SYMBOL CHARTS)

- ❑ Preschoolers use recognition acuity tests to identify symbols
- ❑ Lea Symbols (house, apple, circle, square) are highly standardized
- ❑ The child points to a matching card or names the symbol
- ❑ HOTV charts use four letters (H, O, T, V) for matching



TEST TYPES FOR SCHOOL-AGED CHILDREN (5-6+ YEARS): RECOGNITION ACUITY TESTS (LETTER CHARTS)

- School-aged children use letter optotypes for VA assessment
- 1. The ETDRS chart is the gold standard
 - It features five letters per line
- 2. The Snellen chart is common
 - The child verbally names the letters or points to them on a response card.



E	1	20/200
F P	2	20/100
T O Z	3	20/70
L P E D	4	20/50
P E C F D	5	20/40
E D F C Z P	6	20/30
F E L O P Z D	7	20/25
D E F P O T E C	8	20/20
L E F O D P C T	9	
F D P L T C E O	10	
P E Z O L C F T D	11	

KEY REFERENCES AND SOURCES

1. American Academy of Ophthalmology (AAO): Guidelines on pediatric visual acuity testing and normative data
2. American Optometric Association (AOA): Clinical practice guidelines for the pediatric eye and vision examination
3. Bradford, G. D. (Ed.): Pediatric Eye Disease: Color Atlas and Text
4. Taylor, D., & Hoyt, C. S. (Eds.): Pediatric Ophthalmology and Strabismus
5. National Eye Institute (NEI) / ETDRS Study