

# Subjective refraction

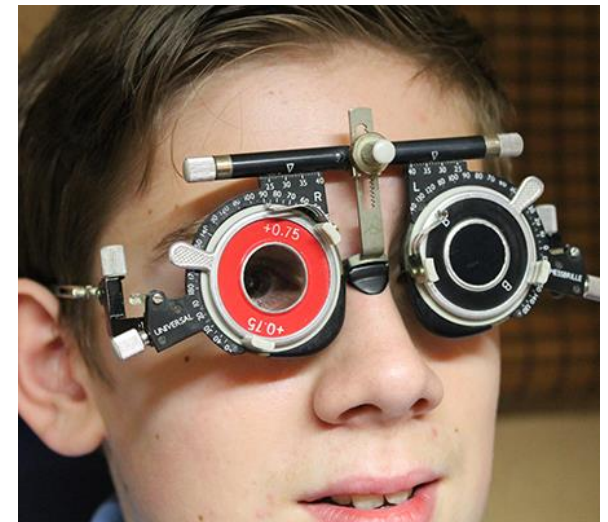
## Clinical points



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# Two methods of evaluating the refractive error

## Objective refraction

- To determine the initial spherical and cylindrical element of refraction
  - The result depends purely on the examiner's judgment



## Subjective refraction

- The result depends on the patient's ability to discern changes in clarity
  - This process relies on the cooperation of the patient



- The goal of the subjective refraction is to achieve clear (best visual acuity) and comfortable binocular vision



- As with the medical problems that present to us, refraction and prescribing glasses involve history, examination, diagnosis and treatment decisions



- The process is not only measurement, but problem-solving

# The art and science of prescribing glasses

- When you do write a prescription, you will usually modify the results of your refraction, depending on

- The patient's symptoms
- Previous prescriptions
- Muscle balance
- Occupation





## Control of Accommodation

- If accommodation is not controlled, retinoscopy will erroneously measure more myopia or less hyperopia
  - Especially in younger individuals
- In older individuals with absolute presbyopia or those who are aphakic or pseudophakic, retinoscopy can be done without concern for accommodation which, of course, is absent in these individuals



## Over-minusing results from the patient accommodating during the refraction

- If a patient were to be prescribed the "over-minused" measurement in a pair of glasses when looking in the distance, they would need to continually accommodate for the focal point to remain on the retina
  - Eye fatigue
  - Less accommodation available for focusing at near



# Control of Accommodation

- Instruct the patient properly
- Using cycloplegic agent
- In some cases accommodation is suspended by “fogging”
  - Plus lens over the fellow eye that is fixing a distant object
  - Fogging can be used in a cooperative patient





# The Four Steps of Subjective Refraction

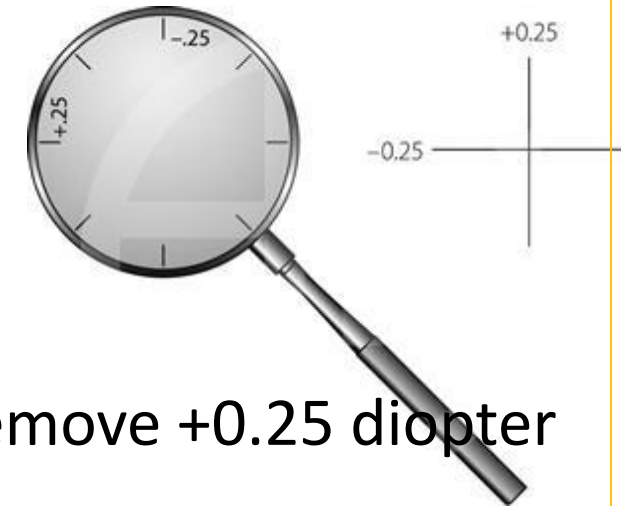
Step 1: Sphere :to place the **circle of least confusion**, or blur circle, onto the retina

Step 2: Cylinder Axis

Step 3: Cylinder Power

- for every +0.50 diopter of cylinder power added, remove +0.25 diopter from the sphere

