



# NEAR REFRACTION FOR PRESBYOPIA

## THINK

A 43 year old woman comes to you for an eye examination. She tells you that she can see very well when she looks far away, but for the last few years she has had trouble seeing up close, especially for sewing.

You measure her distance visual acuity and it is very good. You measure her near visual acuity and it is poor.

You know that this means that the woman has presbyopia and will need to wear near spectacles so that she can see her sewing clearly. How will you know what power near spectacles to give her?

## AIM

This unit shows you how to do a near refraction for a person with presbyopia so that you can give them the correct reading addition.

## LEARNING OUTCOMES

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

- explain what is meant by the near lens addition (and how this is different from the near spectacle prescription)
- define preferred working distance
- define range of clear vision
- demonstrate how to do a near refraction.

## REVIEW: NEAR REFRACTION FOR PRESBYOPIA

<b>PRESBYOPIA</b>	<ul style="list-style-type: none"> <li>The gradual (slow) loss of accommodation as we get older is called presbyopia.</li> <li>Presbyopia affects everyone and usually starts around the age of 40.</li> <li>People with presbyopia usually find it difficult to read or do other near tasks.</li> <li>If a presbyope also has hyperopia or myopia, it will affect them when they need to get spectacles for close work. Some people who have myopia may never need to wear reading spectacles.</li> </ul>
<b>COURSE OF PRESBYOPIA</b>	<ul style="list-style-type: none"> <li>As we get older, the crystalline lens gradually gets harder and cannot change shape easily when the ciliary muscle contracts – this is a normal, natural ageing process.</li> <li>This means that an older person cannot accommodate as much or as easily as a younger person.</li> </ul>
<b>PRESBYOPIA SYMPTOMS</b>	<ul style="list-style-type: none"> <li>People with presbyopia may have trouble doing near tasks such as reading, sewing, and sorting rice. This is because they have blurry vision when they look at things that are close to them.</li> </ul>
<b>CORRECTION OF PRESBYOPIA</b>	<ul style="list-style-type: none"> <li>Presbyopia is corrected with a near addition (or “add”).</li> <li>The “add” is a positive spherical lens power that is added to the distance correction that a person needs (if they also have hyperopia, myopia or astigmatism) so that they can see their near work clearly.</li> <li>Distance Spectacle Prescription + Near Addition = Reading / Near Spectacle Prescription</li> </ul>
<b>TYPES OF PRESBYOPIA SPECTACLES</b>	<p>Reading spectacles:</p> <ul style="list-style-type: none"> <li>are only worn for close work;</li> <li>make close vision clear, but distance vision blurry;</li> <li>must be taken off for clear distance vision.</li> </ul> <p>Bifocal spectacles:</p> <ul style="list-style-type: none"> <li>have two parts divided by a line: the top part has power for distance vision, while the bottom part (the “seg”) has power for near vision;</li> <li>allow a presbyopic person to see clearly both at near and in the distance.</li> </ul> <p>Progressive addition spectacles:</p> <ul style="list-style-type: none"> <li>do not have a line like bifocals: the distance prescription at the top of the lens gradually blends with the near prescription at the bottom of the lens;</li> <li>allow a presbyopic person to see clearly at near, far away, and at an intermediate distance.</li> </ul>
<b>MEASURING REFRACTIVE ERROR</b>	<ul style="list-style-type: none"> <li>Objective refraction methods include: <ul style="list-style-type: none"> <li>Retinoscopy</li> <li>Auto-refraction.</li> </ul> </li> <li>Subjective refraction methods include: <ul style="list-style-type: none"> <li>Best vision sphere refraction</li> <li>Sphero-cylindrical refraction</li> <li>Near refraction.</li> </ul> </li> </ul>

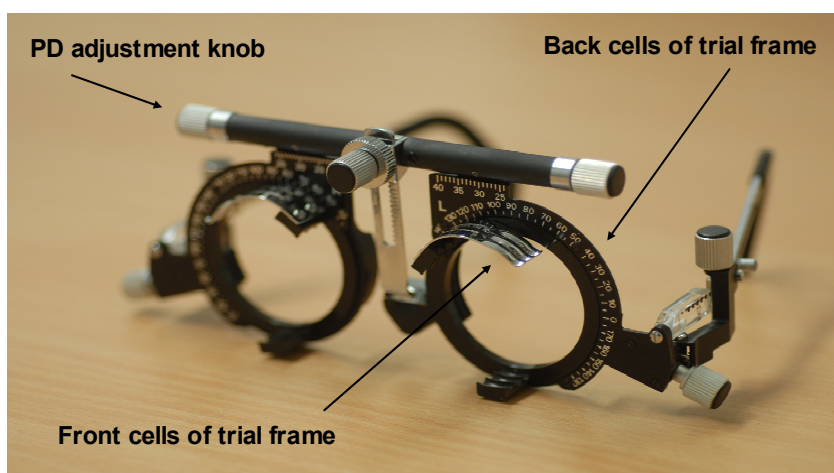
## REVIEW: NEAR REFRACTION FOR PRESBYOPIA (cont.)

