BrienHoldenVisionInstitute

MEASURING VISUAL ACUITY

THINK

Because we are all unique, not everybody has the same vision. Some people can see better at distance, but have poor near vision, while others see better at near and worse at distance.

It is important to be able to measure a person's vision to find out how well they see at various distances, and if their vision is getting better or worse. Knowing how well someone sees can help us to find out if there is something wrong with their eyes.

When we measure a person's vision, we call this measuring their visual acuity.

WHAT YOU WILL LEARN

When you have worked through this unit you should be able to:

- Define visual acuity
- Describe why measuring visual acuity is important
- Describe the different types of visual acuity measurements
- Measure and record distance and near visual acuity
- Recognise when you must do a pinhole test
- Recognise when to refer someone for an eye examination.

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MEASURING VISUAL ACUITY (VA)

WHAT IS VA?

- VA is a measure of how well a person sees when they are looking directly at an object
- We measure VA at distance and near
- Common causes of poor VA are:
  - **Refractive error** (person needs spectacles)
    A person who has a refractive error will need to wear spectacles if they want to see clearly
  - **Eye health problem** (such as cataracts)
    If a person has poor VA because of an eye health problem, spectacles will not improve their vision.

WHY DO WE MEASURE VA?

- To have a starting point for the eye test
- Measuring VA tells us if there is a problem with the person's vision
  - It tells us if the person's vision is getting better or worse
  - It can guide us to what the problem is
- The VA measurement can help us to decide what to do next
- VA measurements are used as a definition for classifying a person as visually impaired or blind.

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TYPES OF VA MEASUREMENTS

We can measure visual acuity in two ways:

- **Unaided VA** (also called uncorrected visual acuity):
  - Visual acuity measured without spectacles

Figure 4-1: Unaided visual acuity is measured without spectacles

- **Aided VA** (also called corrected visual acuity or habitual visual acuity)
- Visual acuity when the person is wearing their spectacles
  - Spectacles can be for distance vision only, near vision only, or for both distance and near vision
  - It is important to make sure that the person is wearing distance spectacles when testing the distance vision, and wearing near spectacles when testing the near vision.

Figure 4-2: Aided visual acuity is measured with the person wearing their spectacles

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PRESENTING VISUAL ACUITY:

- **Common in babies and older people**
- **The tears will run over their cheeks and may look like they are crying**
- **The punctum needs to be opened or unblocked by a medical practitioner.**

- **Monocular and Binocular VA**:
  - Monocular visual acuity is the VA that a person gets when just one eye is open (when the other eye is covered)
  - Binocular visual acuity is the VA that the person gets when both eyes are open and uncovered
  - Both monocular VA (for right and left eyes) and binocular VA must be measured and recorded for every person.

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MEASURING VISUAL ACUITY

THE VA CHART

- We use a VA chart to measure how well a person can see
- Characters on a VA chart are usually largest at the top of the chart, and get smaller towards the bottom of the chart
- VA charts that use pictures or symbols (such as a tumbling E) are useful for children or for people who cannot read.

Figure 4-3a: VA letter chart

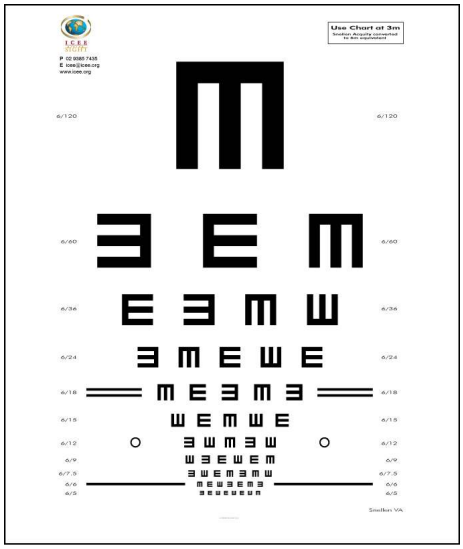

Figure 4-3b: A "tumbling E" VA chart

THE TUMBLING VA CHART

- If the person has not learnt to read you can use the "tumbling E" chart
- Ask the person to show you which way the arms of the "E" point. The person can do this by pointing their fingers in the same direction as the arms of the "E".

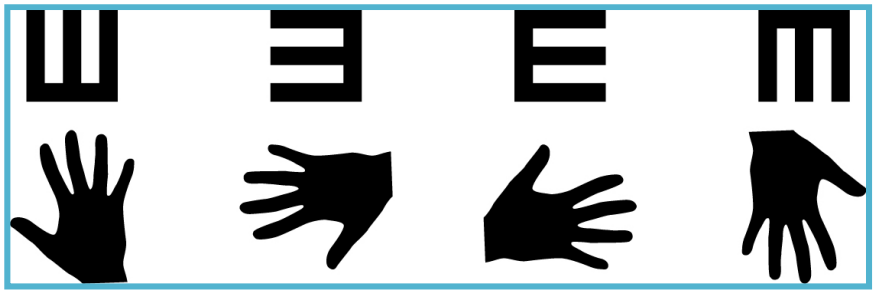

Figure 4-4: Hands with fingers pointed in the same direction as the "E"

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MEASURING DISTANCE VA

WORKING DISTANCE

- Visual acuity is most often measured with a chart placed 6 metres (or 20 feet) from the person
- Sometimes, in a room with limited space, charts are placed 3 metres (10 feet) from the person.
  In this case we need to use a special VA chart designed for use at 3 metres, or we need to adapt our VA measurements accordingly.

RECORDING VA

- 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
- 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 is the distance at which the person is being tested
  - The number on the bottom shows the distance at which a person with normal vision should be able to see that letter or line of letters.

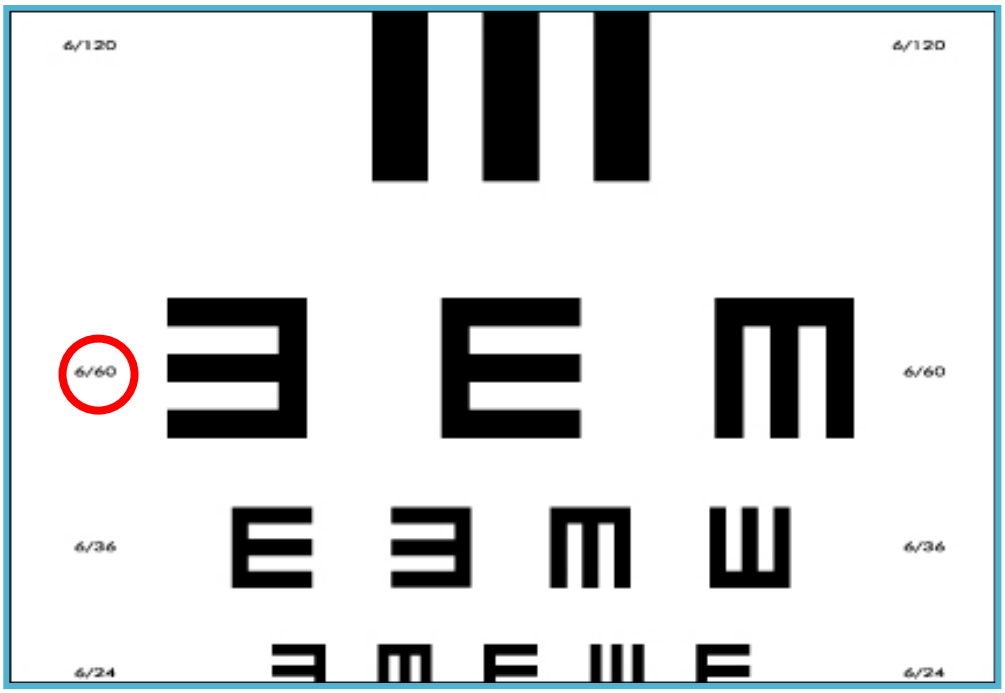

Figure 4-5: The Snellen fraction on the letter chart

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Visual acuity of 6/6 (or 20/20) is considered normal.