Step 4: Sphere : to places the **single focal point** onto the retina



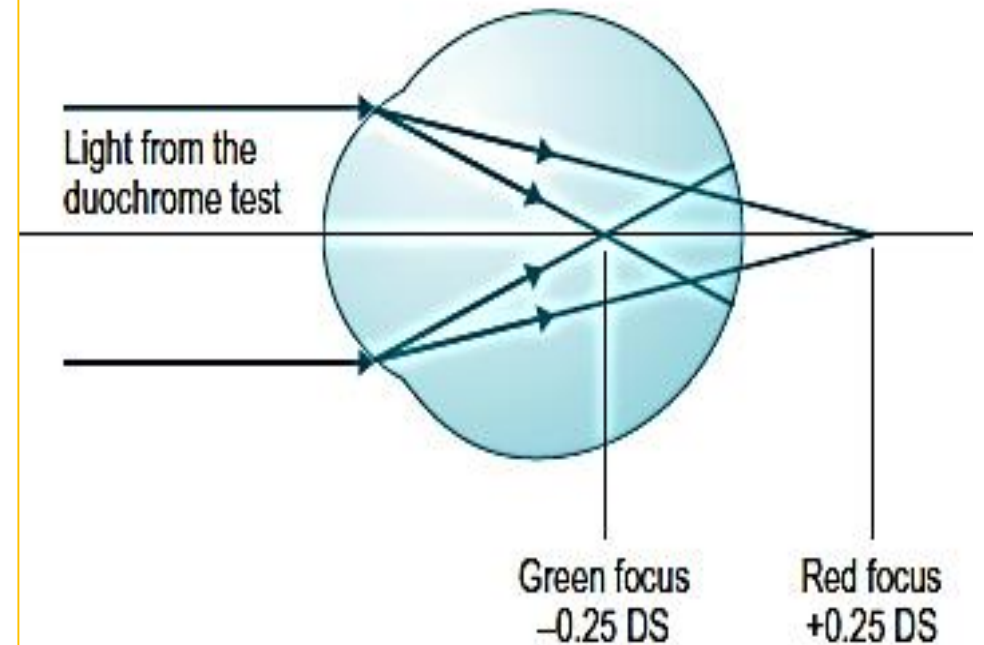
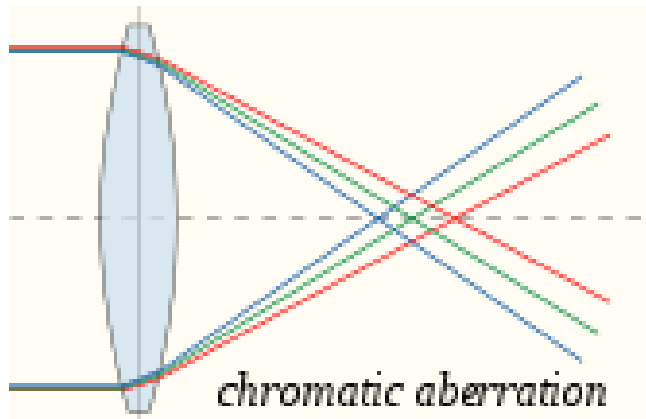
# The Four Steps of Subjective Refraction

- During step 4, the following additional tests can be used:
  - The red-green duochrome test
  - Fogging