### MEASURING INTERPUPILLARY DISTANCE (PD)

- PD is the distance (in mm) between a person's pupils.
- Distance PD is the distance between the pupils when the person is looking at something far away.
- Near PD is the distance between the pupils when the person is looking at something close.
- Distance PD is always greater than near PD because the eyes converge when they look at things that are close to them.
- Calculating near PD:
 

If distance PD > 64 mm	→ subtract 4 mm
If distance PD ≤ 64 mm	→ subtract 3 mm

### TRIAL FRAMES



## CORRECTING PRESBYOPIA

### NEAR ADDITION

Many people confuse the near addition with the near spectacle prescription – but they are not the same.

The near addition (or simply, the “add”) is the extra amount of plus power that must be added to the person’s distance prescription (for hyperopia, myopia or astigmatism) so that they can see things that are close to them clearly.

The near spectacle prescription is the combined total of the near add and the distance prescription.



$$\text{Distance prescription} + \text{Near add} = \text{Near spectacle prescription}$$

The only time the near add and the near spectacle prescription are the same is when the person’s distance prescription is zero – that is, when the person is emmetropic at distance.



**Figure 21.1:** A man wearing look-over reading spectacles. He looks through the near spectacle prescription lenses to read his book and looks over them to see things that are in the distance.

### STRENGTH OF THE NEAR ADDITION

The near add strength that a person needs depends on the person’s:

- age
- preferred working distance
- best corrected distance visual acuity (VA).

#### AGE




The strength of the near add increases as people get older. This is because the crystalline lens continues to gradually get harder until it becomes completely solid. Therefore the amount of accommodation that a person has also decreases as they get older.

#### Example:

A 40 year old person might need a +1.00 D add. When they are 42 they might need a +1.50 D add. When they are 55 they might need a +2.25 D.

For this reason, a person’s near spectacle prescription will also increase as they get older. Older people need stronger near vision spectacles.

## CORRECTING PRESBYOPIA (cont.)

STRENGTH OF THE NEAR ADDITION (cont.)	Table 21.1: Approximate near add expected for people living in hot equatorial countries	
	Person's Age	Expected Near Add
	35 to 40	+0.75 D to +1.25 D
	40 to 45	+1.25 D to +1.75 D
	45 to 50	+1.75 D to +2.25 D
	Over 50	+2.25 D to +2.75 D
		Presbyopia affects people in some countries earlier than other countries. People who live in hot countries near the equator seem to get presbyopia earlier than people who live in countries like Australia or the United Kingdom.
PREFERRED WORKING DISTANCE	<ul style="list-style-type: none"><li>A person's preferred working distance is the distance that they like to keep between their eyes and their near work.</li><li>Usually, a small person with shorter arms will have a closer preferred working distance than a larger person who has longer arms.</li><li>The strength of the near add must be higher for closer working distances. A person who wants a close working distance will need a higher powered near add, and stronger near vision spectacles.</li><li>When you take a case history, you must remember to ask the person the distance at which they would like to do most of their near work. This distance is usually about 40 cm, but it might be further away or closer than this.</li></ul>	
		Be careful when you ask someone what distance they like to hold their close work. A person who is starting to become presbyopic will start to hold things further away from them so that they can see more clearly. They might not be comfortable doing this, but they have become used to doing it. A good way to find out a person's preferred working distance is to ask them to show you where their arms feel most comfortable when they are holding their sewing, reading, or other close work.
		
	Figure 21.2: This man is holding his newspaper more than 40 cm away from his eyes. You need to find out whether he is holding it at this distance because he wants to (because it is more comfortable for his arms) or if he is holding it this far away to see it better.	

## CORRECTING PRESBYOPIA (cont.)

### PREFERRED WORKING DISTANCE (cont.)



**Figure 21.3:** This woman is holding her book closer than 40 cm away from her eyes. Some people are more comfortable holding things closer.

#### Best Corrected Distance VA

- If a person has very poor distance vision – even if they are looking through the best lenses that correct their distance refractive error – they are said to have “low vision”. Low vision is usually caused by an eye health problem which permanently affects the person’s vision.
- Normal presbyopes struggle to see small objects up close, but people with low vision have trouble seeing anything that is close to them. They will also have trouble seeing things that are far away from them.
- Sometimes a person with low vision is prescribed a “high add”. A high add lets the person hold their near work much closer to them, to make it look bigger and easier to see.



A near add is always a plus power.