- The Snellen fraction can also be written in other ways. In some countries people use feet instead of metres to measure distance. VA charts that are made in these countries usually write VA measurements as 20/20 or 20/200, instead of 6/6 or 6/60. This is because 20 feet is the same distance as 6 metres.

MEASURING VISUAL ACUITY AT 6 METRES:

A 3 m VA chart is a VA chart that is used to measure VA at a distance of 3 metres.

It will have a Snellen fraction with the number 3 on the top of the fraction (in a 3/__ format). However, the normal way to record VA is in 6/__ format.

Because 6/__ is most common format, a 3 m chart will sometimes have its Snellen fractions converted to a 6/__ format for you.

This is to make it easier for you to record VA measurements in the 6/__ format, even when you are using a 3 m VA chart.

If you have a 3 m chart that has already done this conversion for you:

- **you only need to look at the Snellen fraction next to the line that the person can read and record this fraction**
- **you do not need to do any calculations or conversions yourself.**

The Brien Holden Vision Institute VA chart is a 3 m VA chart that has been converted to a 6/__ format for you.

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MEASURING DISTANCE VA

- Make sure the VA chart is in good light and that it is clean
- The VA chart must be placed at the exact distance the chart has been designed for (e.g. 6 metres or 3 metres). You need to measure this and maybe place a mark on the floor
- Cover the eye that is not being tested. Always test the right eye first (cover the left eye first)
  - Ask the person to use the palm of one hand to cover the eye not being tested

Figure 4-6: *Correct covering of the eye*

Make sure that the person:

- **is covering the correct eye**
- **does not press hard on the eye being covered**
- **keeps both eyes open (including the eye that is being covered)**
- **covers the eye with their palm, not their fingers**
- **does not lean forward or move closer to the chart.**

- Measure the VA
  - Start at the top of the chart where the larger letters are
  - Ask the person to name the characters until they get at least half of the line wrong
  - Encourage the person to try hard to see – they may give up easily or be ashamed of giving the wrong answer

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- Record the VA for the right eye (monocular acuity)
  - Include the details of the eye (right or left), aided or unaided, the Snellen fraction.
    Example: right eye, unaided 6/12 or RE unaided 6/12
- Repeat for the left eye (monocular acuity)
- Measure the visual acuity with both eyes open
- Record the visual acuity for both eyes together (binocular acuity).

A person's VA is measured by finding the smallest line of characters that they can correctly identify.

IF A PERSON CANNOT SEE THE LARGEST CHARACTER ON THE VA CHART

If the person cannot see even the largest characters on the VA chart (at its normal testing distance):

- Decrease the test distance (bring the person closer to the VA chart)
- Remember to change the top number of the Snellen fraction to the new distance testing distance (remember that the top number of the Snellen fraction shows the distance at which the person is being tested)
- For example: A man cannot see the 6/60 letter at 6 metres. You bring him closer to the chart and he can see it at 3 metres. His visual acuity is 3/60.

WORLD HEALTH ORGANISATION (WHO): CLASSIFICATION OF VISION

- The WHO has grouped different levels of VA into special categories
- They have done this so that people who have visual acuity worse than 6/18 can be given priority, if resources are scarce (minimal).

WHO Category	Visual Acuity
Normal vision	A person who can see the 6/18 line, and maybe lines that are smaller than this. This person sees reasonably well.
Visually impaired	A person who can see the 6/60 line, but cannot see the 6/18 line. This person does not see well.
Severely visually impaired	A person who can see the 6/120 line, but cannot see the 6/60 line. This person sees very poorly.
Blind	A person who cannot see the 6/120 or 3/60 line. This person can see very little, or nothing at all.

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IF A PERSON CANNOT SEE THE LARGEST LETTER ON THE CHART, EVEN WHEN THEY MOVE CLOSER

Figure 4-7: Counting fingers

- Hold up 1, 2, 3 or 5 fingers at a distance of 3 metres from the person
- Ask the person to count how many fingers you are holding up. If the person cannot see your fingers at 3 metres, move to 2 metres and ask the person again
- If the person cannot see your fingers at 2 meters, move to 1 metre and ask them again how many fingers you are holding up
- Record what the person can see as counting fingers (CF) and the distance
- For example: CF @ 2 m.

Figure 4-8: Hand movements

- If the person cannot see the number of fingers, wave your hand in front of the person's eyes at about 20cm
- If the person can see the movement of your hand, you can record the VA as "HM" (hand movement).

Figure 4-9: Light perception

- If the person cannot see HM, shine a light in front of the person's eyes at about 20 cm
- If they see the light, record their VA as "LP" (light perception)
- If they cannot see the light, record their VA as "NLP" (no light perception).

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EXAMPLES OF MEASURING DISTANCE VISUAL ACUITY

EXAMPLE 1

- A lady has no distance spectacles
- You measure her distance VA for each eye
- With each eye, the lady identifies all the characters correctly down to and including all the characters on the 6/6 line. You ask her to try the line below (the 6/5 line), but she does not get these characters correct
- Record her VA as follows: **VA: RE 6/6 unaided LE 6/6 unaided**
- This lady has very good unaided distance VA. She does not need distance spectacles.

