Q: Picture of 15 yo boy in glasses with OD: -0.50 + 1.75 x 150 & OS: -0.50 +1.50 x 22 Just gave glasses for first time, returns few days later says cannot wear them. (NOTE THIS QUESTION HAS COME UP A LOT OF TIMES)

- What is the likely problem?
- How would you manage it?

A:

- The problem is likely distortion due to meridional magnification.
- Manage in 3 step:
  - Reduce the power of the cylinder while maintaining the spherical equivalent of the lens to keep circle of least confusion on the retina (0.25 sph for 0.50 cyl)
  - Rotate the cylinder toward 180° in the case of this patient (90° in the case of other's closer to 90°) – vertical and horizontal distortion is more tolerable
  - Change to minus cylinder lenses, minimize the vertex distance, or Rx contact lenses.

Notes:

- Should forewarn patient's about distortion and adaptation problems. Building confidence and affording time till cortical readaption.
- In very young children Rx full astigmatic correction, quick cortical readaption.
- Beware of changing axis even if previously incorrect in adults
- Binocular meridional distortion increases exponentially not linearly from monocular.

Q: Ptn old glasses OD: -4.25 +1.00 x 90 & OS:-4.25 +1.00 x 90 → 20/30 OU. Partner gives glasses OD: -4.75 +0.75 x 90 & OS: -4.75 + 1.00 x 90. Ptn returns c/o "uncomfortable glasses".

- How would you handle this patient?

A:

- Recheck refraction is the initial step always – would not expect discomfort from such a small change. Then compare with old glasses, see difference in frames.
- Check the new lenses with a lensmeter.
  - Check if any prism is incorporated.
  - Mark the optical centers.
  - Recheck the original Rx/glasses in the same way.
- Put the glasses on the patient take vision monocularly and binocularly.
  - Check motility for induced phorias at distance.
- (For bifocals not here – check position of segment to determine if too high or low,
  - whether centered or decentered corrrectly,
  - whether phoria or tropia is present in reading position)
- Check Pantoscopic tilt
- Check vertex distance (distometer).
- Measure patient's PD and compare to mechanical PD.

- Assess style appropriateness (size of lenses/frames)
- Compare old to new base curves with Geneva Lens Clock
- Geneva lens clock (ASKED several times)
  - Calibrated for crown glass only n = 1.50
  - D = s/y^2 (chord diameter between tow outer pins = 2y, and s from central pin --< read of scale.
- If vision is not as expected,
  - retinoscope over present lenses and subjectively refine Rx.
  - Measure final combination in lensmeter.
  - Recheck this visual acuity.
  - Give "walking around" trial if change is to be made.

Q: Ptn with ARMD OD: 20/200 – OS: 20/100.

- What low vision aids would you offer ptn?
- If bifocal what is the strongest you would use?
- How would you explain to the ptn if gave +12.00 lenses?
- What kind of induced prism would you get when the patient is reading?
- How could you correct for this if ptn symptomatic?

A:

- Selection of type and power of visual aid depend on motivation of ptn, visual ability and acuity of each eye, and visual demands at near or distance.
- Binocular visual aid if < 2 lines between eyes (here 1-2 lines)
- Remember that at 10cm need 10D accommodation as well as 10 meter angles of convergence (if PD=6cm → 10x6 = 60 P.D. of convergence – so would need 12BI prism), maximum 48 P.D. of convergence is possible for binocular correction.
- Amount of initial add = Kestenbaum's Rule = reciprocal of Snellen fraction (will correct near vision to 20/50 newsprint).
- Options are 1) bifocal adds (ADV: large field, two hands; DISADV: close reading distance, cosmesis), 2) hand held or stand magnifier (DISADV: one hand, smaller field), 3) Loupes or telescopes (ADV: more distance; DISADV: cosmesis), 4) Non optical devices – large key pads, lots of light, felt tip pens, 5) Close Circuit Television (DISADV: expense, lack of portability)
- Strongest bifocal add here +10.00 (200/20) for weaker eye.
- Would tell patient that these +12.00 glasses will magnify image by 3X (12/4), and that will need to hold things very close (100/12 cm). Advantageous as will still have both hands free vs handheld magniifier.
- Plus adds act like base out prisms as you converge when reading.
- To correct for this either grind base in prism or decenter the lenses so that IPD = mechanical PD with convergence.

Q: Picture of 32 yo female in phoropter with Prince Rule in front of her.

- How would you measure accommodative amplitude?

- If you measure 2D, is that normal?
- If not what would you do?