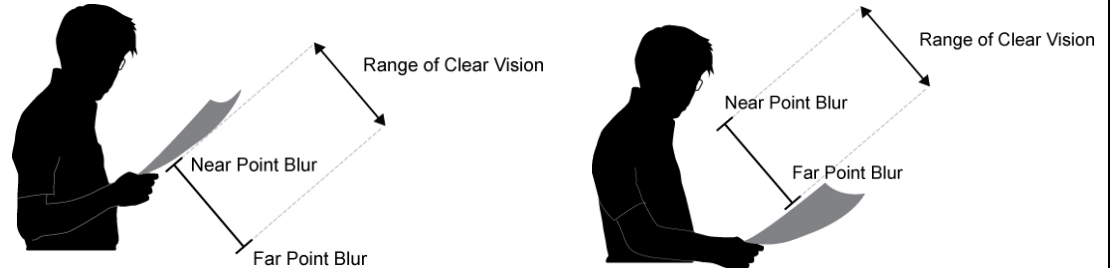
A near add is usually between +1.00 D and +3.00 D.

A high add is much stronger than a normal near add.

A high add can be as strong as +10.00 D.

## CORRECTING PRESBYOPIA (cont.)

When a presbyope wears near vision spectacles, there will be a limit to how close and how far away they can hold their near work and still have clear vision. This is known as the range of clear vision. Objects that are held within the range of clear vision are clear to see.

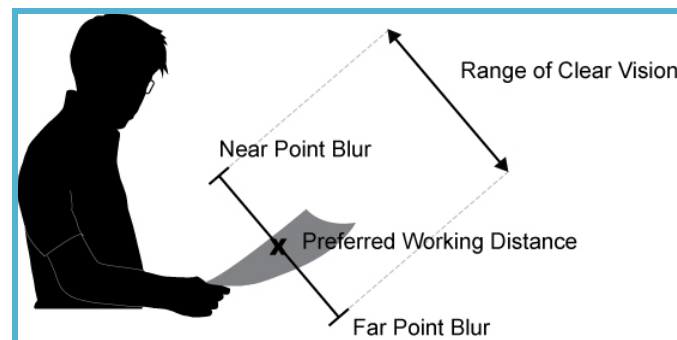


Objects that are held closer than the range of clear vision are blurry  
Objects that are held further away than the range of clear vision are blurry

**Figure 21.4:** A presbyope wearing near vision spectacles has a range of clear vision. Only objects within the range of clear vision will be clear with the near vision spectacles.



A good pair of near vision spectacles has the person's preferred working distance in the centre of the range of clear vision.



**Figure 21.5:** This man is wearing spectacles that put his preferred working distance in the centre of his range of clear vision. This makes it more comfortable for him to see.

### RANGE OF CLEAR VISION

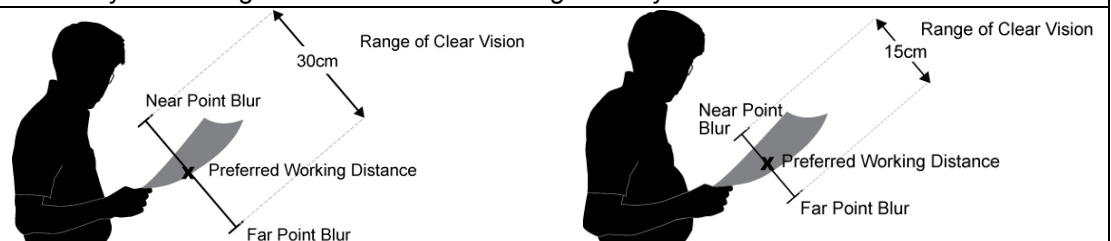
A person's range of clear vision decreases as they get older. A younger presbyope will be able to use their near spectacles for a range of close distances, but an older presbyope will not be able to hold their near work too close or too far away.

#### Example:

A 45 year old has a larger range of clear vision than a 55 year old.

→ A 45 year old might have a clear vision range of 30 cm.

→ A 55 year old might have a clear vision range of only 15 cm.



A 45 year old with a 30 cm range of clear vision

A 55 year old with a 15 cm range of clear vision

**Figure 21.6:** A younger presbyope has a larger range of clear vision than an older presbyope.



## CORRECTING PRESBYOPIA (cont.)

### GOALS OF NEAR REFRACTION

The goals of a near refraction are to find the plus lenses that give the person the best range of clear vision (with the preferred working distance in the centre of this range) and the lowest powered plus lenses that the person needs to see close work clearly. This is because too much plus at near can make a person feel uncomfortable.

In some ways this can be thought of as the opposite of a distance refraction – where we are looking for the most plus (or least minus) that gives clear vision.



#### **Goal of distance refraction:**

To find the highest powered plus lens (or lowest powered minus lens) that gives the clearest distance vision.

#### **Goal of near refraction:**

To find the lowest powered plus lens that gives the clearest near vision.



