Brien Holden Vision Institute

PINHOLE VISUAL ACUITY

THINK

A man comes to you and tells you that his vision has become worse over the past year.

When you measure his visual acuity, he can only read the 6/24 line with both his right and his left eyes.

You want to know if this man's vision is poor because of a refractive error, or if it is because he has an eye disease.

The pinhole test is an easy test that you can do to help you find the answer.

AIM

This unit shows you how to do the pinhole test and to understand what its results mean.

LEARNING OUTCOMES

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

- recognise when you need to do a pinhole test
- describe what the results of the pinhole test mean
- use the pinhole test to measure and record pinhole visual acuity
- explain the possible causes, symptoms and treatment for amblyopia
- decide when to refer a person with poor VA for further care based on the results of the pinhole test.

REVIEW: PINHOLE VISUAL ACUITY

VISUAL ACUITY	• Visual acuity (VA) is a measure of how clearly a person sees when they are looking directly (straight) at an object. • Common causes of poor VA are: - Refractive error (when a person needs spectacles to see clearly) - Eye health problem (when a person has a problem with the health of their eyes). • VA measurement is usually the first test that you do for a person when they come to you for an eye examination. • VA must be measured for the right and left eyes separately.
DISTANCE VA CHARTS	• Different VA charts have specific purposes, and a specific distance that it should be used at. • VA charts use characters (letters, pictures, numbers or symbols) of different sizes. The largest characters are usually at the top of the chart and gradually get smaller towards the bottom of the chart. • VA chart characters and the spaces between them are carefully calculated and printed, to make sure VA measurements are accurate and repeatable. It is very difficult to make a correct VA chart so we usually use readymade VA charts.
SNELLEN FRACTIONS	• Each line of a VA chart is labelled. Usually the label is a fraction number 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 this number is 6 because the 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. $$VA = \frac{\text{Testing distance (m)}}{\text{Distance someone with normal vision could read the same VA line (m)}}$$
PINHOLE AV	If the distance VA for either eye is worse than 6/18 you must do another test called the pinhole test.

PINHOLE TEST

The pinhole test is a simple test that lets you find out whether poor visual acuity (VA) is caused by refractive error or by an eye health problem.

A person with a refractive error needs to wear spectacles so that they can see clearly and comfortably.

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). The pinhole test is only used to measure distance VA, it is never used to measure near VA.

PINHOLE

A pinhole looks like an occluder, but it has a small hole (or sometimes many holes) in the middle of it. Usually a pinhole occluder is made of black plastic, but you can make your own from cardboard if you do not have plastic.

***Figure 11.1**: A pinhole occluder from a trial lens set*

The size of the pinhole is important - if it is too big or too small, the pinhole test will not work properly. The size of the hole must be 1.0 millimetres (mm) to 1.5 mm in diameter.

A pinhole occluder may have only one hole, or it may have many holes. A pinhole occluder that has many holes is easier for a person to use because they may choose any of the holes to look through.

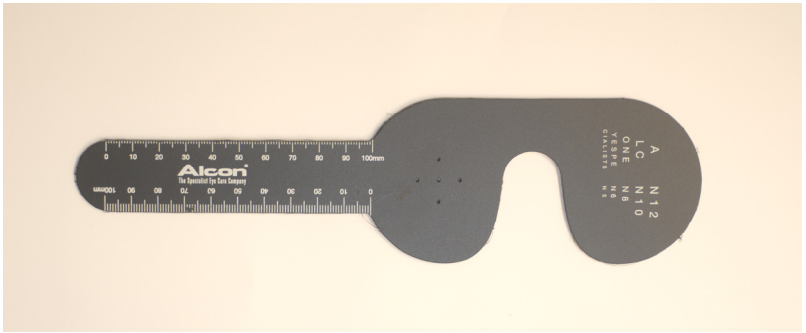

***Figure 11.2:** A pinhole occluder with multiple holes*

PINHOLE TEST (cont.)

