

Visual Acuity (VA):

Visual acuity is the measure of the eyes ability to see object details and shapes at a given distance,e.g. the limbs and spaces in the letter E or the gap in a letter C, and it is a measure of the eye resolution power (visual acuity resolution, VA_{res}).

Visual acuity assessment can reveal refractive errors, optical disorders, and ocular disease.

How doe's visual acuity evaluated?

Visual acuity should be evaluated :

- 1- VA measurement is usually the first test that you do for persons when they come to you for an eye examination.
- 2- both uncorrected and corrected,
- 3--at distance and near,
- 4-with each eye being tested independently for the right and left eye separately.

Common causes of Poor VA are:

- 1-Refractive error (when a person needs spectacles to see clearly)
- 2-Eye health problem (when a person has a problem with the health of their eyes).

The smallest angle (w) subtended at the nodal point of the eye by two points, which can just be seen resolved as separate, is a measure of the eye ability to see detail. The angle (w) is known the minimum angle of resolution (MAR) fig. (1).

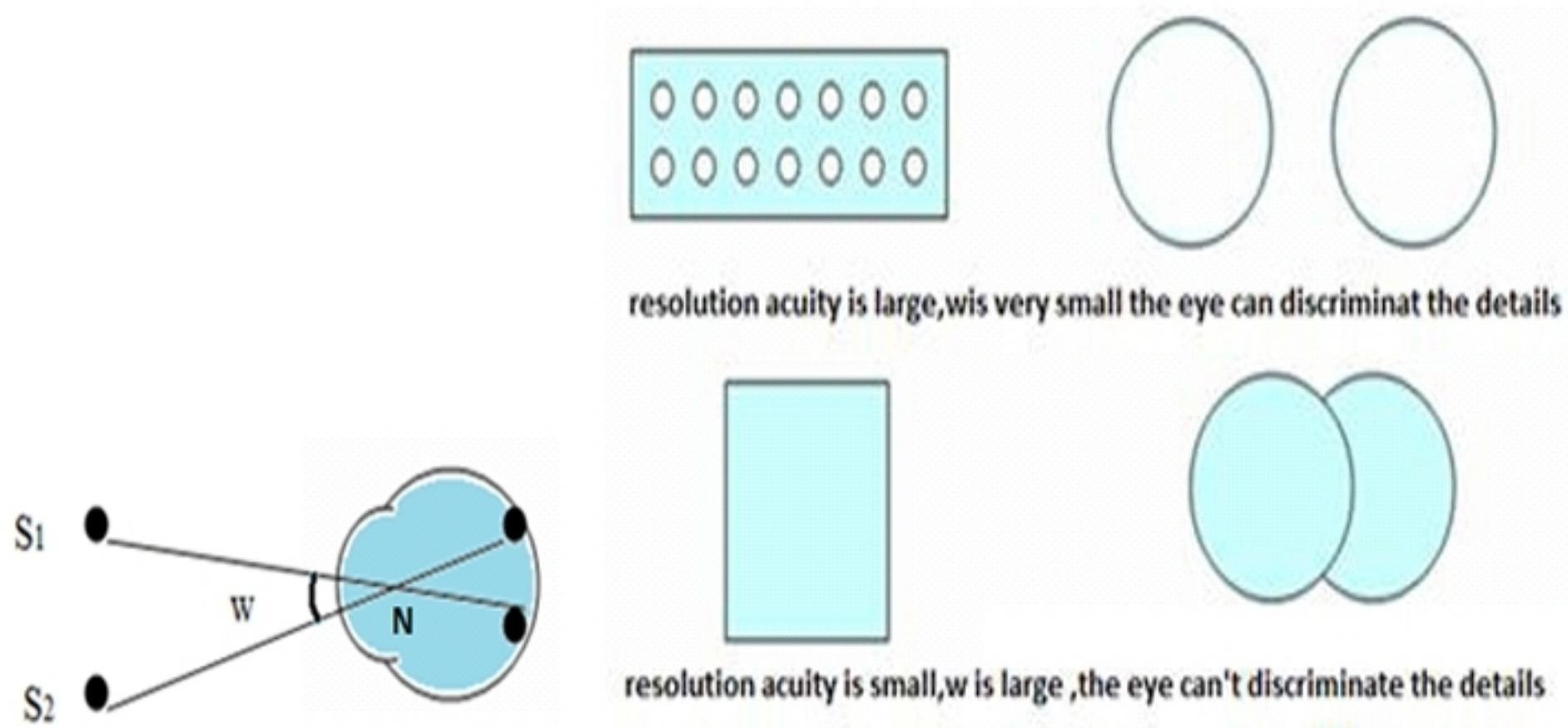


Fig.(1):The minimum angle of resolution

visual acuity resolution VA_{ress} .is defined as:

$$VA_{res} = 1/ w \dots\dots\dots (1)$$

Fig.(1):is a simple illustration of two point objects that are easily resolved (seen) as being separated. As w is an angle its unit will be in minutes of angle (not minutes of time).

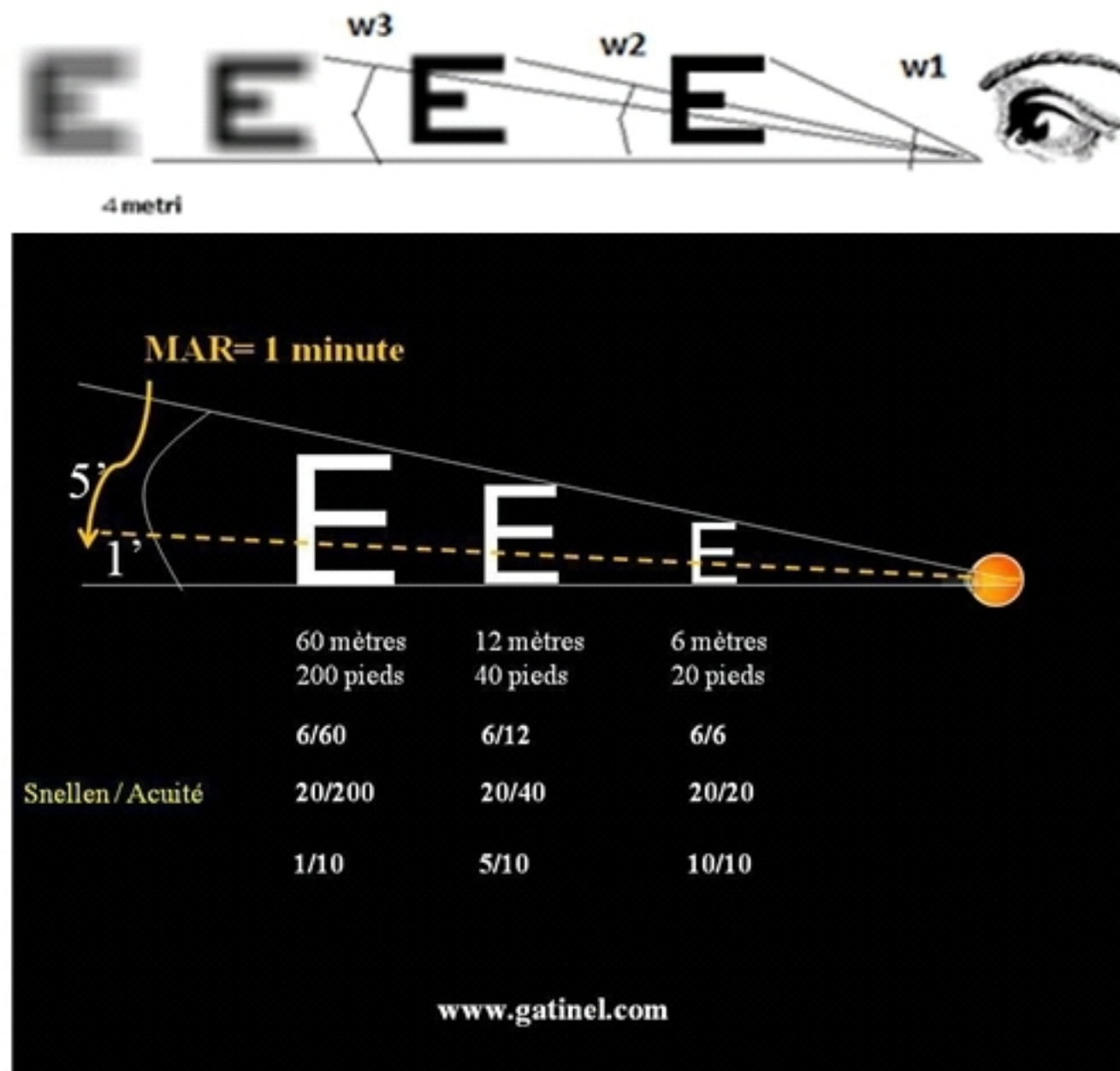


Fig.2 shows for the same letter E as w increased the resolution power is decreased.