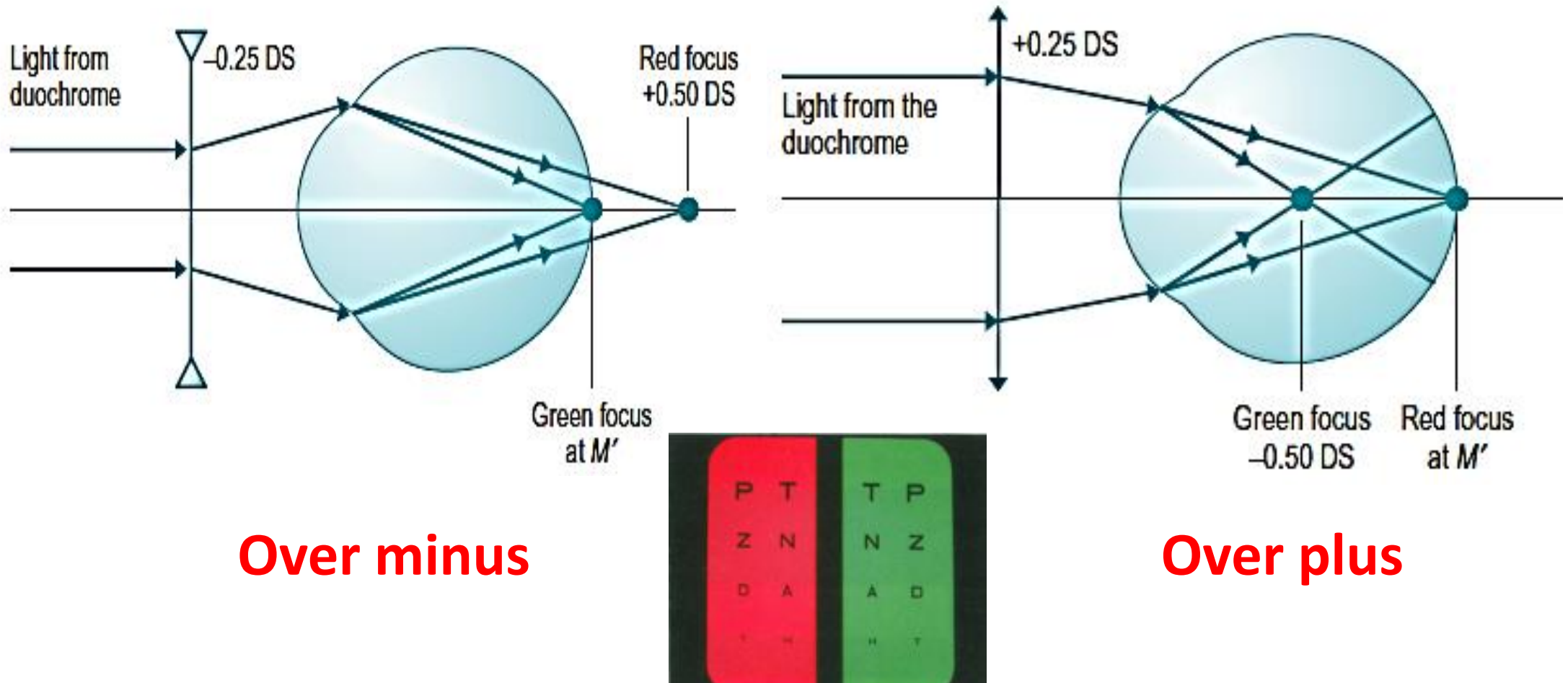


# The duochrome test

- The total amount of ocular chromatic aberration present has been estimated as approximately 2.50 D



# RAMGAP (red add minus, green add plus)

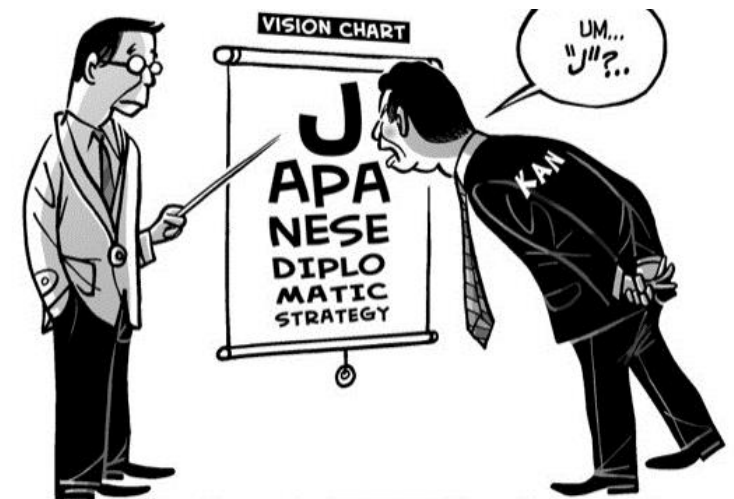


## The duochrome test

- Chromatic aberration appears to be slightly reduced (about 0.30 D) with smaller pupils and rather more (about 1.00 D) with accommodation
- Red light is focused preferentially when the target is remote, but the preferred wavelength shifts progressively towards the blue end of the spectrum as the target distance becomes shorter