WHEN TO DO THE PINHOLE TEST

You must always do a pinhole test if a person's presenting distance VA is worse than 6/18 for either eye.

If VA is worse than 6/18 → you must do a pinhole test.

A pinhole test can also be used if

- a person has poor presenting VA (even if it is better than 6/18)
- a person still cannot read the 6/6 line when you have finished your refraction examination.

WHAT DO PINHOLE RESULTS MEAN?

VA improves when they look through a pinhole, the person has an uncorrected refractive error. You would expect that the person's best corrected VA (with spectacles) will be at least as good as their VA through the pinhole.

If the person's VA does not improve with the pinhole test, the person probably has an eye health problem. They might also have amblyopia (explained later in this unit). Spectacles will not improve this person's vision, unless they have both a refractive error and an eye health problem.

If VA improves with the pinhole test, it means that the eye has an uncorrected refractive error.

This does not mean that the eye is definitely healthy.

It is possible for an eye to have refractive error and an eye disease at the same time.

Therefore, we should always examine the health of the eye even if the pinhole VA is good.

If the VA improves to 6/12 or better when a pinhole is used (written as 6/12+ PH), the person must have a refraction examination. A refraction will tell you what power spectacles the person needs to make their vision better.

If the pinhole improves the VA, you can expect approximately the same improvement in VA with spectacles.

For example:

Presenting VA	RE: 6/36 aided	LE: 6/36+4 aided
Pinhole VA	RE: 6/9 +2 PH	LE: 6/7.5 PH
Best corrected VA	RE: 6/7.5 aided	LE: 6/7.5+2 aided

The pinhole VA and the best corrected VA are almost the same.

The best corrected VA is the best possible VA that a person gets after they have had their eyes refracted – this is the vision that they will get with spectacles.

PINHOLE TEST (cont.)

WHAT DO PINHOLE RESULTS MEAN?

If the VA is not better than 6/12 with a pinhole, they may have an eye health problem, with or without a refractive error.

An eye that has a VA worse than 6/12 (even when the pinhole is used) might have an eye disease and must be referred for further examination and care.

For example:

Presenting VA	RE: 6/24+2 unaided	LE: 6/48+4 unaided
Pinhole VA	RE: 6/12+2 PH	LE: 6/18 PH

This person must be referred because their LE pinhole vision is worse than 6/12.

BE CAREFUL

- **People with VA better than 6/18:**
  Sometimes, doing the pinhole test for an eye that has good VA can make its VA worse. This is because less light can enter the pupil through a pinhole. For this reason, the pinhole test is less useful for people who already have good VA.

- **People with small pupils:**
  The pinhole test might not work well for people who have small pupils. Older people have smaller pupils than younger people. You might find that your pinhole VA results for an older person are less accurate.

Pupils and Age:
As we get older our pupils get smaller. Small pupils can be thought of as natural pinholes in our eyes.

This is why some old people can see better than you would expect – they are using their pupils as natural pinholes!

Pupils and Light:
In bright light our pupils are smaller than in dim light.

There are two reasons why people see better in good bright light:
- more light can enter the eye
- small pupils are like natural pinholes.

If a person has a refractive error they will see better in bright light, when their pupil is small.

Squinting and Refractive Error:
You may have noticed that sometimes people squint their eyes (bring their eyelids closer together) when they want to see something better.

These people probably have refractive error. They have discovered that by making a small space between their eyelids, they can see better.

These people are making their own pinhole with their eyelids!

This is why it is important to make sure that people do not squint their eyes when you are measuring their distance VA, but keep their eyes open normally. Otherwise the VA measurement will be incorrect.

MEASURING PINHOLE VISUAL ACUITY

Measuring pinhole VA is similar to measuring normal distance VA.