The visual acuity of each eye separately is recorded in two ways: The distant visual acuity and the near visual acuity.

Distance VA charts:

There are many types of VA charts available. Different types of VA charts have different sized characters (letters, pictures numbers or symbols), Fig.3 shows some examples. VA charts that use pictures or symbols (such as E chart) are particularly useful for children or for people who cannot read or speak. Characters on a VA chart are usually largest at the top of the chart, and gradually get smaller towards the bottom of the chart.

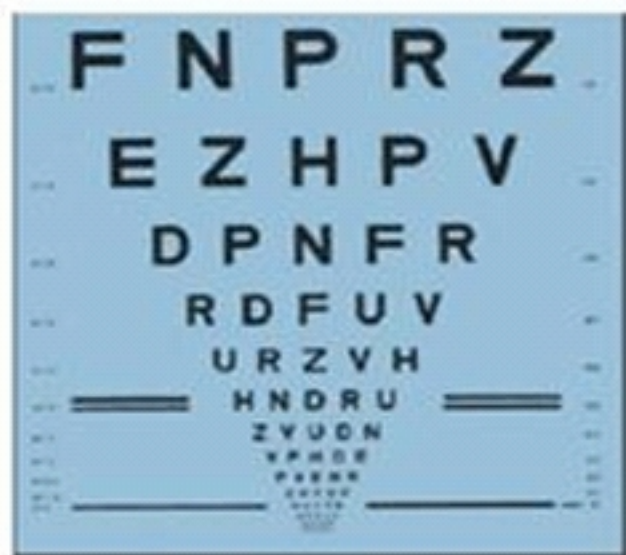


Figure 3A: A LogMAR VA chart

Figure 3B: A picture VA chart

Figure 3C: A "tumbling E" VA chart

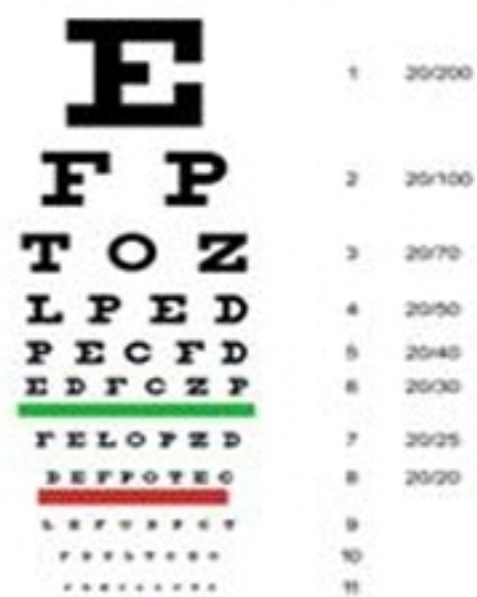


Figure 3 D: Snellen chart

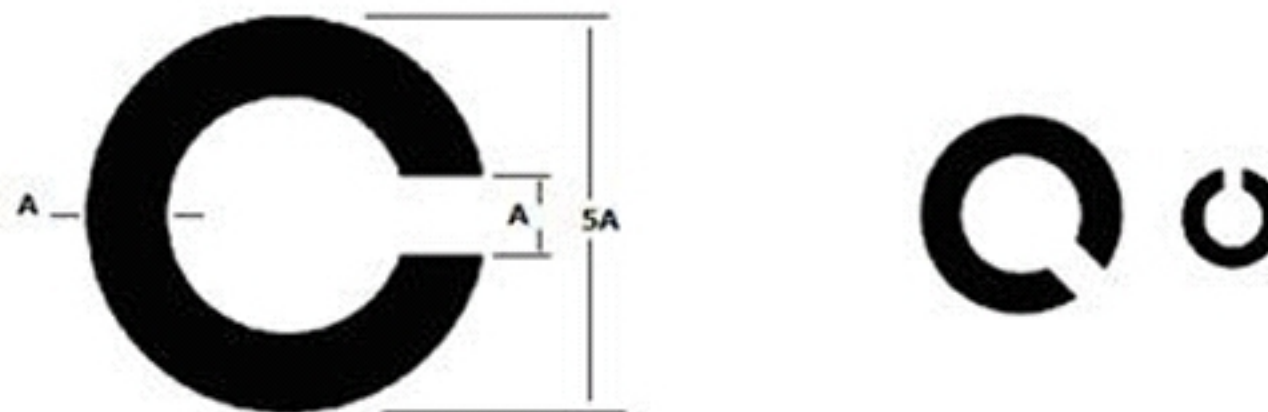


Figure 3 E Landolt C in various sizes and orientations

Special rules must be followed when making a VA chart. The size of the letters or symbols on a VA chart and the space between them must be calculated and printed using special techniques. The original Snellen letter the limbs and spaces subtend 1 minute at specified distances and the overall letter height subtended 5 minutes, Fig. (4).

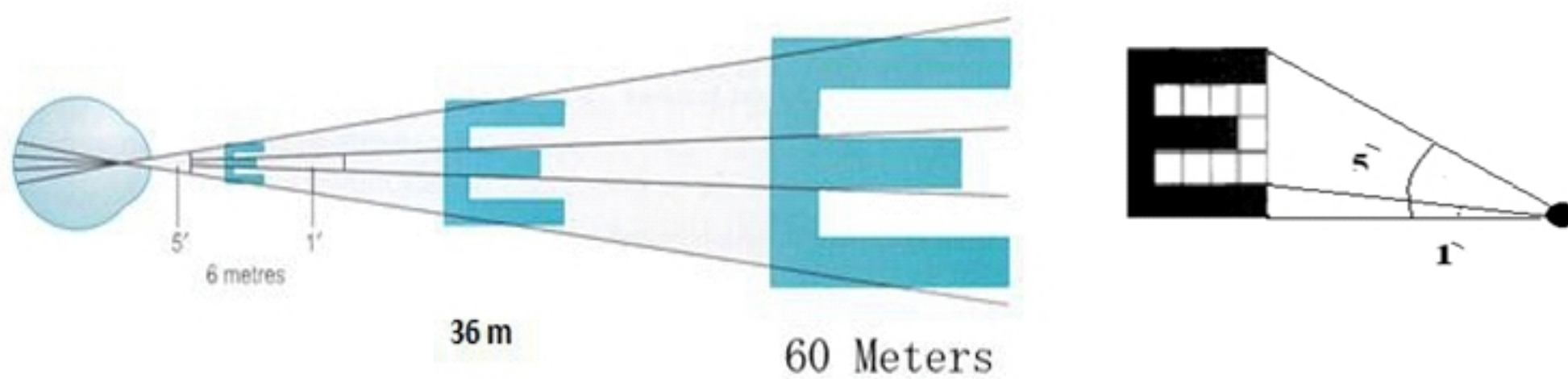


Fig. 4: the original Snellen letter the limbs and spaces subtend 1 minute at specified distances and the overall letter height subtended 5 minutes .