## METHOD – NEAR REFRACTION

Before you do a near refraction you must first do a complete distance refraction, including:

- best vision sphere (BVS) refraction
- sphero-cylindrical refraction (if necessary)
- +1 Test
- Binocular balance.

There are three parts to a near refraction:

- Preparation and estimation of the add
- Adjusting the add power
- Checking the range of clear vision.

The best way to learn how to do a near refraction is to do it yourself as often as possible. With practice you will become fast and accurate. This unit will show you how to do a near refraction using two learning methods:

- Step-by-step instructions
- Flow charts (in the summary).

This information will help prepare you to do your first near refraction.

## STEP-BY-STEP INSTRUCTIONS – NEAR REFRACTION

### PREPARATION AND ESTIMATION OF THE ADD

**Step 1:** Leave the lenses from the person's final distance refraction in the trial frame. Remove all occluders.



A near refraction is done with both the person's eyes open. The near add lenses will always be the same for the right eye and the left eye.

**Step 2:** Adjust the trial frame for the person's near PD.

**Step 3:** Give the person a near VA chart (or reading card). Ask the person to hold it at the distance where they would like to hold things they want to see.



Make sure that this is really the distance they want to use for near work. You can tell the person that this is the distance that you will set for their near spectacles.

Once the person has chosen their preferred working distance, you must make sure that they keep the near VA chart at this distance during the near refraction (they should not move the near chart closer to them or further away from them).

Make sure that there is good light so that the person can see the near VA chart more easily.

**Step 4:** To decide which trial lenses to start with when doing a near refraction, we use the person's age as a guide. If the person is:

- |                      |   |                                  |
|----------------------|---|----------------------------------|
| • 35 to 40 years old | → | start with +0.75 D for both eyes |
| • 40 to 45 years old | → | start with +1.25 D for both eyes |
| • 45 to 50 years old | → | start with +1.75 D for both eyes |
| • Over 50 years old  | → | start with +2.25 D for both eyes |

Put these trial lenses into the back cells of the trial frame (one in front of each eye).

## STEP-BY-STEP INSTRUCTIONS – NEAR REFRACTION (cont.)

### ADJUSTING THE ADD POWER

**Step 1:** Take two +0.25 D trial lenses and hold them in front of the person's eyes.

Tell the person:

**“Look at the reading card.**

**Look at the smallest words that you can see.”**

Ask the person:

**“Do these lenses make the chart look BETTER, WORSE or the SAME?”**

You might need to show the person the near VA chart with and without the lenses a few times.

**Step 2:** If the person sees:

- “Better” with the plus lenses
  - Add +0.25 D to each eye
  - Repeat Steps 1 and 2.
- “Worse” with the plus lenses
  - Do not change the lenses in the trial frame
  - Go to Step 3.
- “Same” with the plus lenses
 

Because they are plus lenses...

  - Do not change the lenses in the trial frame
  - Go to Step 3.



#### Remember:

Near refraction can be thought of as being like the opposite of distance refraction



Always give the person the least amount of plus that is necessary for them to have clear vision at near.

Repeat Steps 1 and 2 until the person says that the plus lenses make their vision worse or the same.



#### Adding +0.25 D to each eye:

When you add +0.25 D to the trial frame you do not need to add the +0.25 D trial lenses themselves. Instead just replace the add lenses that are in the trial frame with new add lenses that are 0.25 D more plus.

#### Example:

If you already have +1.25 D trial lenses in the back of the trial frame and you need to add +0.25 D → remove the +1.25 D lenses and replace them with +1.50 D lenses.

## STEP-BY-STEP INSTRUCTIONS – NEAR REFRACTION (cont.)

### ADJUSTING THE ADD POWER (cont.)

**Step 3:** Take two  $-0.25$  D trial lenses and hold them in front of the person's eyes.

Tell the person:

**“Look at the reading card.**

**Look at the smallest words that you can see.”**

Ask the person:

**“Do these lenses make the chart look BETTER, WORSE or the SAME?”**

You might need to show the person the near VA chart with and without the  $-0.25$  D lenses a few times.

**Step 4:** If the person sees:

- “Better” with the minus lenses
  - Add  $-0.25$  D to each eye
  - Repeat Steps 3 and 4.
- “Worse” with the minus lenses
  - Do not change the lenses in the trial frame
  - Go to “Checking the range of vision”.
- “Same” with the minus lenses
 

Because they are a minus lenses...

  - Add  $-0.25$  D to each eye
  - Repeat Steps 3 and 4.

Repeat Steps 3 and 4 until the person says that the minus lenses make their vision worse.

#### Adding $-0.25$ D to each eye:



When you add  $-0.25$  D to the trial frame you do not need to add the  $-0.25$  D trial lenses themselves. Instead just replace the add lenses that are in the trial frame with new add lenses that are  $0.25$  D more minus, or  $0.25$  D less plus.