# The duochrome test

- Most distance test charts are situated at 6 or 3 m rather than true infinity, so a little underplussing probably works out quite well

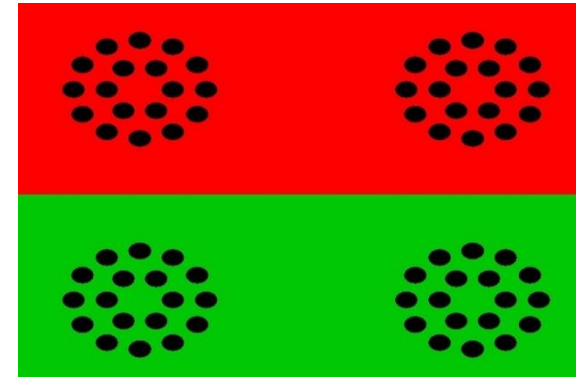


- The power of the correcting lens is adjusted to give equal clarity of red and green targets (equalisation), it may result in a slight underplussing or over-minusing for a distant target



# The duochrome is usually left 'on the red' to avoid overminusing

- When refining the near addition, it is common to leave the patient 'on the green'.
- Another situation where a bias towards  
The green may be useful is a patient who  
Needs spectacles for night driving
  - There is a tendency for the eye to become more myopic under  
conditions of low illumination



# The duochrome test

- Aging
  - The chromatic aberration of the eye reduces after age 55
  - The pupil tends to become smaller
  - The lens becomes optically denser to shorter wavelengths
    - The red background always appears brighter
    - This means that the duochrome test may over-minus (or under-plus) the elderly patient



## The duochrome test

- Fletcher (1991) also recommends that, in young patients, once equality has been achieved between red and green, an extra +0.50 DS be placed before the eye for a few seconds
- This is then removed, and the patient asked on which colour the targets are clearer
  - It is not unusual to find a little extra plus when this is done



# Binocular Balance

- Once the monocular subjective refraction has been completed for each eye, it is time for the binocular balance
- Binocular balancing is only done when the visual acuity is relatively equal between the two eyes



# Refracting in a Shorter Room

- To calculate vergence, use the formula  **$1/x$  (m) or  $100/x$  (cm) or  $40/x$  (in)**
- The acuity charts in shorter exam rooms are adjusted to the correct letter height for the room's testing distance



- When a patient leans in to see the chart better, the testing distance can be 12 to 20 inches less
- A lean of 16 inches while in a 10-foot exam room is equivalent to a one-line improvement in vision

# Glasses prescription , Clinical points

- Do not prescribe glasses unless necessary






## Clinical points

- Subjective refraction results are not an absolute value and will vary from test to retest separated by even a few days
- The distance subjective refraction required for a 6m working distance in typical room illumination, may not be appropriate for all patients



## Clinical points

- In general , a lens change of less than 0.5 diopter seldom diminishes subjective asthenopic symptoms
  - The patients' last doctor may have been wiser than you initially thought
- 



## Don't forget the acquired refractive error

- Acquired hyperopia
  - Retrobulbar tumor
  - CSCR
  - Posterior lens dislocation
  - CL wearing

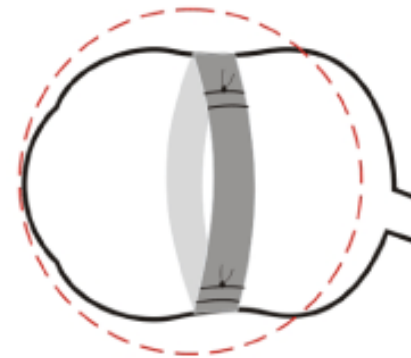


# Don't forgot the acquired refractive error

- **Acquired myopia**

- Systemic disease (diabetes , galactosemia , uremia)
- Miotics (pilocarpine , anticholinesterases such as Phospholine iodide)
- Axial change (retinal detachment surgery , KCN, anterior lenticonus)
- ROP, vitreoretinal degeneration , prematurity

