



CONTROLLING ACCOMMODATION

THINK

A mother brings her two children to see you. She says her 14 year old son cannot see what the teacher is writing on the blackboard, and her 12 year old daughter complains of headaches when she reads. These children may have uncorrected refractive errors, so you need to do a refraction examination for them.

Young children have active accommodation, so you need to be very careful to control their accommodation when you refract them.

AIM

This unit will introduce you to the problems that active and uncontrolled accommodation can create during a refraction.

LEARNING OUTCOMES

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

- explain how uncontrolled accommodation can cause errors in refraction
- recognise the signs that indicate that a person's accommodation is uncontrolled
- avoid over-minusing (or under-plussing) a person during a refraction
- check to make sure that you have not given too much minus.

REVIEW: CONTROLLING ACCOMODATION

REFRACTIVE ERROR	<ul style="list-style-type: none"> • A person who has a refractive error will need to wear spectacles (glasses) or contact lenses so that they can see clearly and comfortably. This is because their eye is not the correct size and shape. • There are four main types of refractive error: myopia, hyperopia, astigmatism, and presbyopia. • Myopia is corrected with minus lenses. Hyperopia is corrected with plus lenses. Astigmatism is corrected with cylindrical lenses. Presbyopia is corrected with a near add (plus lenses). • The amount of refractive error an eye has depends on: <ul style="list-style-type: none"> – the shape of the cornea, and/or – the shape of the crystalline lens, and/or – the length of the eyeball. • A person with a refractive error will have eyes that look normal, but they will not see well. • An eye examination that tests for refractive error is called a refraction. • A refraction tells you: <ul style="list-style-type: none"> – the type of refractive error that a person has – how much refractive error a person has.
ACCOMMODATION	<ul style="list-style-type: none"> • Accommodation occurs when the ciliary muscle contracts and changes the shape of the crystalline lens (makes it thicker). • This changes the optical focus of the eye so that close objects can be seen clearly. • When accommodation in a normal eye (an eye without refractive error) is relaxed, objects in the distance are seen clearly. • Presbyopia is the natural ageing change in the eye where the crystalline lens hardens with age. When this happens, the lens cannot change shape easily when the ciliary muscle contracts. This means that an older person cannot accommodate as easily as a younger person. • All people will get presbyopia when they get older. It is impossible for a child or a young adult in their 20s to have presbyopia.
VISUAL ACUITY	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> – Refractive error (this person needs spectacles to see clearly) – Eye health problem (this person has a health problem with their eyes).
GOALS OF REFRACTION	<ul style="list-style-type: none"> • A refraction must find: <ul style="list-style-type: none"> – the lens that gives the person the clearest vision, and – the lens that gives the person the most comfortable vision. • The clearest and most comfortable lens is always the lens that has the least amount minus power (or most amount of plus power) but still gives the best VA.
ESTIMATING REFRACTIVE ERROR	<ul style="list-style-type: none"> • Case history and VA will give you clues as to what sort of refractive error a person probably has. You should look at: <ul style="list-style-type: none"> – the person's visual symptoms – the person's age. • VA <ul style="list-style-type: none"> – unaided and pinhole VA – the amount of spherical refractive error can be predicted by looking at the unaided VA (each 0.25 D refractive error = approx. one line of VA) • But only if: <ul style="list-style-type: none"> → the person has no astigmatism → the person is not accommodating → the person has no eye health problem.



THE MOST COMMON REFRACTING MISTAKE

The most common mistake that examiners make when they do a refraction is giving the person more minus than they need (or not giving them enough plus).

It is easy to give a person too much minus power. This is because adding a small amount of extra minus power might not make the vision worse if the person can accommodate. If the person is accommodating they may say that their vision looks the same, or they may even say that it seems better.

When a person accommodates during their refraction, the spectacle prescription that they will be given will be incorrect. Often the spectacles that are made from an incorrect prescription will only give the person clear vision if they accommodate while they are wearing them.

If a person wears spectacles that make them accommodate they can get asthenopia (eye strain and headaches) after wearing them for long periods of time (hours). Sometimes these symptoms will be so bad that the person will not be able to wear the spectacles (even if the spectacles make their vision clearer).