#### Example:

If you already have  $+2.25$  D trial lenses in the back of the trial frame and you need to add  $-0.25$  D → remove the  $+2.25$  D lenses and replace them with  $+2.00$  D lenses

## STEP-BY-STEP INSTRUCTIONS – NEAR REFRACTION (cont.)

### CHECKING THE RANGE OF CLEAR VISION

**Step 1:** Ask the person:  
**“Look at the reading card.  
 Look at the smallest words that you can see.”**

**Step 2:** Tell the person:  
**“Slowly bring the reading card closer to you.  
 Stop when the words start to get blurry.”**  
  
**“Slowly move the reading card away from you.  
 Stop when the words start to get blurry.”**

Look at the where the near VA chart is from the person’s eyes when it starts to get blurry – both when they bring it closer and when they move it further away. The distance between these two points is the person’s range of clear vision. The person’s preferred working distance should be in the middle of these two points.

If the person’s preferred working distance is in the middle of the range of clear vision → go to Step 5.

If the person’s preferred working distance is not in the middle of the range of clear vision → go to Step 3.

**Step 3:** If the person’s preferred working distance is not in the middle of the range of clear vision, you need to move the range of clear vision.

The range of clear vision can be moved:

- closer to the person → by adding +0.25 D to both eyes.
- further away from the person → by adding –0.25 D to both eyes.

**Example 1:**

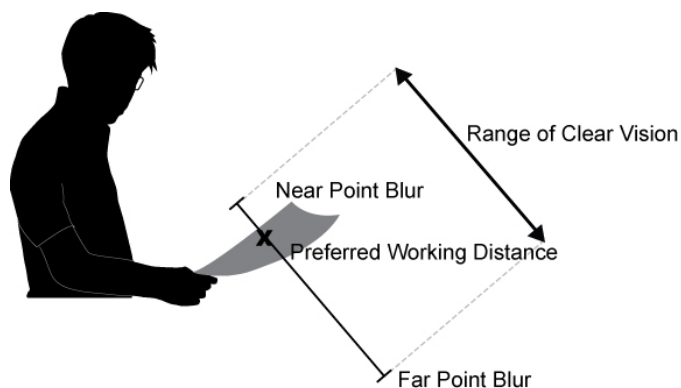
You have +2.00 D near add trial lenses in the trial frame.

You measure the range of clear vision

→ you find that the person’s preferred working distance is further away from them than the middle of their range of clear vision.

You must add +0.25 D to both eyes.

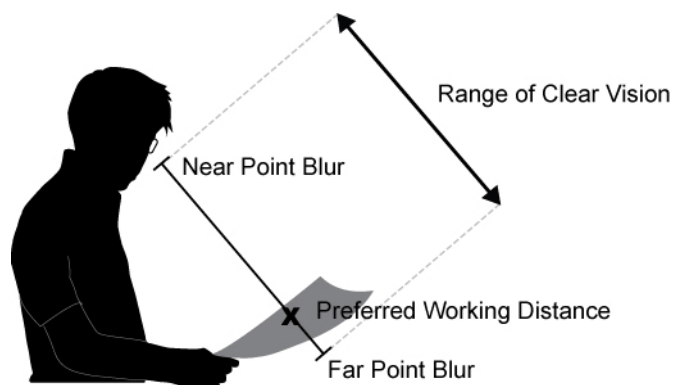
You remove the +2.00 D lenses and replace them with +2.25 D lenses.



**Figure 21.7:** The range of clear vision is too far away from the person. More plus must be added to the near add so that the preferred working distance is in the centre of the range of clear vision.

## STEP-BY-STEP INSTRUCTIONS – NEAR REFRACTION (cont.)

### CHECKING THE RANGE OF CLEAR VISION (cont.)



**Figure 21.8:** The range of clear vision is too close to the person. Plus in the near add must be reduced so that the preferred working distance is in the centre of the range of clear vision.

**Step 4:** Repeat Steps 1 to 3 until the person's preferred working distance is in the middle of their range of clear vision.

**Step 5:** Show the person their range of clear vision. Let the person move the card back and forth to see where it gets blurry.

Ask the person:

**“Is there any close work (including hobbies and special work tasks) that you need to do that is closer than this... or further away than this.”**

Adjust the range of clear vision for the person if you need to as explained in Step 3.

If the person needs to see things clearly at more than one distance (and if both distances are not within the range of clear vision) the person may need to have more than one pair of spectacles, or bifocal spectacles.

**Step 6:** Measure the binocular near VA (aided) and write it on the record card. Write the near add on the record card (because it is the same for both eyes, you only need to write it once).

**Example:**

Near VA (aided) N6

Add +2.00 D

## SUMMARY: NEAR REFRACTION FOR PRESBYOPIA

### CORRECTING PRESBYOPIA

#### Lens addition

- Near addition (add) is not the same as near spectacle prescription.
- The add is the extra amount of plus power that must be added to the person's distance prescription so that they can see clearly at near.
- Distance prescription + Near add = Near spectacle prescription.