STEP 1	**Occlude (cover) the eye not being tested.** Occlude the person's left eye. This can be done with an occluder, or simply with the palm of the person's hand.
STEP 2	**Use the pinhole occluder on the other eye** Put a pinhole occluder in front of the right eye. You can also ask the person to hold the pinhole occluder themselves.  If the pinhole is held closer to the person's eye, the VA chart will seem to be brighter. This will make it easier for the person to see.
STEP 3	**Measure pinhole VA.** Ask the person to look through the pinhole and name the characters on the smallest line that they can see on the distance VA chart.
STEP 4	**Record pinhole VA.** Write down the pinhole VA measurement on the record card. Remember to write down that it is a pinhole VA measurement: **Example:** RE 6/7.5 with pinhole or RE 6/7.5 PH
EXAMPLES OF MEASURING PINHOLE VA **EXAMPLE 1**	A woman who has no distance spectacles comes to you for an eye examination. You measure her distance VA for each eye. • Right eye VA (left eye occluded): The woman reads the 6/120 line correctly, but only gets two letters correct on the 6/60 line (below the 6/120 line). → You write: **VA RE 6/120+2 unaided** • Left eye VA (right eye occluded): With her left eye, this woman can read all of the 6/60 line. You ask her to try the characters on the line below (6/48 line), and she gets three of these characters correct. → You write: **VA LE 6/60+3 unaided**. **This woman's VA is *worse than 6/18* in both eyes so you must do a pinhole test.** **Y**ou measure her pinhole VA for each eye. • RE looks through the pinhole and LE is occluded. Now the woman can read all of the 6/7.5 line, but she cannot read any letters on the line below it. → **You write: VA RE 6/7.5 PH** • LE looks through the pinhole and RE is occluded. With this eye the woman can see all the letters on the 6/7.5 line and two letters on the next line. → **You write: VA LE 6/7.5+2 PH** From this we expect that the woman's poor VA is a result of refractive error and we expect that this woman will see very well with spectacles.

MEASURING PINHOLE VISUAL ACUITY (cont.)

EXAMPLE 2	A man comes to you for an eye examination. He was given distance spectacles 2 years ago and he wears them all the time. You ask the man to put his distance spectacles on, and measure his distance VA for each eye (this is the man's habitual VA). • Right eye VA (left eye occluded): The man reads the 6/18 line correctly, and gets two letters correct on the 6/15 line (below the 6/18 line). → You write: **VA RE 6/18+2 aided** You decide to try a pinhole test for this eye (even though this test is optional because the VA Is better than 6/18). With a pinhole he can read the 6/6 line, but nothing on the next line. → You write: **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 two fingers 3 m away from the man, and he correctly tells you that you are holding up two fingers. → You write: **VA LE CF @ 3 m aided** **This man's left eye VA 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 write: **VA LE CF @ 3 m aided PHNI** **PHNI = Pinhole No Improvement** This means that the VA does not improve with a pinhole. This man has very poor vision that is not only due to uncorrected refractive error. This man probably has an eye health problem that is causing his poor vision and needs to be referred.

WHAT TO DO WITH PINHOLE VISUAL ACUITY RESULTS

You now know how to measure pinhole VA, but you also need to know what it means and what you should do next.

If the pinhole VA is 6/12 or better → Do a refraction.

If the pinhole VA is 6/12 or worse → Refer for an eye health check.
→ You can also do a refraction.

AMBLYOPIA

CAUSE OF AMBLYOPIA

An eye with amblyopia is sometimes called a lazy eye. An amblyopic eye will not see clearly – even if a pinhole is used.

Amblyopia develops during early childhood when the eyes are growing and the brain is developing.

During childhood, the brain makes pathways that let it interpret visual messages that are sent to it by the eye. If an eye does not see clearly during childhood, the brain will not be able to make these pathways.

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Examples:

- A child will not see clearly if she has high refractive error.
- A child will not see clearly if he has a cataract.

Both of these children will probably get amblyopia if they do not get treatment in time.

Most brain development for vision occurs before a child is 7 years old. After 7 years the brain will still develop, but the growth will be much slower and the visual pathways to the brain will probably never work as well as they should – this is why amblyopia develops if eye problems are not treated when a child is still very small.