Snellen Fractions: Each line of characters on a VA chart is labelled to tell you what vision a person needs to be able to see that line. Usually the label is a fraction number that is called a Snellen fraction.

A Snellen fraction has a number on the top and a number on the bottom:

- The number on the top tells you how far away the chart is from a person (usually a distance chart is 6 m away).
- The number on the bottom tells you how far away a person with normal vision could be and still see that line of characters.

$VA = \frac{\text{Testing distance (metres)}}{\text{Distance at which someone with normal vision could read the same VA line (metres)}}$
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To convert from resolution acuity VA_{res} to Snellen acuity, simply multiply: $1/w$ by $6/6$.

Snellen acuity = $\frac{1}{w} \times \frac{6}{6}$ (2)

For example, if $w = 2'$, $VA_{res} = 1/2$:

In Snellen acuity = $\frac{1}{2} \times \frac{6}{6} = \frac{6}{12}$.

Why a testing distance is about 6 m?

Six meters or 20 feet is “close enough” to optical infinity. The rays of light entering the eye are parallel, and the crystalline lens of the eye is thin and relaxed because, there is zero accommodation.

If lack of space is a problem, front-surface reflective mirrors usually can be utilized to increase the virtual viewing distance in an exam room.

Example 1:

You measure a boy’s VA and find that the smallest line of pictures that he can see is 6/6.