Right (left eye occluded)

Figure 4-10a: Measuring the VA of the right eye (unaided)

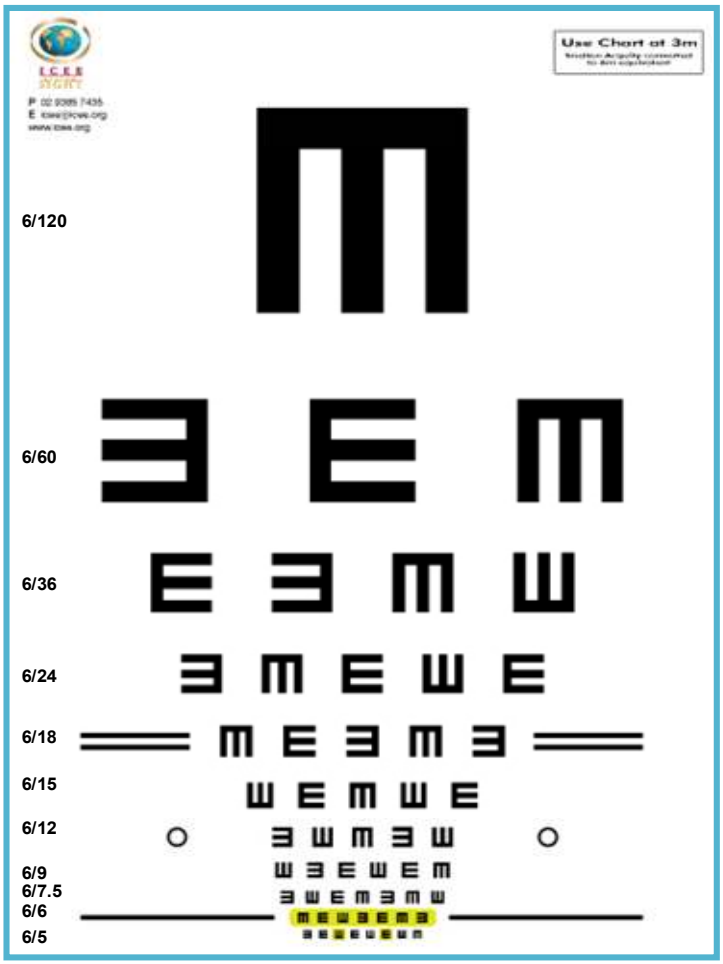

Figure 4-10b: The smallest characters the lady could identify with the right eye (the 6/6 line)

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Left (right eye occluded)

Figure 4-10c: Measuring the VA of the left eye (unaided)

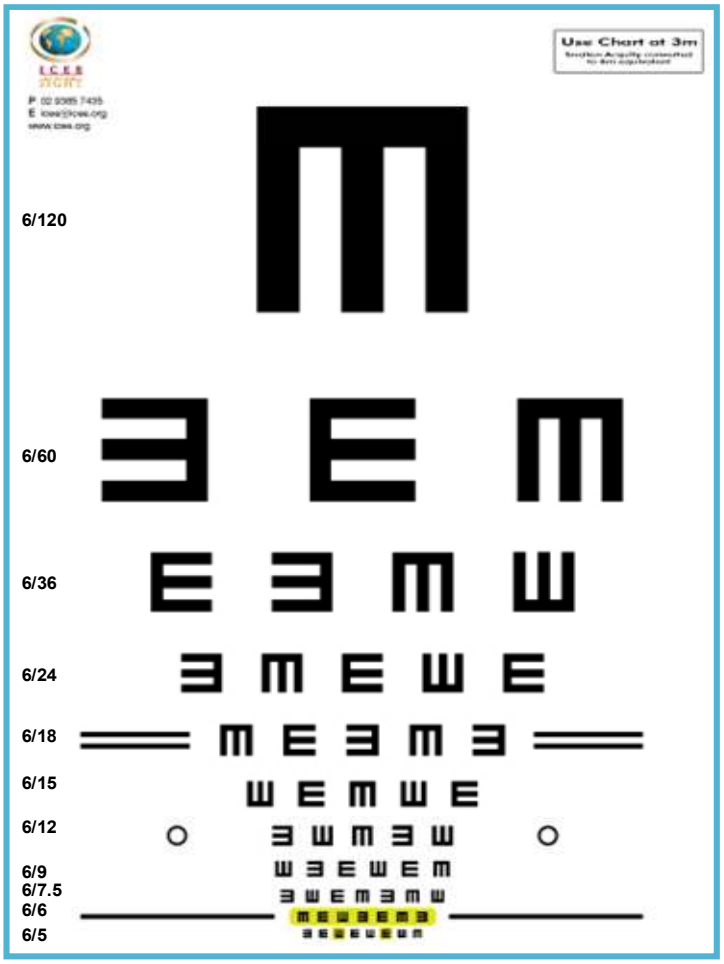

Figure 4-10d: The smallest characters the lady could identify with the left eye (the 6/6 line)

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EXAMPLE 2

A man comes to see you for an eye examination. He has spectacles for reading

- You measure his distance VA for each eye
- The man should not wear his spectacles for distance visual acuity measurement testing (because he uses his spectacles only for reading, not for distance vision)
- With his right eye, the man correctly identifies the 6/60 line, as well as 3 more letters on the line below it
- With his left eye, the man correctly identifies the 6/60 line, as well as one more letter on the line below it
- Record the man's VA as follows: **VA: RE 6/60+3 unaided LE 6/60+1 unaided**
- This man's unaided VA is very poor. He is visually impaired.

Right (left eye occluded)

Figure 4-11a: Measuring the VA of the right eye (unaided)

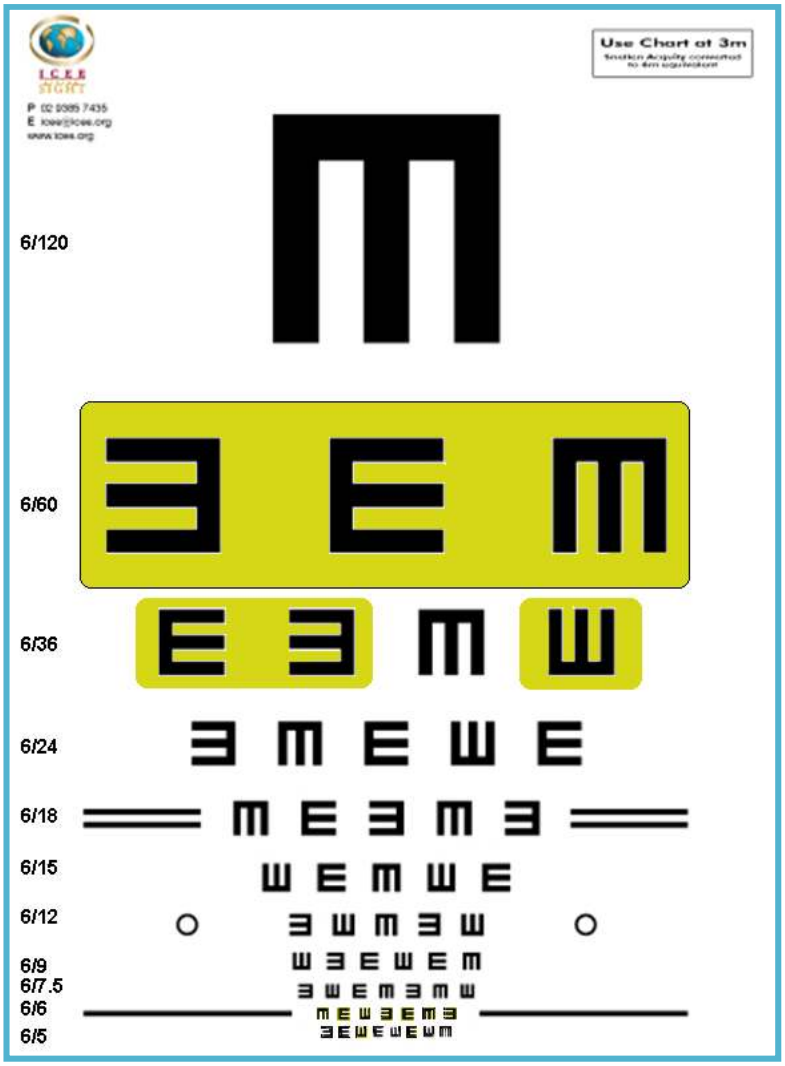

Figure 4-11b: The smallest characters the man could identify with the right eye

Left (right eye occluded)

