



جامعة المستقبل
كلية التقنيات الصحية والطبية
قسم تقنيات البصريات



Second Stage 2024-2025

REFRACTIVE ERRORS

Lecture Title
Visual Acuity

Lecture Number: 5 / course 1

Prepared by
Hassan A. Aljaberi
OPTOMETRIST

Visual Acuity (VA)

- One of the important tests to determine the state of refraction of light in the eye, and it is a subjective method that depends on the patient mainly during the examination.
- Visual acuity refers to the ability to distinguish fine details, and it is one of the most frequently evaluated visual functions. It is measured by the patient's ability to identify letters or numbers on a standard eye chart from a specified viewing distance.
- Visual acuity is measured based on the patient's answer and is expressed as a fraction (numerator – denominator): -

$$VA = \frac{\text{distance at which the patient person sees the target}}{\text{distance at which the healthy person sees the target}}$$

- Visual acuity is recorded in the form of a fraction, and as in the table below: -

الكسر بوحدة المتر (نظام بريطاني)	الكسر بوحدة القدم (نظام امريكي)	ت
6/60	20/200	1
6/48	20/160	2
6/36	20/120	3
6/24	20/80	4
6/18	20/60	5
6/12	20/40	6
6/9	20/30	7
6/6	20/20	8

- That is, it is the fraction that is used to measure degrees of vision. For example, when we say that a person has a visual acuity of 6/18, this means that this patient

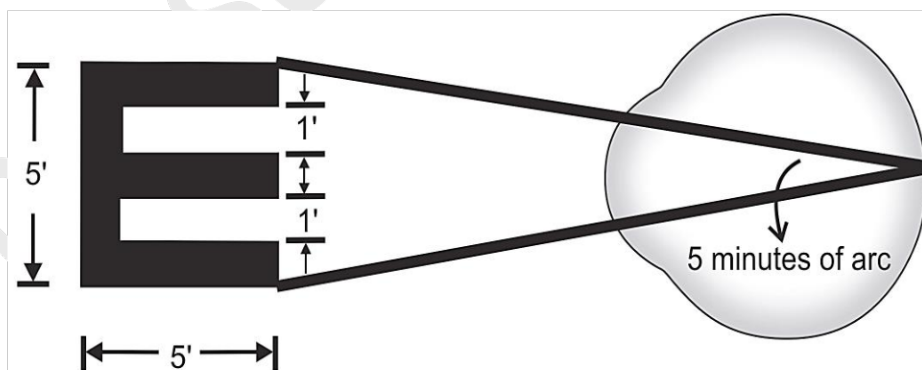
person can see at a distance of 6 meters while a healthy person can see at a distance of 18 meters.

- In general, the degrees of visual impairment vary in numbers according to the case, and are classified according to the World Health Organization as follows:

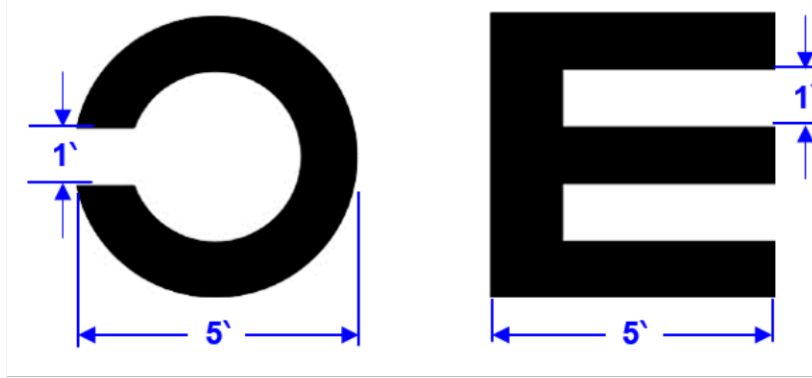
Visual Acuity Levels	Degrees of Visual Impairment
Mild Visual Impairment	6/12 or worse
Moderate Visual Impairment	6/18 or worse
Severe Visual Impairment	6/60 or worse
Blindness	3/60 or worse

How do visual acuity test charts work?