#### Strength of the near add:

- The near add strength depends on:
  - age
  - preferred working distance
  - best corrected distance VA.
- **Age**
  - The strength of the near add must increase as the person gets older and their presbyopia gets worse.
  - This table shows the approximate near add expected for people living in hot equatorial countries:

Person's Age	Expected Near Add
35 to 40	+0.75 D to +1.25 D
40 to 45	+1.25 D to +1.75 D
45 to 50	+1.75 D to +2.25 D
Over 50	+2.25 D to +2.75 D

- **Preferred working distance**
  - This is the distance that a person likes to keep between their eyes and their close work. It is usually about 40 cm, but may be closer or further away.
  - Smaller people usually have closer working distances than larger people.
  - A stronger add is needed for people who have closer working distances than for people who have working distances further away.
  - The preferred working distance needs to be determined during the case history.
- **Best corrected distance VA**
  - A person with very poor best corrected distance VA has "low vision".
  - Sometimes people with low vision are given "high add" reading spectacles.
  - These spectacles are very high powered and let the person hold things very close to their eyes to see.

#### Range of clear vision:

- A presbyope who wears near spectacles has a limit to how close and how far away they can see when they are wearing their spectacles.
- The range of clear vision describes the distances where the person's near vision is clear.
- A good pair of near spectacles is prescribed so that the person's preferred working distance is in the centre of the range of clear vision.
- A person's range of clear vision decreases as they get older.

#### Goals of near refraction:

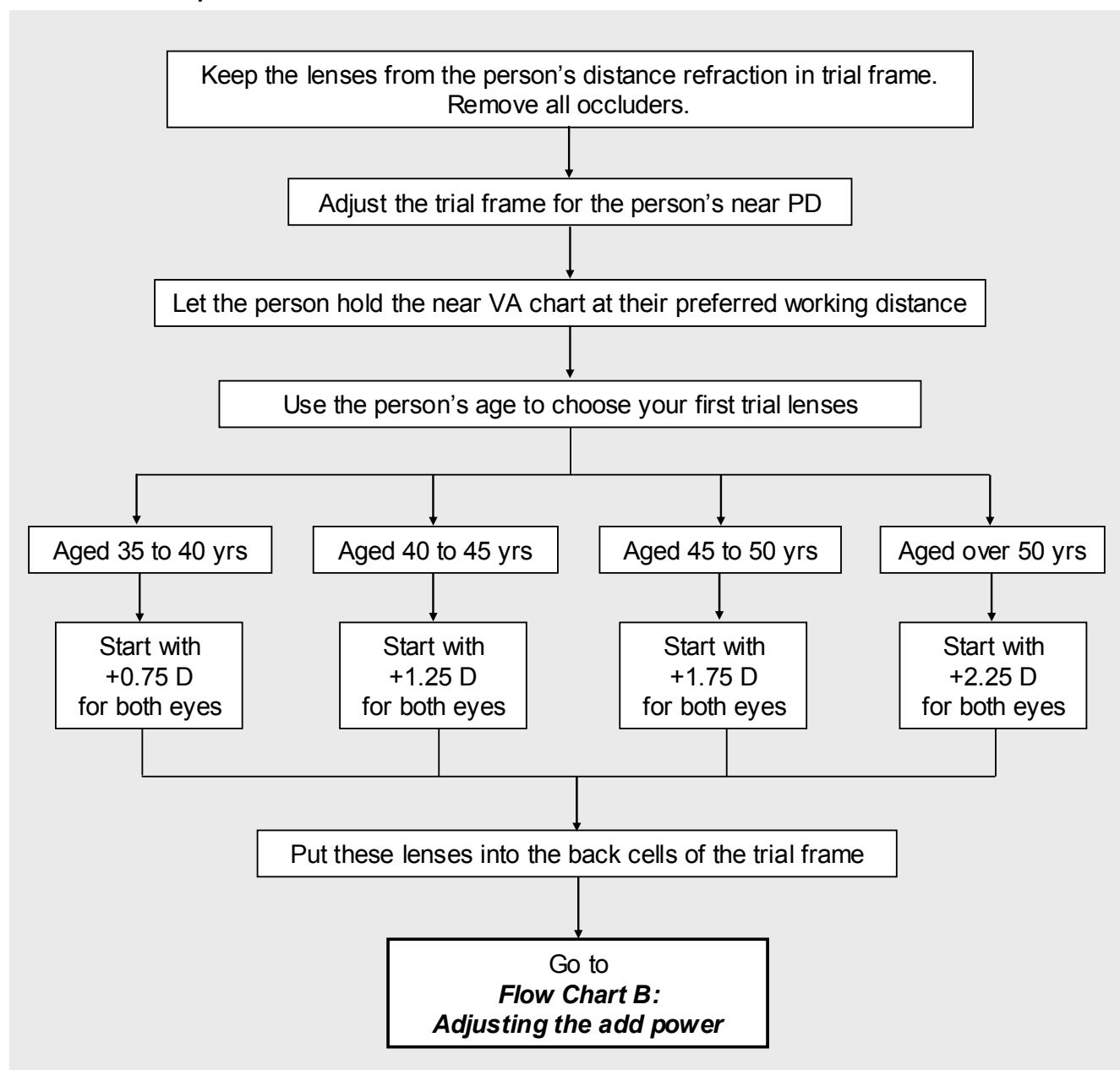
To find:

- the plus lenses that give the person the best range of clear vision (with the person's preferred working distance in the centre) of that range.
- the lowest powered plus lenses that the person needs to see close work clearly.

## SUMMARY – METHOD – NEAR REFRACTION

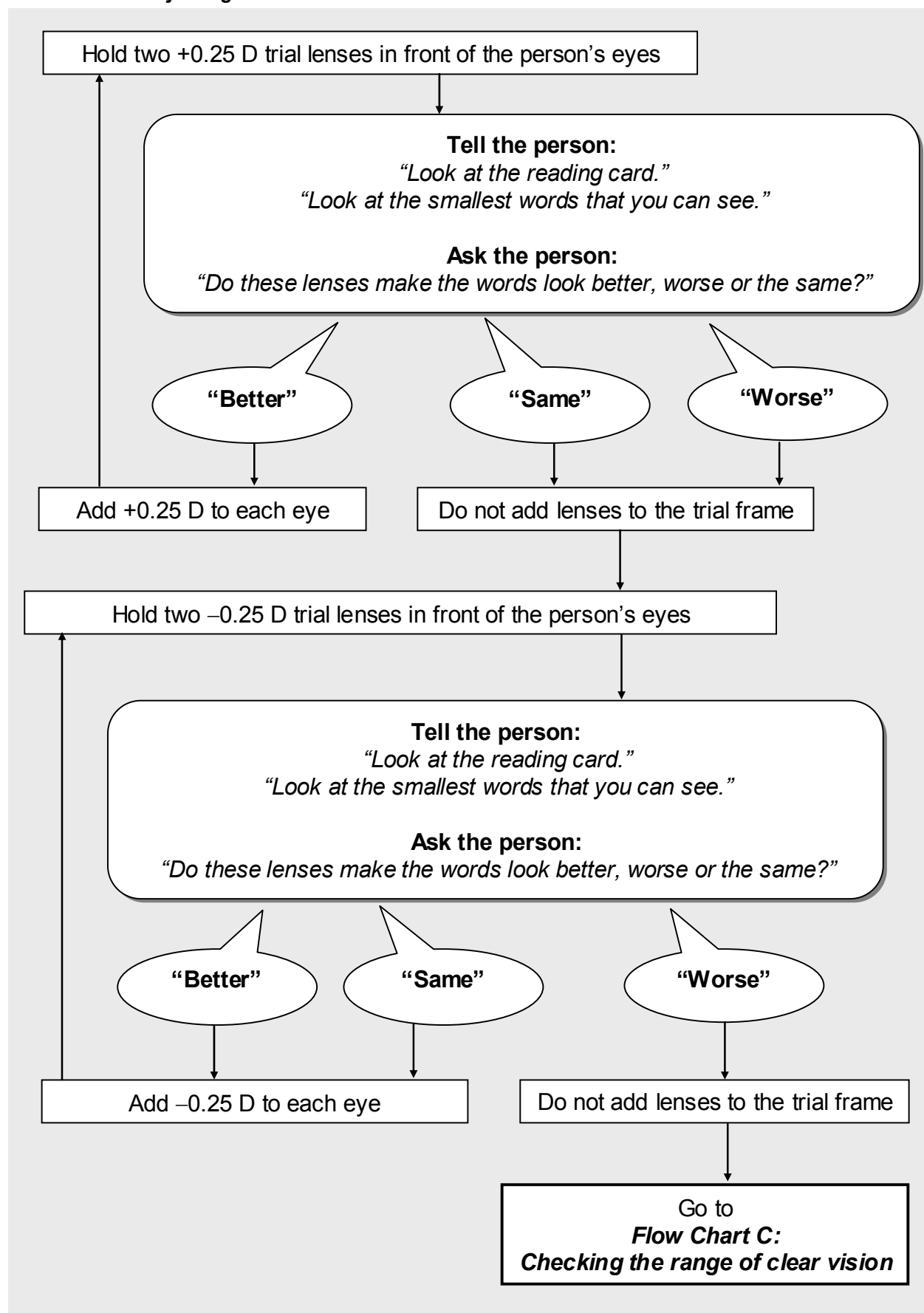
- Before you can do a near refraction, you need to know the person's final distance refraction.
- There are three parts to a near refraction:
  - Preparation and estimation of the add
  - Adjusting the add power
  - Checking the range of clear vision.