Figure 4-11c: Measuring the VA of the left eye (unaided)

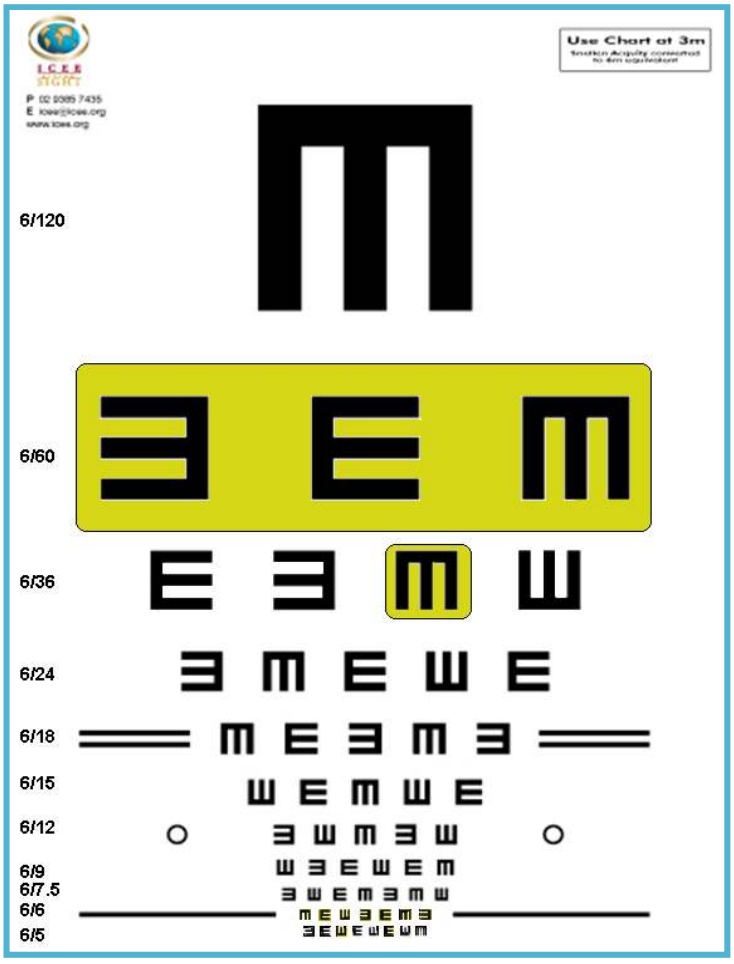

Figure 4-11d: The smallest characters the man could identify with the left eye

THE PINHOLE TEST

WHAT IS THE PINHOLE TEST?

- The pinhole test is a simple test that lets you find out whether poor visual acuity is caused by refractive error or by an eye health problem
- Pinhole acuity is measured using a pinhole occluder (Figure 4-12).

WHY DO WE DO THE PINHOLE TEST?

The pinhole test is important because it helps you find out if:

- A person's vision will get better with spectacles (refractive error) or
- If there is something other than a refractive error affecting the person's vision, such as:
  - A "lazy" eye

    A "lazy" eye is often "turned" or "crossed" and the person may be able to tell you if the vision in that eye has been bad since early childhood
  - An eye health problem (like cataracts, glaucoma or other eye disease).

WHEN DO WE DO A PINHOLE TEST?

- The pinhole test can be done whenever we suspect that a person's poor visual acuity could be related to uncorrected refractive error (the need to wear glasses to see clearly)
- Poor visual acuity due to uncorrected refractive error could be because a person does not have a pair of spectacles at all, or it could be that their spectacle prescription needs to be updated
- If the distance vision in either eye is worse than 6/18, you should do a pinhole test on that eye.

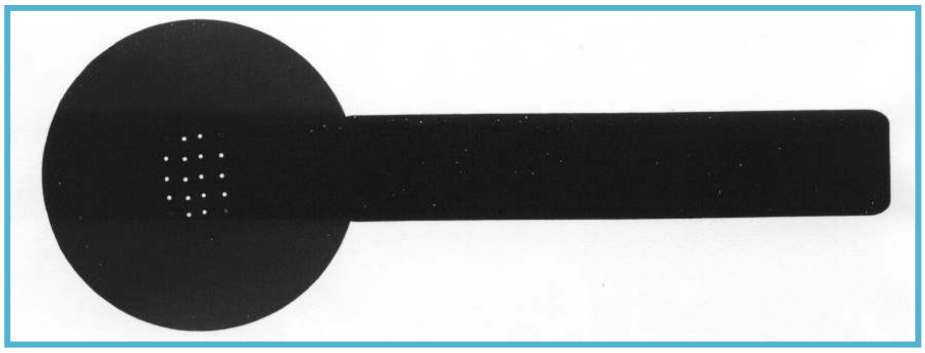

Figure 4-12: Pinhole occluder

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HOW TO MEASURE PINHOLE VA

- We do the pinhole test with a pinhole occluder
- Pinhole occluders are usually made of black plastic but you can make one from cardboard if you do not have one
- A pinhole occluder can have one hole or many holes. The holes should be about 1.0 to 1.5 mm
- To measure pinhole VA, the person must look through a special pinhole occluder (or simply, a pinhole) at a distance VA chart
- Pinhole VA is always measured monocularly (for each eye separately), and never binocularly (for both eyes together)
- Measuring pinhole VA is similar to measuring normal distance VA
  - Cover the eye not being tested
  - Put a pinhole occluder in front of the eye to be tested
  - Ask the person to look through the hole(s) and name the characters on the smallest line that they can see
  - When you write down the VA a person has with a pinhole test, remember to write “with pinhole” or “PH” after the VA
  - Example: RE 6/12 with pinhole (or RE 6/12 PH)
- The pinhole test is only used to measure distance VA, it is never used to measure near VA.

RESULTS OF THE PINHOLE TEST

- If VA improves with the pinhole test, it tells us that the eye has uncorrected refractive error
- The person needs to be referred for an eye examination as they probably need a pair of glasses to improve their vision
- If the VA improves with pinhole, it does not mean that the eye is definitely healthy though – an eye could have refractive error and eye disease at the same time
- The health of the eye should be examined during each eye exam, even if the VA was poor due to uncorrected refractive error and improved with the pinhole
- If a person’s pinhole VA is worse than 6/12, they should be referred to an eye care professional as they probably have an eye health problem.