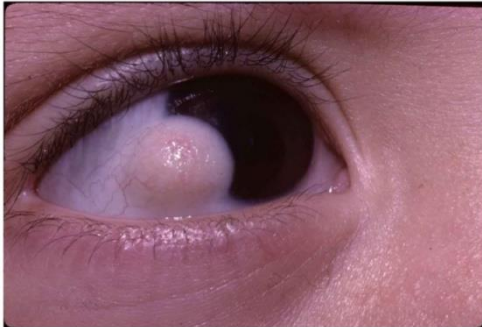
- Nuclear sclerosis cataract
- Drug (sulfanamid)
- Anterior lens dislocation
- Steep CL fitting



# Don't forget the acquired refractive error

- **Acquired astigmatism**

- Eyelid mass (hemangioma ,chalazion)
- Ptosis
- Pterygium ,limbal dermoid
- Marginal corneal degeneration, KCN ,  
cataract surgery ,keratoplasty, radial keratotomy



## Don't forgot the acquired refractive error

- **Premature presbyopia or accommodation insufficiency**
  - Severe debilitating illness (diphtheria, botulism ,Mercury poisoning)
  - Head injury
  - Third nerve palsy , adie' syndrome
  - Drug (tranquilizer)





- **It is important to understand that some patients can give a very precise and repeatable end-point, and others cannot**

- Sometimes there is a medical explanation for those that cannot (Cataracts, macular edema, dry eyes, ARMD and other conditions can cause vision to fluctuate)

- Less minus in the sphere..... to avoid over-minusing
- Less power in the cylinder.....to make adjustment to the glasses easier for the patient
- Axis at 90 or 180 degrees



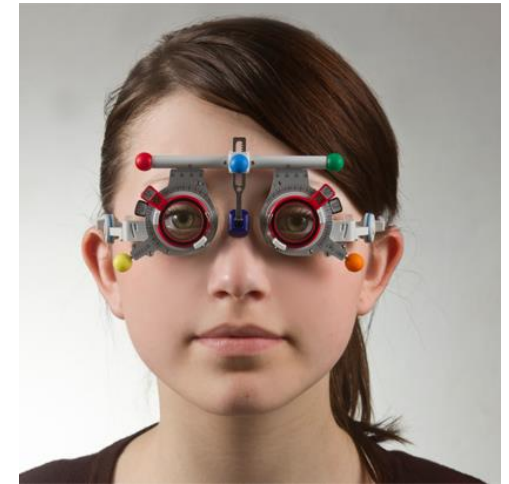
## Clinical points

- Watch to make sure the patient is **not squinting**, as this will give an unwanted pinhole effect



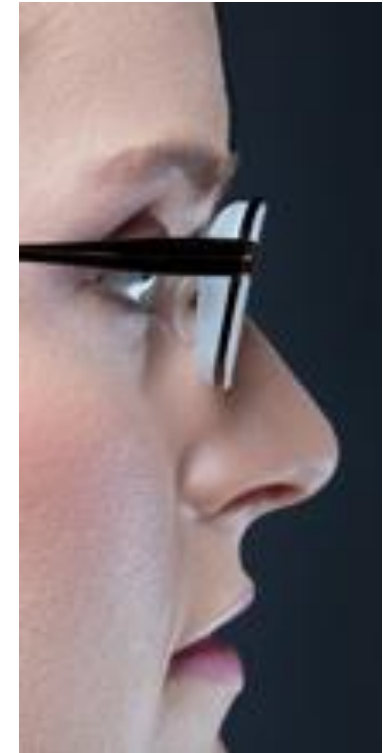
## Clinical points

- Be cautious in making asymmetric or significant lens changes
  - Particularly in elderly patients
  - Place the prescription in the trial frame and ask the patients to view a distance target beyond the confines of the examination room