### Flow Chart A: Preparation and Estimation of the Add

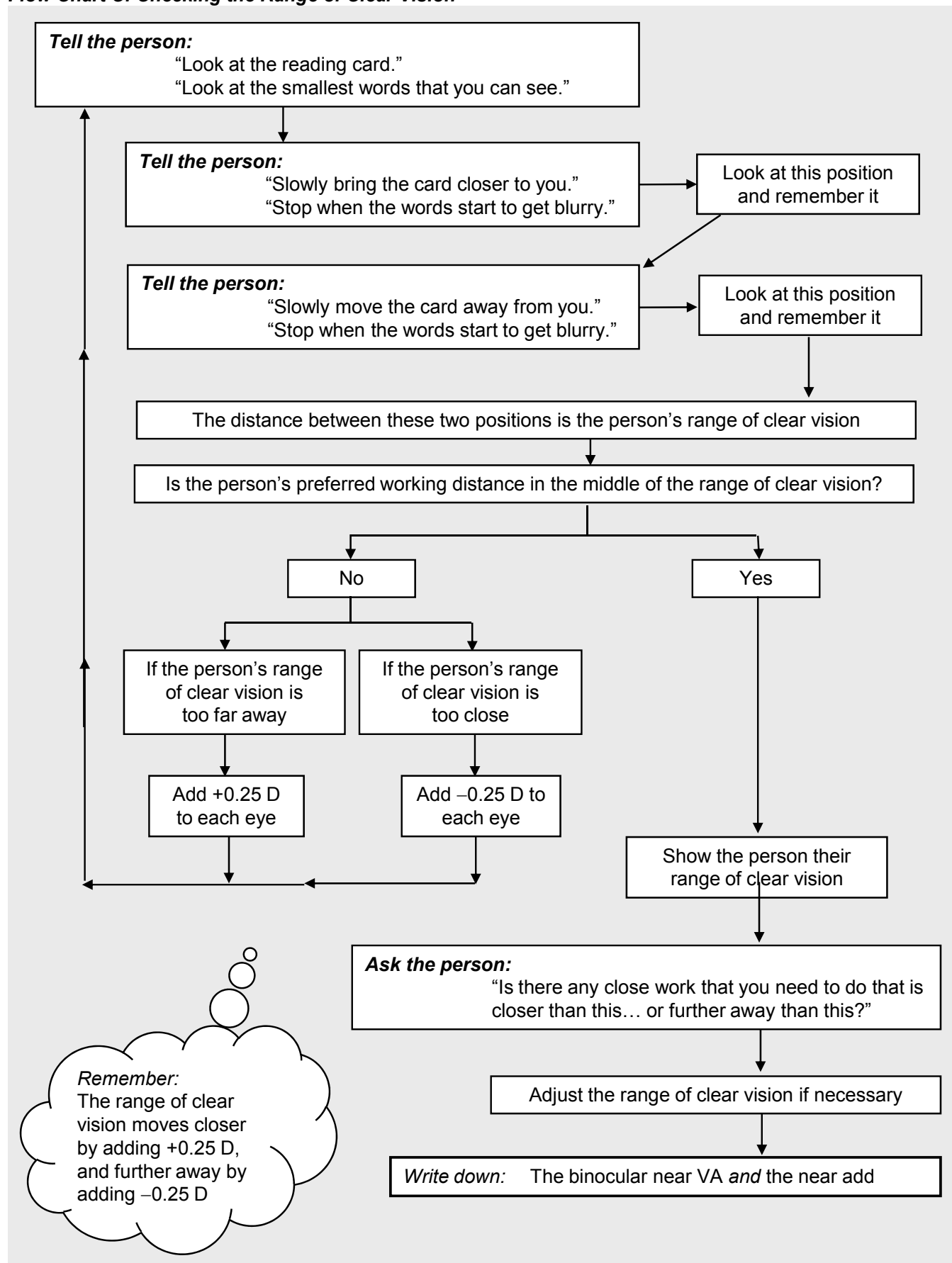




**Flow Chart B: Adjusting the Add Power**



**Flow Chart C: Checking the Range of Clear Vision**



## TEST YOURSELF QUESTIONS

1. What is the difference between the near lens addition (add) and the near spectacle prescription?  

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2. Why do people need a stronger near add as they get older?  

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3. Why is it important for us to know a person's preferred working distance when prescribing near spectacles?  

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4. What is a person's range of clear vision?  
How do you move the range of clear vision closer to a person? How do you move it further away?  

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5. What are the goals of a near refraction?  

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6. We know that, for a distance refraction, we want to give the person the most amount of plus that gives them the best VA. How is a near refraction different? Why is this so?  

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