- The principle that was adopted in the design of these charts is that the size of the object, the farther away from the eye, the larger it should be, so that it has the same size on the retina and the eye can see it clearly.
- In designing the signs, the scientists relied on optical and physiological scientific principles, which is that the smallest object that the visually and organically healthy eye can see two adjacent cones.



- The minimum angle of resolution (MAR), the eye can distinguish between two points that form an angle of one minute (1 min arc) on the pupil, which is equal to 1/60 of a degree.



- The height and width of the symbol shape in the chart is equal to $5X$ (where the X depends on the distance of the denominator in the fraction), and according to the following mathematical relationship to calculate the size of the shape:

$$X = R \cdot \theta$$

حيث:

X : إبعاد شكل الحرف (ارتفاع وعرض)

R : المسافة بين عين الشخص السليم ومخطط الفحص (تساوي مقام الكسر)

θ : هي اقل زاوية نظر يمكن رؤية فتحة الشكل (تساوي 3×10^{-4})

Measurements included in visual acuity

- Distance visual acuity (DVA) and near visual acuity (NVA).
- Examination with or without glasses.
- Examination of the right eye, the left eye, then both eyes.

Steps for performing a distance visual acuity test

1. Recording the patient's medical history.
2. If the patient wears medical glasses, he is asked about his complaint about the old glasses and period wearing the glasses. Next, the power of the eyeglass lens is measured with a lensometer device.
3. Choosing the appropriate examination chart to check the visual acuity of the distant, and the patient sits at a distance of 6 meters.
4. Wear the trial frame after adjusting the PD and arm length.
5. Close the left eye (using an eye occluder).
6. Examination of the right eye, and asking the patient to see the first row in the diagram (6/60) to the last row (6/6).
7. The appropriate correction lens is selected from trial lens case.
8. Add the pinhole in case the patient cannot see all the rows.
9. Repeat the steps to examine the left eye.
10. Opening both eyes to check the visual acuity (mostly the visual acuity in both eyes is better than one eye).
11. Writing the visual acuity (VA) on the eyeglass prescription, with (VA with glasses) or without (VA without glasses).

If the patient cannot see the largest letter in the chart at a distance of 1 meter, we follow the following steps in order: -

- 1) **Count Fingers (CF)**: one meter distance, raise the number of fingers in front of the patient, and ask him to tell you the number of fingers.
- 2) **Hand Movement (HM)**: movement of the hand at a very close distance and ask him if he can see the hand.
- 3) **Perception of Light (PL)**: shine a spotlight at a distance of 30 cm from the patient, and ask him to tell you about seeing the light.
- 4) **No-Perception of Light (NPL)**: if the patient cannot distinguish the light, recorded as (blind).

Normal Visual Behavior for children

- ✓ **0-1 Month**: they turn eye/head to look at light sources and track objects horizontally. Make eye contact and begin to look at objects that are close to their faces. They appear serious as they fixate.
- ✓ **2 Months**: eye contact at 6-8 weeks, vertical and circular tracking begin to display facial expression as they fixate.
- ✓ **3-4 Months**: begin to observe their hands, hold them close to their faces. watch activity that occurs around them.
- ✓ **6 Months**: observe surroundings and recognize favorite people, toys or foods at a distance reaches towards/grasps hanging objects, observe toys falling or rolling away, shift fixation across midline
- ✓ **7-10 Months**: notices small objects, recognizing partially hidden objects
- ✓ **11-12 Months**: looks through windows, recognizes people /pictures

HOME WORK

- 1.** Using the formula $X = R \cdot \theta$ for calculating symbol size on eye charts:
 - a) What does each variable represent?
 - b) If $R = 6$ meters, calculate X
- 2.** According to WHO classification, describe all degrees of visual impairment and their corresponding VA levels.
- 3.** A patient comes in with VA of 6/18.
 - a) What category of visual impairment does this fall under?
 - b) What does this measurement mean in practical terms?
 - c) What would be the equivalent measurement in the American system?
- 4.** You are examining a patient who cannot see the largest letter on the chart at 1 meter. Describe in detail the sequential steps you would take to assess their vision, and what each assessment indicates about their visual capability.
- 5.** A 9-month-old infant is brought in for examination.
 - a) List the normal visual behaviors expected at this age
 - b) What specific tests would you perform?
 - c) What would raise concerns about the infant's visual development?