<p>EXAMPLES</p>	<p>These people have been given too much minus power (or not enough plus power):</p> <ul style="list-style-type: none"> • A person with myopia who has a refractive error of -3.50 D, but is given -4.00 D. • A person with hyperopia who has a refractive error of $+3.25$ D, but is given $+2.50$ D. <div data-bbox="459 974 1517 1162">  <p>If a person has too much minus in their spectacles we say that they are over-minused.</p> <p>If a person does not have enough plus in their spectacles we say that they are under-plussed.</p> </div> <p>You can think of over-minusing as being like making a person become hyperopic – a person with hyperopia can get asthenopic symptoms because they have to accommodate to make their vision clear.</p> <p>You can think of under-plussing as leaving a person with uncorrected hyperopia.</p>
<p>THE CLEAREST AND MOST COMFORTABLE LENS</p>	<p>The clearest and most comfortable lens for a person is the least minus (or most plus) lens that gives them the best VA.</p> <p>Young people will often see the VA chart clearly with more than one lens. This is because young people have a lot of accommodation that they can use to compensate for small errors in refraction.</p> <div data-bbox="459 1592 1517 1995">  <p>If you are refracting a young person they might tell you that their vision seems better with more minus (less plus), but really they will see equally clearly and more comfortably with less minus (more plus).</p> <p>If you accidentally give someone too much minus (not enough plus) in their spectacles, they will say that their vision is clear...</p> <p>...but, they may come back to see you later to complain that their eyes do not feel comfortable when they wear the spectacles that you gave them.</p> </div>

THE MOST COMMON REFRACTING MISTAKE (cont.)

THE CLEAREST AND MOST COMFORTABLE LENS (cont.)

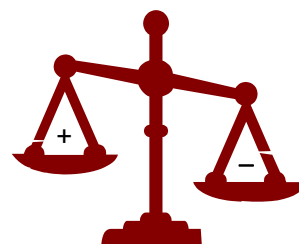
People are usually unaware that they are accommodating. However, when a person accommodates for long periods of time (hours), their ciliary muscles become tired. This can lead to symptoms of asthenopia (eye strain).

**Too much plus
(or not enough minus)**



The person's vision will be blurry.

**Too much minus
(or not enough plus)**



The person may accommodate to make it clear. This can result in uncomfortable eyes (asthenopia).

**The correct lens for the person
(not too much plus, not too much minus)**



The person's vision will be clear and comfortable.

Figure 19.1: When doing a refraction, we need to find a balance between the clearest lens and the most comfortable lens

HOW TO AVOID OVER-MINUSING

To make sure that you do not give too much minus (or not enough plus) when you are doing a refraction you must:

- Control the person's accommodation – you must keep their accommodation relaxed.
- Check that you have not given too much minus.

Over-minusing (or under-plussing) occurs when the person's accommodation is not controlled during the refraction.

When performing a subjective refraction you must control the person's accommodation. This is especially important with young people who have a lot of accommodation.

CONTROLLING ACCOMMODATION

How to Control Accommodation

1. Always try plus lenses before minus lenses.

If you put a minus lens in front of an eye that does not need a minus lens the eye will accommodate.

Once an eye has started to accommodate it is hard to make it relax again. It is better to stop the eye accommodating from the beginning.



Always show plus lenses before minus lenses.

2. Is the person really seeing better?

When you hold a minus lens in front of a person's eye, ask:

"Does this lens let you see more letters or does it just make everything look smaller and blacker?"

If the person says that the lens makes things look smaller and blacker, they are probably accommodating. You are adding too much minus.

3. When refracting hyperopic eyes: put the second (plus) trial lens in the trial frame before removing the first trial lens.

When refracting myopic eyes: remove the first (minus) trial lens before putting the second trial lens in.

4. Check the VA before adding minus lenses (or removing plus lenses). If the VA does not improve, do not add more minus.

5. If you think a person is accommodating, add more plus and decrease the power slowly.

Encourage the person to read the next line on the VA chart – ask them to try hard and "guess" even if they are not sure.

Check that you have not given too much minus:

During a refraction an examiner must pay attention to what is happening. The examiner must be alert to things that do not make sense.

HOW TO AVOID OVER-MINUSING (cont.)