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EXAMPLES OF MEASURING PINHOLE VA

EXAMPLE 1

Distance Visual Acuity

- A woman who has no distance spectacles comes to you for an eye examination
- You measure her distance VA for each eye
- With her right eye, she identifies the 6/120 letter correctly, as well as 2 more characters from the next line
- With her left eye, she identifies the all the letters on the 6/60 line correctly, as well as 3 from the next line
- You record her VA as follows: **VA: RE 6/120+2 unaided LE 6/60+3 unaided**
- Because her VA is less than 6/18 in each eye, you need to do a pinhole test.

Right (left eye occluded)

Figure 4-13a: Measuring the VA of the right eye (unaided)

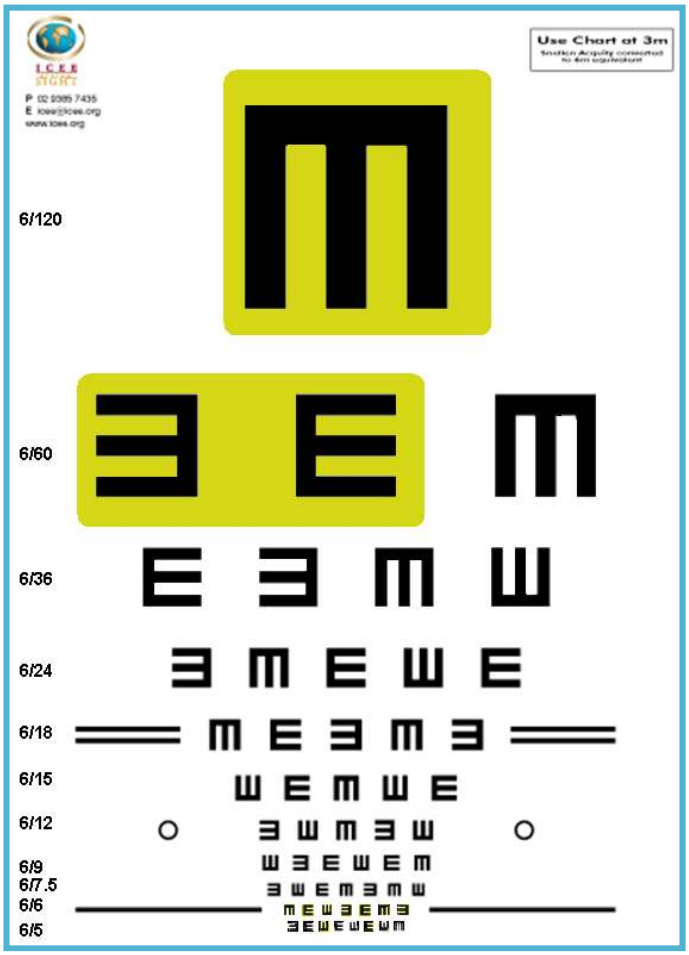

Figure 4-13b: The smallest characters the lady could identify with her right eye

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Left (right eye occluded)

Figure 4-13c: Measuring the VA of the left eye (unaided)

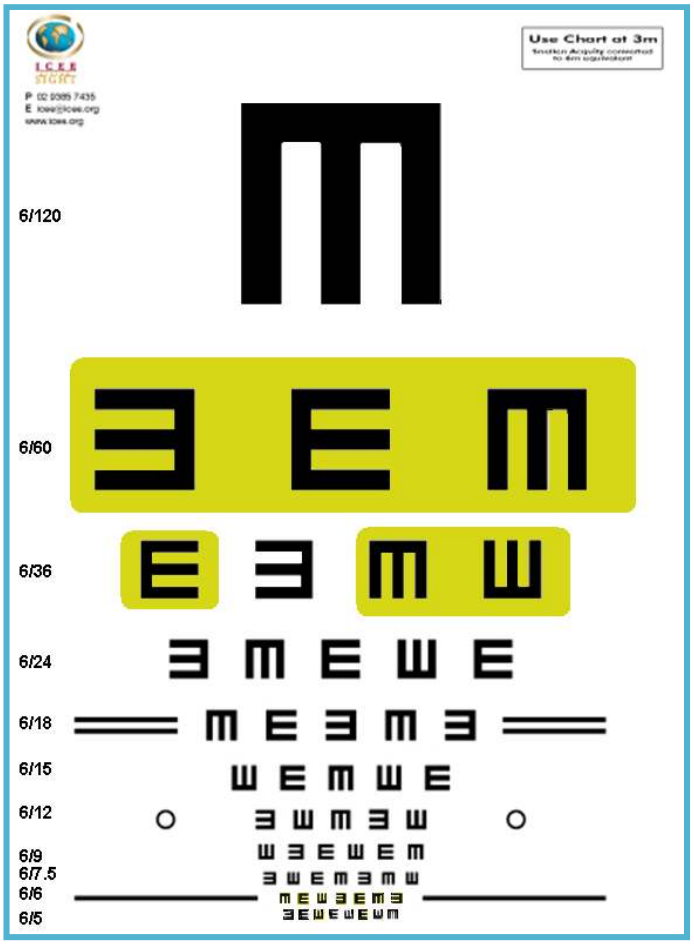

Figure 4-13d: The smallest characters the lady could identify with her left eye

Because her vision in each eye is less than 6/18, you need to do a pinhole test.

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Pinhole Visual Acuity

- You ask the woman to occlude her left eye with her hand, and to look through the pinhole occluder with her right eye
- She is able to correctly identify all the characters on the 6/7.5 line, but nothing more than that
- You then ask her to cover her right eye with her hand, and to look through the pinhole occluder with her left eye
- She is able to correctly identify all the characters on the 6/7.5 line, as well as 2 characters on the next line
- You record her pinhole VA as follows: **RE 6/7.5 PH LE 6/7.5+2 PH**
- This woman's VA in the right eye has improved from 6/120+2 (unaided) to 6/7.5 with the pinhole
- Her VA in the left eye improved from 6/60+3 (unaided) to 6/7.5+2 with the pinhole
- This improvement in VA with the pinhole tells us that her reduced VA is most likely due to uncorrected refractive error
- This lady needs and eye examination and a pair of spectacles to improve her distance vision.