This mean that when the boy is 6 m away from the VA chart he can see what a normal person sees if they were 6 m away from the chart. This means that the boy’s VA is normal.

Example 2:

You measure a woman's VA and find that the smallest row of letters that she can read is 6/48.

- This means that when the woman is 6 m away from the VA chart she can only see the letter size that a person with normal vision could see if they were 48 m away from the chart.
- This means the woman has poor vision.

Distance VA is usually recorded as a Snellen fraction.

If the person reads all of one line correctly, but cannot read any characters on the next line, VA is recorded as the Snellen Fraction of the line that was read correctly.

For example: If a person reads all of the 6/12 line correctly, but cannot read any characters on the next line, their VA is recorded as 6/12.

If the person reads a line correctly *and* some of the characters on the line below, VA is recorded as the Snellen Fraction of the whole line that was read correctly, *plus* the number of characters that were correct on the next line.

For example: If a person reads all of the 6/12 line correctly, as well as three characters from the next line, their VA is recorded as 6/12+3.

It is possible to have vision superior to 6/6: the maximum acuity of the human eye without visual aids (such as binoculars) is generally thought to be around (6/3).

The less the bottom number in the visual acuity ratio, the better the acuity; and the greater the bottom number, the worse the acuity. Therefore, 6/5 acuity is better than 6/6 acuity, and 6/9 acuity is worse than 6/6 acuity.

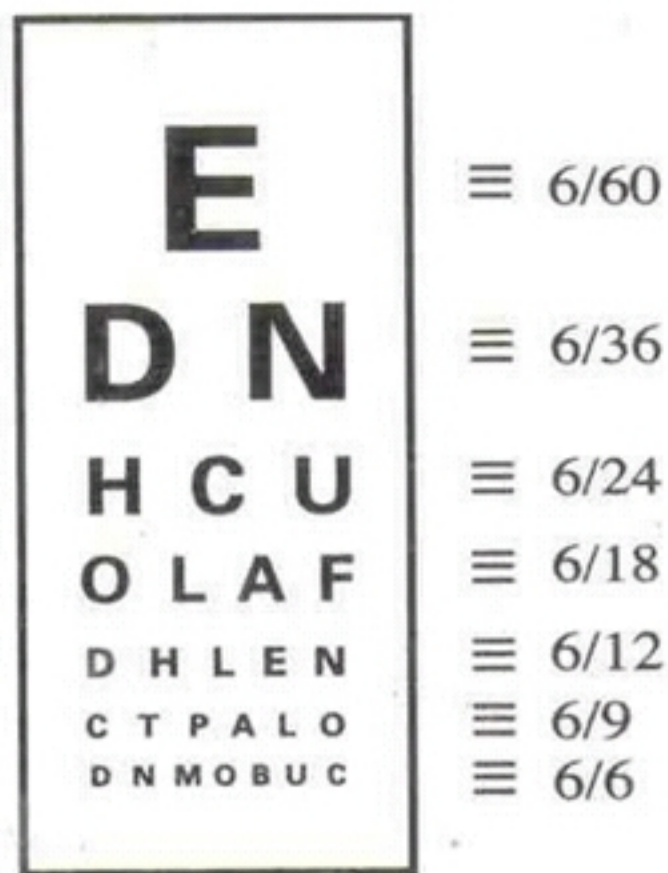


Fig. (5)

Make sure that the VA chart is clean and in good light. The chart should be flat and straight on the wall, and not positioned too high or too low. Be careful that bright light is not reflecting off the VA chart. Glare on the chart makes it harder to see.

Procedures for assessment of distance visual acuity follow these basic steps:

- 1- Position the patient at the appropriate distance.
- 2- Occlude (cover) the eye not being evaluated.
- 3- Ask the patient to read the characters from right to left.
- 4- Continually decrease the size of the characters until the patient is unable to read or misses more than half the characters on any one line.
- 5- Note the line read and record the result in the patient chart.
- 6- Repeat above procedure for the fellow eye.

If a person can't see any of the VA chart, what other VA tests can you do?