ASK YOURSELF

1. What do the person's symptoms tell you about their refractive error?
Example:
If a person has hyperopic symptoms, you should not be giving them minus lenses.
2. How much refractive error do you expect?
When you measure the unaided VA you can estimate the amount of refractive error they will have. Remember that each 0.25 D refractive error = approximately one line of VA:

Refractive Error (+ or -)	Expected Unaided VA
0.25	6/6
0.50	6/7.5
0.75	6/9
1.00	6/12
1.25	6/15
1.50	6/18
1.75	6/24
2.00	6/36
2.25	6/48
2.50	6/60
> 2.50	< 6/60

Example:

A person tells you they can see clearly at near, but they cannot see far away. You measure their unaided VA: 6/12.

Their symptoms (poor distance vision) tell you that they probably have myopia. Their unaided VA (6/12) tells you that they have approximately -1.00 D of refractive error.

If your refraction finds -2.00 D the person is probably accommodating and you have given them too much minus.

3. Is the person's VA improving as expected?
Each time you add 0.25 D the VA should improve by approximately one line. If it does not improve by one line the person might be accommodating.
4. Is the person's VA variable (does it change)?
If you measure a person's VA with the same lens power it should not change.

Example:

You put a +2.00 D lens in front of a person's eye and they can see 6/7.5.

A short time later, they can only see 6/9 through the +2.00 D lens.

This means that the person has uncontrolled accommodation. You need to relax their accommodation.

5. Is the final VA as good as the pinhole VA?
At the end of your refraction the VA should be as good as the pinhole VA.

Example:

A person has unaided VA of 6/60. Pinhole VA is 6/9.

You would expect that at the end of your refraction the VA will be at least 6/9 or better (maybe even 6/7.5 or 6/6).

6. Does an extra +1.00 D make the vision worse?
There is a test you can do called the +1 Test. In this test you put a +1.00 D lens into the trial frame after you think that you have finished your refraction. The +1.00 D lens should make the person's VA at least two lines worse. If it does not make the person's VA two or more lines worse the person is accommodating, which means the refraction is over-minused or under-plussed.

HOW TO AVOID OVER-MINUSING (cont.)

EXAMPLES

- Example 1:**

A teenage boy comes to you for an eye examination.

You do a refraction on him and find that he can see the 6/6 line with many different lens powers.

Each time you add more minus he tells you that he is seeing more clearly, but when you measure his VA he can still see only 6/6 (and no extra letters on the next 6/5).

-0.75 D (Clearer)	→	6/9
-1.00 D (Clearer)	→	6/7.5
-1.25 D (Clearer)	→	6/6
-1.50 D (Clearer)	→	6/6
-1.75 D (Clearer)	→	6/6
-2.00 D (Clearer)	→	6/6

This boy can see the 6/6 line of the VA chart with -1.25 D, -1.50 D, -1.75 D and -2.00 D lenses. The least minus of these lenses is the -1.25 D lens.

The clearest and most comfortable lens for this boy is the -1.25 D lens.

- Example 2:**

An 8 year old girl comes to you for an eye examination.

You do a refraction for her and find that she can see the 6/7.5 line with many different lens powers.

Each time you decrease the plus she tells you that she is seeing more clearly – but no matter how much you decrease her plus, she still cannot see the 6/6 line below.

+3.75 D	→	6/12
+3.50 D (Clearer)	→	6/9
+3.25 D (Clearer)	→	6/7.5
+3.00 D (Clearer)	→	6/7.5
+2.75 D (Clearer)	→	6/7.5
+2.50 D (Clearer)	→	6/7.5

This girl can see the 6/7.5 line of the VA chart with +3.25 D, +3.00 D, +2.75 D and +2.50 D lenses. The most plus of these lenses is the +3.25 D lens.

The clearest and most comfortable lens for this girl is the +3.25 D lens.

CYCLOPLEGIC EYE DROPS

Sometimes a person's accommodation can be extremely active or unstable. In these situations it may be necessary to use cycloplegic eye drops to do a cycloplegic refraction.

Cycloplegic eye drops are used to temporarily paralyse the ciliary muscle so that the eye cannot accommodate. This can make it easier to do a refraction on people with active or unstable accommodation – especially children.

After a cycloplegic refraction the person will have blurry vision for a few hours and will be photophobic (light sensitive) for the rest of the day.