Right (left eye occluded)

Figure 4-13e: Measuring pinhole VA of the right eye

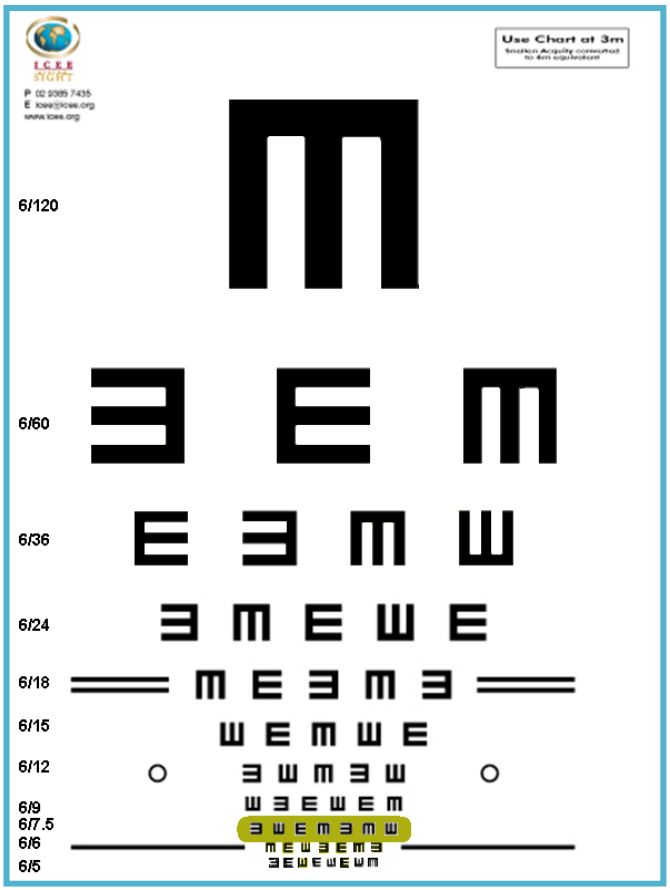

Figure 4-13f: The smallest characters the lady could identify with her right eye

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Left (right eye occluded)

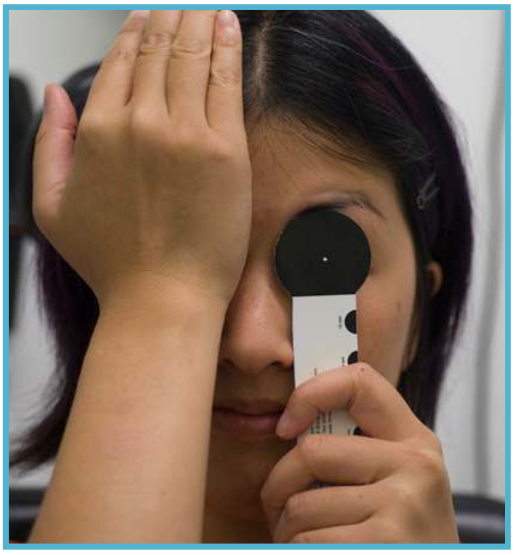

Figure 4-13e: Measuring pinhole VA of the left eye

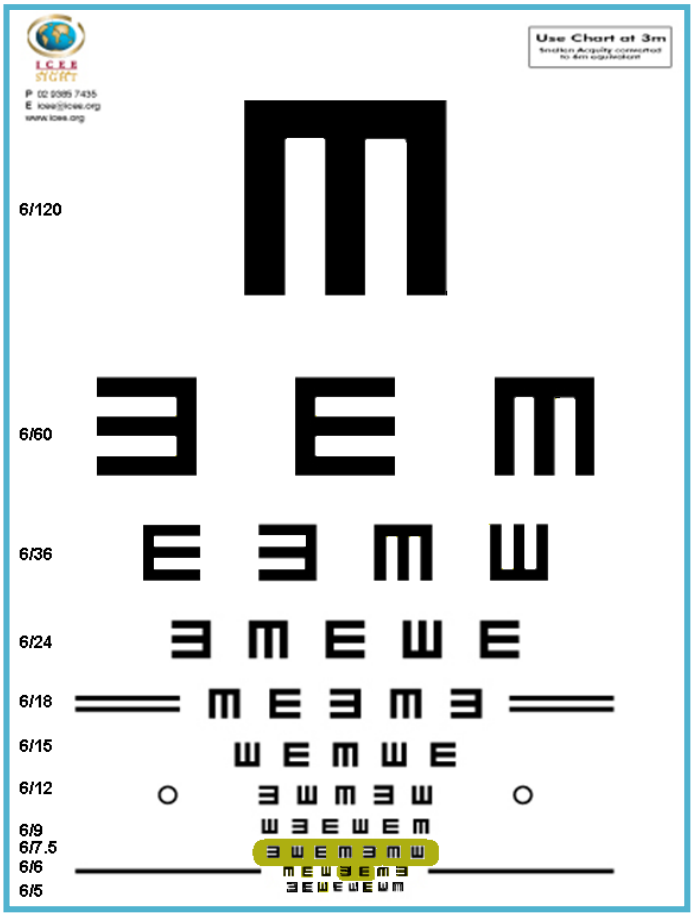

Figure 4-13f: The smallest characters the lady could identify with her left eye

EXAMPLE 2

- A man comes to you for an eye examination; he was given spectacles for distance vision 2 years ago
- You ask the man to put on his distance spectacles and you measure his distance VA for each eye
- Right eye VA (left eye occluded):
  - The man reads the 6/18 line correctly, and also gets 2 letters on the next line correct
  - You record his VA as follows: **VA: RE 6/18+2 aided**
  - Even though the pinhole test is optional in this case (because the VA is better than 6/18), you suspect that his spectacle prescription might not be good enough anymore, so you decide to do a pinhole test for this eye
  - With a pinhole the man can read the 6/6 line, but nothing on the next line
  - You record this as: **VA: RE 6/6 PH**
- Left eye VA (right eye occluded):
  - With his left eye, this man cannot see any letters on the VA chart even when he is wearing his spectacles
  - You ask the man to try very hard, but still he tells you that he cannot see any letters
  - You hold up some fingers 3 metres away from the man, and he correctly tells you that you are holding up two fingers
  - You write his VA as follows: **VA: LE CF @ 3m aided**

This man's left eye is worse than 6/18 so you must do a pinhole test.

- With a pinhole the man tells you that he still cannot see any letters on the chart
- You tell him to move the pinhole and see if that helps
- The man tells you that this does not make the VA chart easier to see
- You record this as: **VA: LE CF @ 3m aided PHNI** (pinhole no improvement). This means that the VA does not improve with a pinhole
- This man has very poor vision that is not due to refractive error
- This man might have an eye disease that is causing his poor vision
- He needs to be referred to an ophthalmologist or other eye care professional for a careful eye examination, as well as diagnosis and treatment of his eye condition.