- 1- if a patient cannot read the largest character on a given chart, a hand held 6/60 "E" may be brought toward the patient until it is seen.
- 2- If a patient with low visual acuity is not able to resolve the largest characters at their face, the technician will then ask the patient to **count fingers** at the greatest distance possible.
- 3- If the patient cannot see fingers, then the ability to see **hand motion** is assessed by moving the examiners hand in front of the eye being evaluated.
- 4- When hand motion is absent, the technician should proceed with evaluation for **light perception**. To examine for light perception vision, ensure that the fellow

eye is completely masked, and shine a penlight from distance of 20 cm into the patient's eye being evaluated. Ask the patient to state when the light is on or off.

- 5- A further evaluation of light perception can include asking the patient to **identify from which quadrant they believe the light is coming**. If the patient can point to or verbalize the light position accurately, the acuity is recorded **as light projection**.
- 6- If no light is perceived then the statement **no light perception** is recorded in the medical record.

There are several abbreviations used to record visual acuity in a patient's medical record.

c.c	With correction
s.c	Without correction
N	near
D	Distance
PH	Pinhole
OD or RE	Right Eye (oculus dexter)
OS or LE	Left eye (oculus sinister)
OU	Both eyes (together)
CF or FC	Count fingers or finger counting
HM	Hand motion
LP	Light perception
LP c pro	Light perception with projection
NLP	No light perception

Unaided VA: A person's unaided VA is their VA without spectacles.

Aided VA: A person's aided VA is their VA when they are wearing their spectacles.

Example 3

A man has no distance spectacles. You measure his distance VA for each eye.

- Right eye VA (left eye occluded):
The man reads all the lines correctly down to and including all the characters on the 6/6 line. You ask him to try the line below (the 6/4.5 line), but he does not get these characters correct.
→ You write: **VA RE 6/6 unaided**.
- Left eye VA (right eye occluded):
With his left eye, this man can still read the 6/6 line.
You ask him to try the characters on the line below (6/4.5 line), and he gets two of these characters correct.
→ You write: **VA LE 6/6+2 unaided**.

This man has very good unaided distance VA. He probably does not need distance spectacles.

Example 4

A woman has distance spectacles that she bought 1 year ago. You measure her distance VA for each eye.

You ask the woman to put her distance spectacles on.

- Right eye VA (left eye occluded):
The woman reads all the 6/6 line correctly, and can also read five letters on the next line.
→ You write: **VA RE 6/6+5 aided.**
- Left eye VA (right eye occluded):
With her left eye, this woman can only read the 6/12 line and three characters on the line below it.
→ You write: **VA LE 6/12+3 aided.**

Although this woman has distance spectacles, the vision in her right eye is different to the vision in her left eye. There is more than one line difference between her two eyes.

Her problem might be a refractive error, or she may have an eye disease – further testing will be needed to find the reason.

Example 5: A man cannot see the 6/60 line at 6 m, so you decrease the test distance to 3 m. Now he can tell you what the characters on this line are so you record the VA as 3/60.

Example 6: A woman cannot see the 6/60 line at 6 m or at 3 m, so you decrease the test distance again to 1.5 m. Now she can read the line below 6/60 which is the 6/48 line. So you record the VA as 1.5/48.

Example 7: Patient with distance acuity of 6/6 in the right eye and count fingers at one meter in the left eye who does not wear corrective lenses.

RE VA: sc 6/6 unaided

LE VA: CF @ 1m unaided

It should be noted that visual acuity is expressed with the right eye on top.

Questions: Write VA for the following persons and describe what they need:

1- A man has no distance spectacles. You measure his distance VA for each eye:

Right eye VA (left eye occluded): the man reads all the lines correctly down to and including all the characters on 6/9 line. You ask him to try the line below), but he does

not get these characters correct. With his left eye, this man can still read the 6/9 line. You ask him to try the characters on the line below) and he gets two of these characters correct.

2-A woman has distance spectacles. You measure her distance VA for each eye:

Right eye VA (left eye occluded): she reads all the lines correctly down to and including all the characters on 6/24 line. You ask her to try the line below), but she does not get these characters correct. With her left eye, she can still read the 6/24 line. You ask her to try the characters on the line below) and she gets two of these characters correct.

3-A woman has no distance spectacles. You measure her distance VA for each eye:

Right eye VA (left eye occluded): she reads 6/60 lines correctly but only gets two letters correct on the line below. With her left eye (right eye occluded): she can still read the 6/36 line and she gets three of line below.

4- Patient with distance acuity of count fingers at two meter in the right and no perception of light in the left eye, who does not wear corrective lenses.