An adult who gets poor vision later in life will not develop amblyopia because the visual pathways already developed in the first years of life. Unlike a child, when the cause of the poor vision is removed, an adult will see clearly again.

Example

A 55 year old man gets a cataract, but he does not have the chance to have it operated on until he is 65 years old.

When the cataract is removed his eye will see clearly again – he did not develop amblyopia, because his visual pathways were already formed.

DETECTING AMBLYOPIA

Sometimes a person who has poor vision in one eye never knows that they have a problem. This is because when both eyes are open the good eye can provide all the visual information that a person needs. It is only when both eyes are tested separately that the problem becomes obvious. This is why it is important to always measure VA for each eye separately during an eye exam.

If a child has poor vision in only one eye, it is extremely unlikely that she will notice it. This is because she will use her other eye to see.

Usually a child with poor vision in only one eye will only be identified if she has her eyes examined by a trained eye care worker.

Sometimes a person will tell you that their vision in one eye has always been poor. If a person tells you this they might have amblyopia, but you must check for all other eye problems first.

Amblyopia is a diagnosis of exclusion

This means that you can only say that a person has amblyopia if all other possible reasons for poor vision have been excluded (ruled out).

It can be very dangerous to just assume that a person has amblyopia when their vision is poor – they might have a more serious eye disease that you are missing!

AMBLYOPIA (cont.)

Usually the best corrected VA of an amblyopic eye will be 6/9 or worse.

Sometimes an eye that has amblyopia will also have a strabismus (a turned eye).

- Strabismus can cause amblyopia (because the turned eye does not see very well and the visual pathways do not form normally; and
- Amblyopia can cause strabismus.

TREATMENT OF AMBLYOPIA

It is extremely important that a young child who has poor vision receives treatment for the eye problem as soon as possible.

If a child does not receive treatment for their poor vision early, the child might become amblyopic which means their vision will be permanently affected.

If you think that a child has amblyopia, you must refer the child to someone who is trained in the treatment of amblyopia (or someone who knows how to manage children's vision) as soon as possible.

The earlier a child is treated for the poor vision, the more likely it is that they will get their vision back and not develop amblyopia.

EXAMPLES

- You examine a 20 year old woman who has had high hyperopia in her right eye since she was a baby. You give her the first pair of spectacles she has ever had.

  Even though the image on her retina is now clear, her brain never learned how to interpret the visual message from this eye.

  Her vision with her right eye will never be perfectly clear – because the high hyperopia in that eye was treated at an early age while the visual pathways were still developing. She has amblyopia in her right eye.

- A 30 year old man comes to you for an examination. He tells you that he was born with a cataract in his eye. Last year he finally had the opportunity to have a cataract operation.

  Even though the cataract is now gone, his brain never learned to understand visual messages from this eye when he was a child.

  His vision with his left eye will never be perfectly clear – his left eye is amblyopic.

Can you see why it is important to treat the cause of poor vision at an early age?

- You examine the eyes of a 4 year old girl and discover that she has a large amount of refractive error in both eyes.

  You give her spectacles and tell her that she must wear them all the time – even though it might take a few weeks for her to feel comfortable wearing the glasses.

  Now her eyes have clear vision and her brain has a chance to make visual pathways.

  This girl will not develop amblyopia and will have good vision when she is older (although she will need to wear spectacles for her whole life to see clearly), because her refractive error was treated early and her visual pathways can now develop normally.

INTERESTING FACT:

Imagine this girl in the example is now 18 years old. She has worn her spectacles every day since she was 4 years old, but now she refuses to wear her glasses even though her vision is blurry without them.

Do you think that she will develop amblyopia now?

No! Even if she does not wear her spectacles again until she is 28 years old she will not develop amblyopia.

This is because her brain made the visual pathways it needed when she was a small girl (when she was wearing her spectacles).

If this girl starts to wear her spectacles again when she is 28 she will see clearly again – she will not have amblyopia.