A:
- Need to measure amplitude and range of accomodation
- Amplitude
  - Monocular vs Binocular (Binocular is more physilogic, more affected by convergence and greater in value)
  - With perfect distane Rx (far point infinity) in place bring two dot target as close as posible till blur. Reciprocal of distance = amplitude.
  - Alternately Prince Rule with + 3.00 lenses. Measure far point and near point on ruler recprocal of disatnce between them is amplitude.
  - Alternately stimulte accomodation with minus lenses till break/blur point and then relax with plus lenses till blur point, difference is amplitude.
- Range
  - Distance between near point and far point.
  - Remember to keep half of acc. amplitude in reserve for comfort.
- 2D for a 32 yo is too low. Remember age 40 = 6 D (+/-2), for every 4 years –1.50 till 48 (44→4.50, 48→ 3.00), then –0.5 for every for years after. For every 4 years under 40 add +1.00 till age 8. So for 32 yo = +8 D.
- So probably she has latent hyperopia. – remember Total hyperopia = absolute (20/20) + facultative (still at 20/20) + latent (first two terms = manifest hyperopia).
- To measure this cycoplege the ptn with 1% Cylogyl (cyclopentoloate) recheck in 30 mins.

Q: Photo of Ophthalmologist doing retinoscopy. (HAS COME UP SEVERAL TIMES)
- What is being done in this picture?
- Why is it being done?
- How is it being done?
- If there is "with motion" why is there?
- Where is the light going in a hyperope with downward flash of light?
- When you get with motion where is the light going in <u>your</u> retina?
- How do you define axis with retinosopy?

A:
- Retinoscopy
- To obtain an objective idea of a patient's refraction and/or to look for abnormalities in the retinal reflex.
- It is done at a fixed distance from the patient called the working distance – either 50 or 66 cm, which gives you a working lens of +2 or +1.50 which must be adjusted for in your final Rx. It works on the principle that with adding plus or minus lenses in front of the eye you can move the far point in a controlled fashion. Direction of movement of light reflex changes with movement of far point. Hyperopia far point

initially behind patient's eye (With Motion) and for myope in front (against motion). Emmetropia for purposes of retinoscopy is –15.

- "With Motion" occurs with hyperopes and weak myopes < 1.5 D. The far point plane is behind the eye, so as light moves down on the retina (object) the image of the light also moves down on the conjugate far point plane → this image is therefore moving up on the examiner's retina and is perceived thus also as moving down → "with motion" – at neutralization far point is peephole of retinoscope filling examiner's pupil.
- So the light is moving upward on your retina if you are getting with motion with downward streak movement.
- To define axis add enough minus sphere to convert all types of astigmatism to compound hyperopic astigmatism. Yielding with motion of two streaks at 90° to each other. The band that neutalizes first = sphere align axis and add plus cylinder axis 90° till neutrality in both meridians. Things that help find axis 1) thinnest streak on axis, 2) dropping sleevbe points to axis, 3) skew when move with break, 4) break in reflex to intercept if off axis 5) straddle corrective cylinder axis 45° if unequal widths rotatetoward thnnest streak.

Q: Refraction –6.00 + 1.50 x 180, K1: 42 @ 090, K2: 44 @ 180.

- Which is flattest meridian?
- What axis is cylinder?
- Power of cylinder?
- What does it mean to fit on K for RGP lenses?
- What does it mean to fit steeper than K by 0.5 D, what do you do?
- Go through steps of fitting RGP

A:

- The 90° meridian with 42 D.
- The cylinder is + 2D x 90°
- The power of the cylinder is at 90°
- Fitting on K means the flattest K is used and the lens is fitted parallel to it.
- Fitting 0.5 D steeper than K allows more apical clearing and better tear physiologic exchange – plus tear meniscus. Remember SAM (steeper adds minus), need to add minus power to the CL. Rule of thumb for every 0.25 D steeper increase radius by 0.05 mm and subtract 0.25 from power of CL.
- Steps in fitting RGP
  - Hx and discussion with ptn of adv and disadv of each type
  - SLE, Schirmer test, Hx dry eye Sx
  - Adv for <3 D astigmatism, Kconus, dry eye, other ext disease, last longer , less care.
  - Disadv: less comfort, blinking distortion, difficult to fit, spectacle blur due to warpage
  - Diameter = iris –2.3mm

- BC = low astigmatism 0.5 D steeper than flattest K ; for >2D astigmatism use "mean of means" = difference between K's divided by 4 added to flattest K.
- Power: Sphere from Rx in minus cylinder form ignore cylinder; if > 4 D adjust for vertex distance
- Assess fit at SLE – just high on cornea, tucked under upper lid, good movement, not tight with fluoroscein pattern showing good apical clearance, no staining in mid-periphery and staining in periphery for edge clearance.
    - If too tight flatten by flattening BC, decreasing diameter, or decrease posterior optical zone.
    - If too flat steepen by steepening BC, increasing diameter, or increase posterior optical zone.
- Overefract, dispense
- RTC 1 week, increase wear time

Q: Two variations here 1) 25 yo with asthenopia type symptoms 20/20 OU. MR → OD: +0.75 – OS: +0.50. 2) Patient without glasses with 20/20 vision c/o of asthenopia type headaches.