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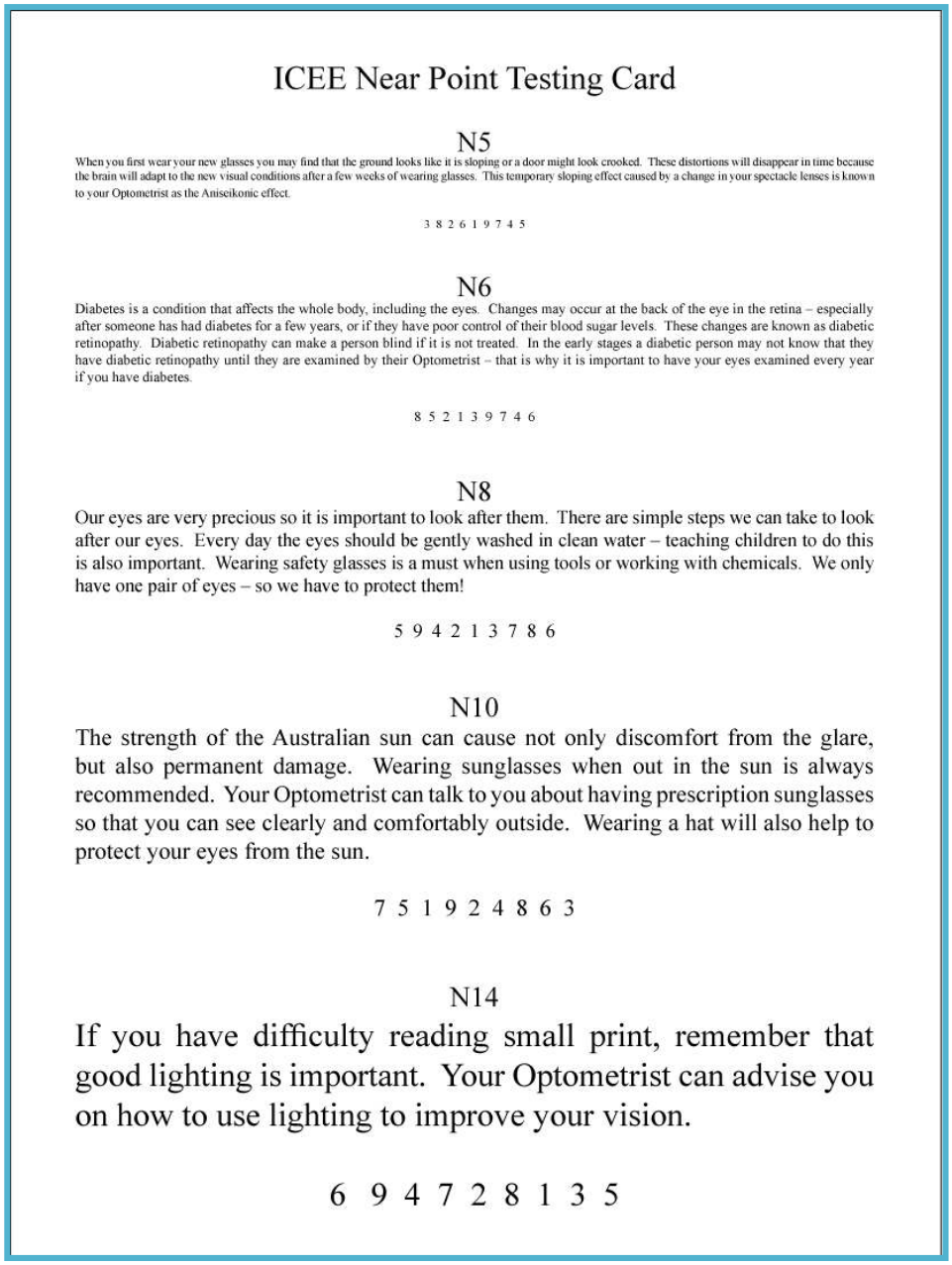
MEASURING NEAR VA

NEAR VISION CHARTS

- Near vision charts usually have paragraphs of words, rather than letters
- Instead of a Snellen fraction, they often use an "N" point scale
  - Most people can read N6
  - N8 is about the size of normal newspaper print
- Near charts with numbers or the tumbling E can be used for people who can not read.



ICEE Near Point Testing Card

N5

When you first wear your new glasses you may find that the ground looks like it is sloping or a door might look crooked. These distortions will disappear in time because the brain will adapt to the new visual conditions after a few weeks of wearing glasses. This temporary sloping effect caused by a change in your spectacle lenses is known to your Optometrist as the Aniseikonic effect.

3 8 2 6 1 9 7 4 5

N6

Diabetes is a condition that affects the whole body, including the eyes. Changes may occur at the back of the eye in the retina – especially after someone has had diabetes for a few years, or if they have poor control of their blood sugar levels. These changes are known as diabetic retinopathy. Diabetic retinopathy can make a person blind if it is not treated. In the early stages a diabetic person may not know that they have diabetic retinopathy until they are examined by their Optometrist – that is why it is important to have your eyes examined every year if you have diabetes.

8 5 2 1 3 9 7 4 6

N8

Our eyes are very precious so it is important to look after them. There are simple steps we can take to look after our eyes. Every day the eyes should be gently washed in clean water – teaching children to do this is also important. Wearing safety glasses is a must when using tools or working with chemicals. We only have one pair of eyes – so we have to protect them!

5 9 4 2 1 3 7 8 6

N10

The strength of the Australian sun can cause not only discomfort from the glare, but also permanent damage. Wearing sunglasses when out in the sun is always recommended. Your Optometrist can talk to you about having prescription sunglasses so that you can see clearly and comfortably outside. Wearing a hat will also help to protect your eyes from the sun.

7 5 1 9 2 4 8 6 3

N14

If you have difficulty reading small print, remember that good lighting is important. Your Optometrist can advise you on how to use lighting to improve your vision.

6 9 4 7 2 8 1 3 5

Figure 4-14: A near vision chart

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HOW TO MEASURE NEAR VISUAL ACUITY

- Near VA is usually measured with both eyes open
- Older people may have spectacles for near vision (like reading or sewing). Their near vision is tested with these spectacles. We must record if reading or sewing spectacles are used when testing near vision
- The person must hold the near VA chart at 40 cm
- Ask the person to read the smallest paragraph of text or line of numbers they can read

  Encourage the person to try hard to see – they may give up easily or be ashamed of giving the wrong answer
- Record the visual acuity
- For example: **Near VA: N8 unaided** or **Near VA: N8 aided** (if the person was wearing their near vision spectacles)
- If vision is worse than N6, you need to refer the person to a refractionist or trained eye care professional for a near refraction.