## Clinical points

- Be careful in changing the lens design with high prescriptions
  - For high-powered glasses in particular, the vertex distance, PD, base curve, lens thickness, material etc can all cause problems if they are changed



## Before Writing a Glasses Prescription



- After the subjective refraction has been completed for each eye, show the patient what you plan to give them binocularly
  - It is essential that the patient be part of the decision-making process
- If the patient is currently wearing glasses, ask them to compare what has just been measured to their glasses

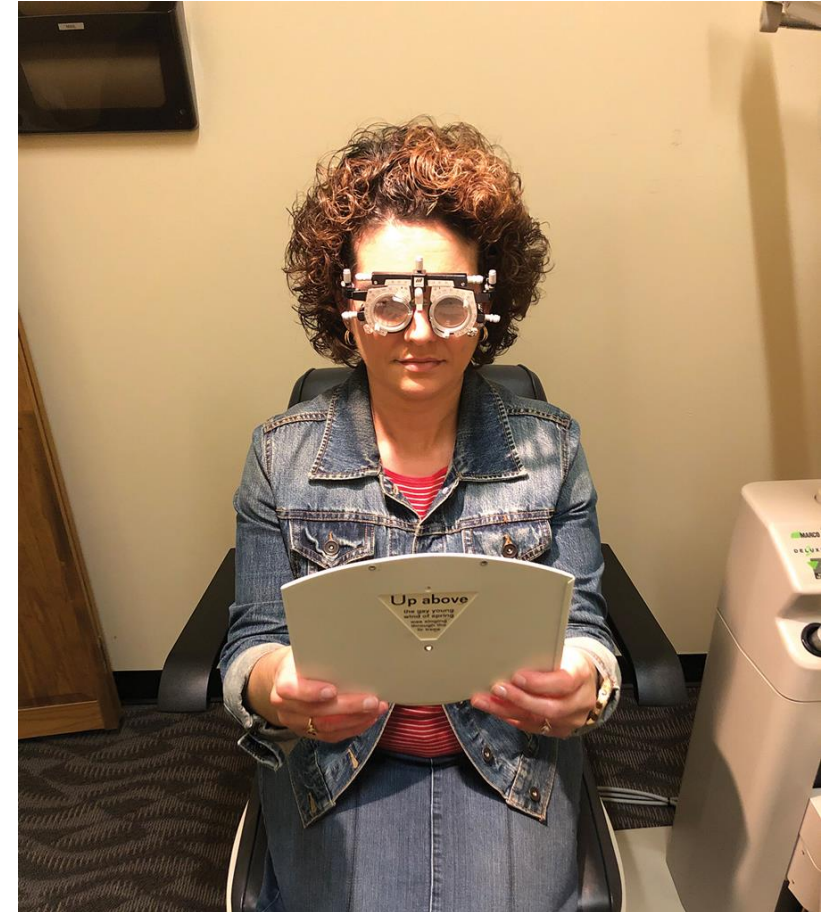
## Trial Run

- There is a large change in the patient's spherical correction or a change in cylinder power or axis
- This is the patient's first pair of glasses
- Cylinder is being prescribed for the first time
- The patient does not have their previous glasses and therefore the amount of change cannot be determined



## Trial Run

- When the intended prescription is not tolerated on the trial run, it is very unlikely the patient will adjust to it over time



## Instructing the Patient

- When prescribing a patient's first pair of glasses, discuss with them how often the glasses should be worn
- The glasses are worn all the time or only for specific tasks such as night driving
- If one is prescribing glasses for a child or teenager, it is important to give these instructions to both the child and the parent

## Instructing the Patient

- Explain any possible shortcoming or side effects the new prescription
- The patients should understand the prognosis of his or her eye condition



## Instructing the Patient

- It is essential to warn patients of adaptation problems, even when changes are small and adaptation problems are not expected
  - Patients should be informed that the new glasses may take a little getting used to and may cause headaches and discomfort and a feeling that the patient is not wearing their own glasses and the adaptation can last from a few hours to a couple of weeks