- What would you do?
- Cycloplegic Rx gives +3.5 OD, +2.75 OS, amplitude of accomodation 2-3 D. What do you think of this?
- How would you treat Acc. Spasm?
- Why might astigmatism cause this?

A:

- Wearing his current glasses I would test where his near point was using an accomodative target and bringing it closer till his covergence broke. If it happens before the tip of his nose than he likely has convergence or acc. insufficiency → asthenopia. Also must check ductions, versions and do cover uncover test, and alternate cover test breaking fusion too look for large phorias. Measure fusional convergence amplitudes by base-out prism. Normal fusion convergence amplitudes are between 30 and 35 prism diopters. Patients with convergence insufficiency often show fusional convergence amplitudes of less than 20 prism diopters. Finally measure acc. amplitude and do cycloplegic refraction. Convergence insuff disappears under monocular testing conditions, acc. insuff. does not.
- So this is acc. insufficiency. Premature loss of acc. amplitude (would expect +10 at this age). DDx – 1) accomodative spasm, , 2) Adie's pupil, 3) Trauma, 4) Drugs (lithium, tranquilizers, cold medicines, anticholinergics), 5) Presbyopia, 6) Latent hyperopia, 7) Parkinson's
- Convergence insufficiency is the one type of strabismus that is best treated with orthoptic exercises. Convergence exercise is the treatment of choice and is successful in the majority of patients. The two most useful convergence exercises are near point exercises (pencil push-ups) and base-out prism convergence exercises. These

exercises are dependent on the patient recognizing diplopia and the fusion breakpoint. Rarely, surgery is necessary. If surgery is deemed necessary, small unilateral or bilateral medial rectus resections have been advocated. Pateint's with true acc. insuff. are only slightly helped by exercises and need + glasses.

Q; 7 yo failed vision test. 20/100 OU. Wearin Rx = OD: -2.00 + 3.50 x 150 – OS: –2.0 +2.75 x 30.

- What would you do?
- Cyclo → -1.00 + 3.00 x 150 OD -- -0.50 +2.75 x 30 OS and 20/40 OU. What would you do.
- When would you see the ptn again?

A:

- Do a full eye exam and ensure a cycloplegic exam and retinoscopy. Probably refractive amblyopia..
- Give full cyclo correction – ptn prob. overminused due to accomodation.
- F/u in 4-6 weeks. (Vision was 20/30 and continued too improve next visit)

Q: Picture of 3 yo child

- How do you check visual acuity? (NOTE HAS COME UP A FEW TIMES)
- What is the etiology of decreased vision in all patients. (ONE EXAMINER ADDED THIS TO THIS SCENARIO)

A; For Verbal PreLiterate Children

- Graded Optotypes
  - Rarely, children as young as 18 months can respond to Snellen optotypes, but it is uncommon for children under 4.5 years to read a standardized Snellen acuity chart dependably.
  - Tests useful in the age range 2.5-4.5 years include Allen picture cards, Landolt rings, the HOTV test, the Tumbling E test, and the Sheridan-Gardner test.
  - Most important thing to keep in mind is "crowding phenomenom" this is where reading single optotypes can give false impression of better acuity. Children with amblyopia have more trouble distinguishing the same letter if it is part of a line of letters.
- Allen picture cards are quite useful (the near test card is slightly easier for the younger child), but have certain disadvantages:
  - pictures are not constructed according to the Snellen formula (each element in the target subtends 1 minute of visual angle);
  - some (the telephone) may not be familiar to modern children because of their antiquated form;
  - targets are variably larger than the corresponding Snellen letter target; and
  - smallest target size is labeled 20/30 (6/9).