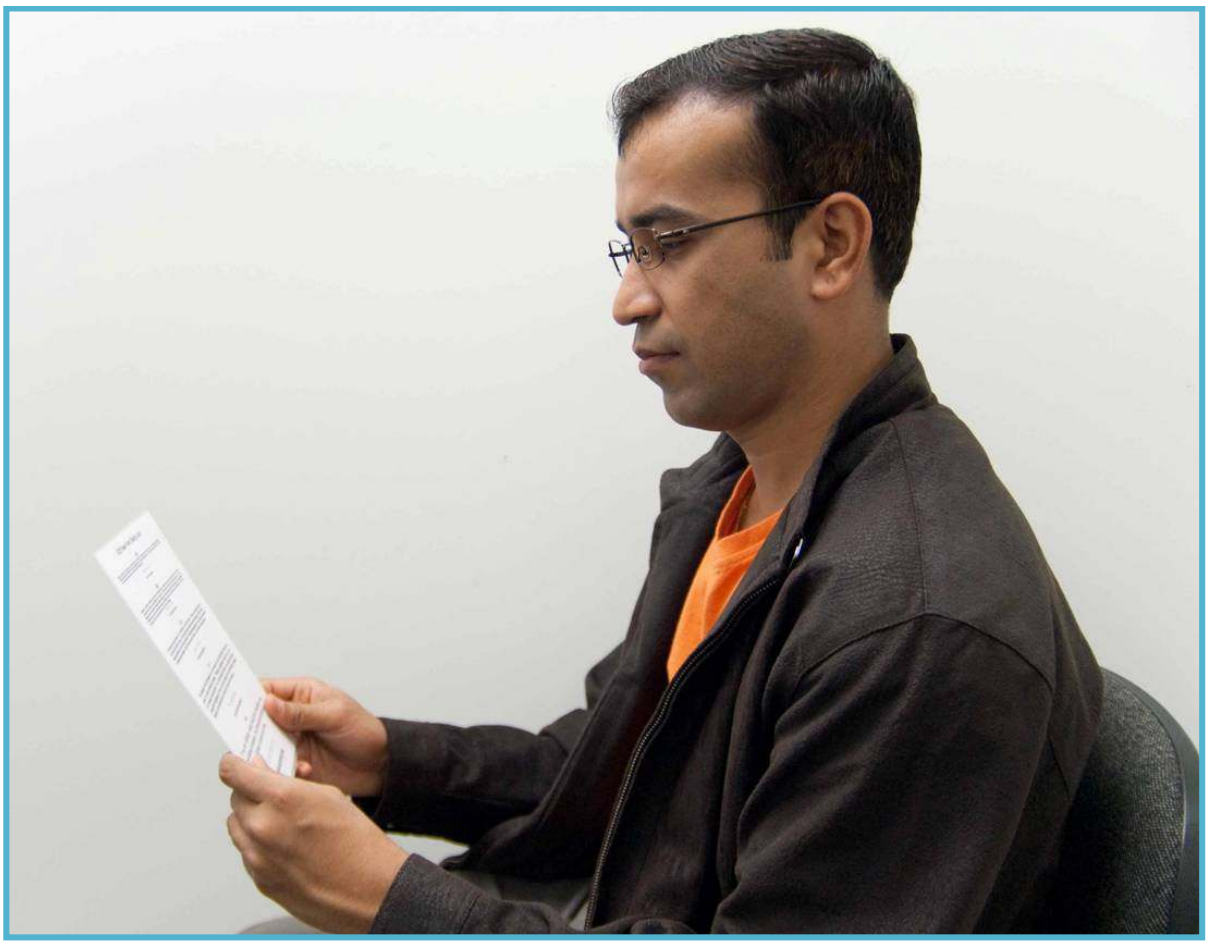

Figure 4-15: Measuring near VA – the person holds the near VA chart at their normal reading or near working distance

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EXAMPLES OF MEASURING NEAR VA

EXAMPLE 1

- A man has no distance spectacles and no near spectacles
- His distance VA is RE 6/6 unaided and LE 6/6+2 unaided
- You measure his near VA while he keeps both his eyes open
- You ask the man to read the smallest print that he can see on the reading card
- The smallest print that he can read is N12
- You write: **Near VA: N12 unaided**
- This man has good distance VA, but he cannot read a newspaper or see small objects that are close to him
- He may need spectacles for close work or reading.

EXAMPLE 2

- A woman has spectacles for both distance and near vision
- Her distance VA is RE 6/9 aided and LE 6/12 aided
- You measure her near VA while she is wearing her near spectacles
  - Right eye (left eye occluded): The smallest print on the reading card that she can read with her right eye is N6

    You write: **RE Near VA: N6 aided**
  - Left eye (right eye occluded): With her left eye, the smallest print that she can read is N8

    You write: **LE Near VA: N8 aided**
- Just like her distance VA, this woman's near VA is worse in her left eye than in her right eye.

EXAMPLE 3

- A man has the following distance VA: RE 6/60+3 unaided LE 6/60+4 unaided
- He is visually impaired when he looks in the distance
- He also has spectacles for near vision, and you measure his near VA while he is wearing his spectacles
- He keeps both his eyes open and you ask him to read the smallest print that he can see on the reading card
- The smallest print that he can read is N6
  - You write: **Near VA: N6 aided**
- With his reading glasses, this man has good near VA
- Because his near VA is so good, it is unlikely that he has any eye disease
- We would expect that his distance VA would also improve if he was given distance spectacles.

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SUMMARY – MEASURING VISUAL ACUITY

VISUAL ACUITY

- Visual acuity (VA) is a measure of how well a person sees when they look directly at an object
- Common causes of poor VA:
  - Refractive error (a person needs spectacles)
  - Eye health problems (for example cataracts)
- VA measurement is one of the first tests that you do for a person when they come to you for an eye examination.

TYPES OF VA MEASUREMENTS

- Distance VA must be measured for the right and left eye separately (monocular VA) and together (binocular VA)
- Near VA is usually measured for both eyes together
- Unaided VA is the VA measurement without spectacles
- Aided VA is the VA measurement with spectacles.

MEASURING VA

- Make sure the VA chart is clean and in good light
- Place the VA chart at the correct distance away from the person (usually 6 metres or 3 metres)
- Occlude the eye not being tested (always test right eye first, cover the left eye)
- Measure the VA: Find the smallest line that a person can see
- Record the VA measurement using the Snellen fraction
- Repeat for the left eye.

ADDITIONAL VA TEST

- If a person cannot see the top line of the VA chart, try:
  - Finger counting (FC) at 3 m, 2 m, then 1 m
  - Hand movements (HM) at 20 cm
  - Light perception (LP) at 20 cm
  - No light perception (NLP) at 20 cm.

THE PINHOLE TEST

- The pinhole test is a simple test that lets you find out whether poor visual acuity is caused by refractive error or an eye health problem
- If VA is less than 6/18, the pinhole test should always be performed
- If VA improves with the pinhole, the person has uncorrected refractive error
- If VA with pinhole is worse than 6/12, the person should be referred because they might have an eye health problem.

NEAR VA TEST

- Near vision charts usually have paragraphs of words or lines of numbers
- Near VA is most commonly recorded on an “N” point scale
- Near vision is tested with the person’s near work spectacles (if they have any)
- The person must hold the near chart at their normal reading or close work distance
- Refer to a refractionist or trained eye care professional if they see N6 or worse.

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TEST YOURSELF QUESTIONS

1. **Name two reasons why it is important to measure VA.**

_____

_____

2. **What does unaided vision mean?**

_____

3. **What does aided vision mean?**

_____

4. **What does presenting vision mean?**

_____

5. **If a person has not learned to read, how can you measure their visual acuity?**

_____

6. **Can all distance vision charts be used at 6 metres (tick one)?** ☐ **Yes** ☐ **No**
Please explain your answer

_____

7. **Why should you remember to look at the person while you measure their VA?**

_____

8. **When would you measure pinhole VA?**

_____

_____

9. **If a person has poor vision with pinhole, what does this mean, and what should you do?**

_____

_____

10. **If a person cannot see the largest letter on the VA chart, what other tests can you do to measure their visual acuity?**

_____

_____

_____

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