Cycloplegic eye drops should only be used by eye care workers who are trained to use them.

SUMMARY: CONTROLLING ACCOMMODATION

CONTROLLING ACCOMMODATION

- The most common mistake that examiners make when they do a refraction is giving the person too much minus (or not enough plus).
- The person might tell you that their vision looks the same (or even better) if too much minus is added but their VA will not get better.
- If too much minus (or not enough plus) is prescribed, the person will need to accommodate to see clearly with their new spectacles. This can cause asthenopia (eye strain and headaches).
- People do not usually know that they are accommodating. They will only tell you that their eyes feel sore or tired.
- Over-minused = too much minus in the person's spectacles. Under-plussed = not enough plus in the person's spectacles.

The clearest and most comfortable lens

- The clearest and most comfortable lens is the least minus (or most plus) lens that gives the best visual acuity (VA).
- Young people often see the VA chart clearly with more than one lens
– the most comfortable of these lenses is the least minus (or most plus) lens.
- You must find the balance between the clearest lens and the most comfortable lens.

HOW TO AVOID OVER - MINUSING

- When you are doing a refraction you must:
 - control the person's accommodation
 - check to make sure that the person has not been given too much minus.

Controlling accommodation:

- Always show the person a plus lens before a minus lens.
- Check to see that the person is really seeing better
 - When you hold a minus lens in front of a person's eye ask: "Does this lens let you see more letters or does it just make it look smaller and blacker?"
 - "smaller and blacker" means that the person is probably accommodating and you are adding too much minus.
- When refracting hyperopic eyes
 - put the second plus trial lens in the trial frame before removing the first plus trial lens.
- When refracting myopic eyes
 - remove the first minus trial lens before you put the second minus trial lens in the trial frame.
- Check the VA before adding minus lenses (or removing plus lenses)
 - if the VA does not improve, do not add the minus lens (or remove the plus lens).
- If you think the person is accommodating, add more plus and decrease the plus power slowly.
 - encourage the person to try hard or "guess" the next VA line even if they are not sure.

SUMMARY: CONTROLLING ACCOMMODATION (cont.)

HOW TO AVOID OVER – MINUSING (cont.)

Check that you have not given too much minus:

- Pay attention to what is happening and what the person is telling you
 - does it make sense, based on their symptoms and unaided VA?
- Think about the person's symptoms
 - what sort of refractive error do you expect?
- Look at the person's unaided VA
 - how much refractive error do you expect?
- Watch the person's changing VA
 - you should expect one line of VA improvement for every 0.25 D change in lens power
 - is the VA changing unexpectedly?
- Look at the person's pinhole VA
 - the final aided VA should be as least as good as the pinhole VA, or even better.
- The +1 Test
 - does an extra +1.00 D make the person's VA at least two lines worse?

Cycloplegic eye drops:

- Cycloplegic eye drops temporarily paralyse a person's ciliary muscle so that they cannot accommodate.
- Cycloplegic refraction may be necessary if a person has extremely active or unstable accommodation.
- Cycloplegic eye drops should only be used by eye care workers who are trained to use them.

TEST YOURSELF QUESTIONS

1. What is the most common mistake people make when they are doing a refraction?

2. You accidentally give a young woman too much minus power, but you notice that she can still see clearly?
 - a) Why can she still see clearly?

 - b) If she can still see clearly, why is it a problem?

3. What are some things that you can do to help control a person's accommodation when you are refracting them?
 - a) _____
 - b) _____
 - c) _____
 - d) _____
 - e) _____

4. A man tells you that he can see well at near, but has trouble seeing things that are far away. You measure his VA for his right (R) and left (L) eyes and find: R: 6/12 L: 6/18
 - a) What *type* of refractive error does this man have? _____
 - b) What do you estimate the *amount* of the man's refractive error to be? R: _____ D
L: _____ D

5. A woman sees 6/9 with her right eye when a +1.50 D lens is in the right cell of a trial frame. If you change the lens to a +1.25 D lens she says that her vision is better. What would you expect her VA to be?

6. A woman sees 6/9 with her left eye when a +1.50 D lens is in the left cell of a trial frame. If you change the lens to a +1.25 D lens she says that her vision is worse. What would you expect her VA to be?