    - Despite these difficulties, most children respond readily to this familiar and easily obtainable test.
- The HOTV test requires pattern recognition and matching of progressively smaller optotypes with those on a hand-held card.
    - These letters are chosen to be of average recognition difficulty and have a vertical axis of symmetry, which obviates the issue of right-left confusion so common in this age group.
    - An advantage is the exact correspondence of the target to the graded Snellen optotypes.
- Landolt rings are discontinuous circles; the child points to a similar ring on a hand-held card.
    - The test often confuses the younger child and perhaps is more useful for illiterate adults; it does have the advantage of corresponding directly to the Snellen chart.
- The familiar Tumbling E test requires matching orientation of the letter E with a figure or the child's fingers;
    - unfortunately, right-left disorientation is common in this age range and limits the usefulness of the test.
    - Its major advantage is the direct correspondence to graded Snellen optotypes.
- The Sheridan-Gardner method requires children to match familiar object patterns viewed at distance with those on a near card.
- Some children respond to isolated Snellen optotypes, or graded numerical optotypes, before linear Snellen presentations.

- DDx of visual loss use anatomical approach out—in
    - Refractive errors
    - Lids – ptosis, lesion
    - Conj – conjunctivitis
    - Cornea – tear film prob, edema, scar, FB etc.
    - AC – iritis
    - Iris – polypupil
    - Lens – cataract, dislocation
    - Vitreous – inflamation, VH
    - Retina – many problems
    - ON – many problems

A: NOTE For Preverbal
- Fixation Testing
    - Monocular fixation testing assesses whether the patient fixes with the fovea (centrally) and the quality of fixation. Each eye should be occluded in turn, and fixation should be assessed for three separate factors: quality and accuracy (good, fair, poor), location (central versus eccentric), and duration (maintained versus sporadic). Abbreviations often used to describe fixation include GCM for good, central, and maintained; CSM for central, steady, and maintained; and FF for fix and follow. Eccentric fixation is an important sign to note as it indicates severe

amblyopia. By 8 weeks the vast majority of infants will have central fixation with accurate smooth pursuit and easily demonstrable optokinetic drum responses.

- Binocular fixation preference testing detects unilateral amblyopia and compares the vision of one eye with the other. This test is based on the fact that strong fixation preference in patients with strabismus indicates amblyopia or decreased vision in the nonpreferred eye. Binocular fixation preference testing is more sensitive than monocular fixation testing, as significant amblyopia can be present (20/100 to 20/200), yet the patient may show normal central monocular fixation. Binocular fixation preference testing, however, will identify even mild amblyopia (two to three lines Snellen acuity difference). Remember to assess monocular fixation before fixation preference testing to rule out the possibility of bilateral symmetric visual loss in preverbal children.

- Standard Fixation Preference Testing
  - This is a reliable method for diagnosing amblyopia in patients with large angle strabismus. If a patient with strabismus spontaneously alternates fixation, using one eye then the other, this indicates equal fixation preference and no amblyopia. In contrast, strong fixation preference for one eye indicates amblyopia. The stronger the fixation preference, the worse the amblyopia. The degree of fixation preference can be estimated by briefly covering the preferred eye to force fixation to the nonpreferred eye. Remove the cover from the preferred eye then observe how well and how long the patient will maintain fixation with the nonpreferred eye before refixating back with the preferred eye. If fixation immediately goes back to the preferred eye after the cover is removed, this indicates strong fixation preference for the preferred eye and amblyopia of the deviated eye. If the patient maintains fixation with the nonpreferred eye through smooth pursuit, through a blink or for at least 5 seconds, this shows the nonpreferred eye holds fixation well, and indicates no significant amblyopia is present (vision within two to three Snellen lines difference). The ability to maintain fixation with the nonpreferred eye while following a moving target is a very reliable indicator of equal vision and no significant amblyopia.
- Vertical Prism Test (Induced Tropia Test)
  - Standard fixation testing is not useful in children with small angle strabismus (less than 10 prism diopters) and in patients with straight eyes. Patients with deviations less than 10 prism diopters often have the monofixation. These patients show strong fixation preference even though the vision may be equal. Thus many nonamblyopic patients with small angle strabismus will falsely appear to have amblyopia by standard fixation preference testing. Additionally, standard fixation preference testing cannot be performed on patients with straight eyes because one does not know which eye is fixing.
  - The vertical prism test is performed by placing a 10 to 15 prism diopter prism base up or base down in front of one eye, thereby inducing a vertical strabismus. If the eye behind the prism is fixating, then both eyes will move up as the fixing eye views through the prism. If the eye without the prism fixes then the eyes view straight ahead in primary position. Thus, with the induced vertical strabismus, it is possible to determine which eye is fixing in patients with straight eyes or small angle tropias. Patients with equal vision will be able to hold fixation with either

eye, but patients with amblyopia show strong preference for the dominant eye. If the monofixation syndrome is present, the vertical prism will dissociate the eyes, which eliminates their facultative suppression scotoma and breaks peripheral fusion, allowing correct assessment of amblyopia by fixation testing. This eliminates the overdiagnosis of amblyopia associated with standard fixation testing in patients with small angle strabismus. The vertical prism test is useful in clinical conditions such as anisometropic amblyopia, unilateral ptosis, postoperative congenital esotropia, microstrabismus, and other conditions that are associated with unilateral amblyopia.