# Instructing the Patient

- Full-time spectacle wearers are often advised to wear new spectacles in familiar surroundings at first
- Adaptation is more difficult if the patient only wears the glasses for specific tasks and not all the time

## Instructing the Patient

- Swapping from an old to new pair of glasses does not help adaptation to the new ones, which need to worn full time at some point



## Instructing the Patient

- When a change in the prescription is being made, it is good to instruct the patient to **purchase only one pair of glasses initially**
  - If the prescription should need to be modified for whatever reason, only one pair of glasses will then need to be remade

- Finally, if a patient has a record of poor adaptation to new glasses (**this should always be recorded**)
  - Only change the refractive correction if absolutely necessary and then make partial changes in both sphere and cylinder



# What do you check when a patient complains that their new glasses are not as good as their previous pair?

- Ask specifically what the complaint is
  - Distance? Near? Asthenopia? Diplopia? Pain behind the ears or at the bridge of the nose from ill-fitting glasses?
- Read the new and old glasses on the lensometer and compare
  - Check the optical centers in comparison to the pupillary centers



## What do you check when a patient complains that their new glasses are not as good as their previous pair?

- Make sure the old glasses did not have any prism
- Check the patient for undetected strabismus with cover testing
- Refract the patient again
  - Possibly, with a cycloplegic agent

## What do you check when a patient complains that their new glasses are not as good as their previous pair?

- Make sure the new glasses fit the patient correctly
- With postoperative glasses, evaluate for diplopia in down gaze due to anisometropia



## What do you check when a patient complains that their new glasses are not as good as their previous pair?

- Check whether the reading segments are in the correct position
  - The add may be too strong or too weak
- Check the patient using trial lenses and reading material

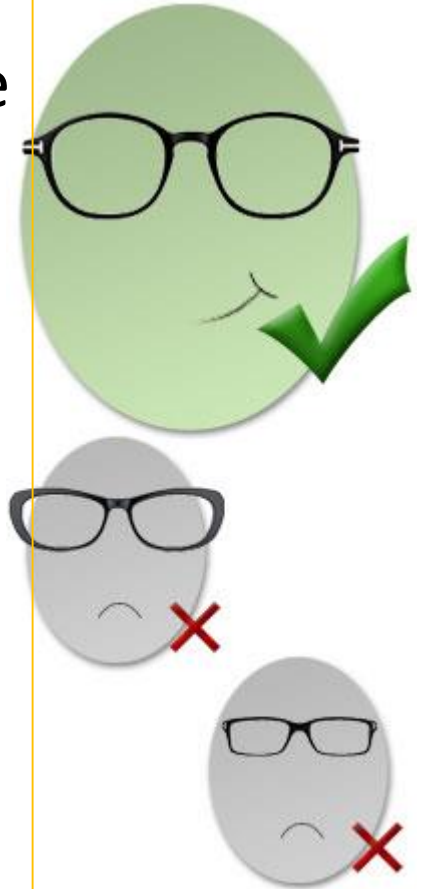
# What do you check when a patient complains that their new glasses are not as good as their previous pair?

- If the patient has a high prescription, check the vertex distance
- Check whether the old glasses were made in a plus cylinder design using the geneva lens clock
- Check the pantoscopic tilt



## What do you check when a patient complains that their new glasses are not as good as their previous pair?

- Sometimes if the diameter of the lens is much larger in the newer frame, the patient may be noticing distortion in the periphery of their lenses
- if the new frame is significantly smaller, the patient may notice the edges of the lenses or, the reading area of their multifocal lens may be too small to use efficiently



## What do you check when a patient complains that their new glasses are not as good as their previous pair?

- Evaluate the patient for dry eye





## What do you check when a patient complains that their new glasses are not as good as their previous pair?

- Above all, try to test the new prescription in a trial frame with a walk around the office; you do not want to go through this process again
- If you can find nothing wrong with the Rx and the optics of the lenses, encourage the patient to give the glasses another try





**Thanks for your  
attention**