Amblyopia in an adult cannot be treated – it is too late. This is why it is so important to treat amblyopia and the causes of poor vision in children as early as possible.

SUMMARY: PINHOLE VISUAL ACUITY

THE PINHOLE TEST

- The pinhole test is a simple test that lets you find out whether poor visual acuity (VA) is caused by refractive error or an eye health problem.
- To measure pinhole VA, the person must look through a pinhole at a distance VA chart.
- A pinhole looks like an occluder, but it has a small hole (or sometimes many holes) in the middle of it.
- You can make your own pinhole, but you must be careful that the size of the hole or holes is between 1 mm and 1.5 mm in diameter.
- You must do a pinhole test if a person's presenting distance VA is worse than 6/18 for either eye.
- You can also do a pinhole test if:
  - the person has poor presenting VA (even if it is better than 6/18)
  - the person still can't read the 6/6 line after you have finished your refraction examination.

WHAT DO PINHOLE VA RESULTS MEAN

- If VA improves with a pinhole
  → the person has a refractive error.
  This does not mean that the eyes are definitely healthy. It is possible for an eye to have a refractive error and an eye disease at the same time.
  We should always examine the health of the eye even if the pinhole VA is good.
- If VA does not improve with a pinhole
  → the person has an eye health problem or amblyopia (a lazy eye).
- If VA improves to 6/12 or better with a pinhole, the person needs a refraction examination. A refraction will tell you what power spectacles the person needs to make their vision better.
- The best corrected VA (after a refraction) should be at least the same as the pinhole VA.

MEASURING PINHOLE VA

- Occlude the eye not being tested.
- Put a pinhole in front of the other eye.
- Measure the person's VA when they look through the pinhole.
- Record the pinhole VA.
  Example: RE 6/7.5 PH

WHAT TO DO AS A RESULT OF PINHOLE VA

- If pinhole VA is better than 6/12→ do a refraction.
- If pinhole VA is worse than 6/12
  → Refer for an eye health check
  → You can also do a refraction.

AMBLYOPIA

- Sometimes called lazy eye. Usually the best corrected VA of an amblyopic eye will be 6/9 or worse.
- This is an eye problem that develops during early childhood (usually before a child is 7 years old) if the child does not see clearly. This is because the brain does not make pathways to interpret visual messages.
- An adult who gets poor vision later in life will not develop amblyopia because the visual pathways are already developed.
- An amblyopic eye will never see perfectly – even with a pinhole.
- Ambyopia is a diagnosis of exclusion
  → This means that you can only say that a person has amblyopia if all other possible reasons for poor vision have been excluded (ruled out).
- If you think that a child has amblyopia you must refer the child as soon as possible.
  The earlier a child is treated, the more likely it is that they will get their vision back.
- Amblyopia cannot be treated in adults – it is too late.
  This is why it is important to refer children as early as possible.

TEST YOURSELF QUESTIONS

1. **What size (diameter) should a pinhole be to get the best results?**

   _____

2. **When *must* you do the pinhole test?**

   _____

3. **If a man's unaided distance visual acuity (VA) improves when he looks through a pinhole, what does this mean?**

   _____

4. **If a woman's unaided distance VA stays the same when she looks through a pinhole, what does this mean?**

   _____

5. **If a man has poor distance VA with his current distance spectacles, but good VA with a pinhole, what does this mean?**

   _____

6. **A woman's distance VA is 6/18 unaided and 6/6 with a pinhole. Does this mean that the woman does not have an eye health problem?**

   _____

7. **What things can make your pinhole VA measurement less accurate?**

   _____

   _____

   _____

8. **A pinhole test should always be done** *(circle all correct answers)*:

   a. ☐ Monocularly ☐ Binocularly

   b. ☐ For Distance ☐ For Near

9. **If you think a child has amblyopia, what must you do?**

   _____

10. **If an adult has amblyopia, what must you do?**

    _____

11. **What must you do if the pinhole VA is worse than 6/12?**

    _____

NOTES