- Special Tests
  - Teller acuity cards are gray rectangular cards with stripes (technically termed gratings) on one end. Infants and children inherently prefer to look at formed images; so if the infant has the ability to see the stripes, the infant will demonstrate an eye movement toward the stripes. The infant is presented a card with the stripes oriented either on the left or right side. The examiner is behind the card and observers the infants eye movements through a peep hole in the center of the card. Varying widths of stripes are used to determine the thinnest stripes that provoke the appropriate eye movements. One problem with stripes or grating acuity tests is their tendency to underestimate the severity of amblyopia.
  - The pattern visual-evoked potential (PVEP) measures brain wave activity in response to pattern stimulation. Luminance balanced patterns (usually black and white checks) are presented by monitors and scalp electrodes over the occipital area measure potential changes in the brain. The patterns reverse and the occipital brain activity is recorded and analyzed by computer. The pattern stimulus can be changed to measure a variety of acuity levels; however this test only gives a visual acuity estimate

Q: Shown a picture of a female post cataract surgery with wearing –3 D glasses 20/25 OU and they are slid down her nose and tilted downward.

- Why is she doing this with her glasses?
- Does she want more or less power when she moves the glasses away?
- What would be the difference if they were + glasses.

A:

- For pantoscopic tilt remember MMM – tilting a minus lens induces minus sphere and large minus cylinder axis 180 (which is + cyl at axis 90). Similarly tilting a plus lens → PPP, small plus sphere with large plus cylinder axis 180.
- For the glasses moving away from the eye remember CAP (Closer Add Plus). So for a minus lens the further away it is from the eye the weaker (less effective it is). So in our patient's case (-3) she pushes it down the nose it becomes less effective and therefore she can see better up close (helps with reading).
- If they were plus glasses they would become more effective also helping in reading.

Q: Patient with Rx +1.00 +2.00 x 90 OU. You fit with RGP lenses getting 20/60 OU and with overefraction you get +1.00 x 65. (NOTE QUSTION ALSO ASKED SAYING FIT WITH SCL AND GET CYL ON OVERREFRACTION)

- What is going on?
- How would you solve the problem?
- What else could you do?

A:

- You have residual lenticular astigmatism since the RCP lens will correct for up to 3 cyl. Of corneal astigmatism.
- Could wear 1) Glasses over CL; 2) Glasses instead of CL; 3) toric SCL; 4) bitoric RCP lens
- Lasik

Q: Woman comes into office, has lost her glasses, your partner Rx –2.00 + 0.50 x 90 OD - -2.00+ 0.75 x 85 OS. She returns to see you c/o diploplia.

- What do you do?
- Told she has binocular diploplia – what now?
- Told she has vertical seperation – what now?
- Told she has 5 RHT. How would you manage the problem?

A:

- Test to see if she has binocular or monocular diploplia. Hx and subjective testing.
- See if she has vertical or horizontal seperation of images.
- Measure without glasses to see if she has a hyper, maybe 3-Step test to see if she has SO palsy. Ask if she found her old glasses and use lensmeter to see if they have any ground in prism.
- Measure least amount of RBD prism that she needs for fusion, give it to her either initially with Fresnel to test or grind into glasees 2BD OD, 2BU OS.

Q: Shown a picture of a high myope with ugly thick glasses. (NOTE ASKED SEVERAL TIMES)

- Could you improve the appearance of these glasses?
- Is this patient a good candidate for refractive surgery and how would you advise him about the options. (NOTE – THIS QUESTION WAS ASKED IN THE TIME OF RK, BUT I AM SURE IT WILL BE ASKED ABOUT THE NEW TECHNIQUES)

A:

- Use high index plastic (HIP) lenses, with scratch resistance and antireflective coating (increased chromatic dispersion with high index); beveled edges, small complete plastic frame and peripheral tinting same color as frame (reduces myopic halo rings)

or photochromic lenses. Minimize size of frame and vertex distance (can be less minus this way). NOTE – you can also consider CL.

- Almost anyone who does not have a contraindication for refractive surgery is probably a good candidate for refractive surgery these days. For high myopes, LASIK is probably the modality of choice, for extremely high myopes, CLE extraction may be the thing to wait for. Some surgeons advocate PRK even for mod-high myopia. Need to know the corneal thickness of the ptn and the pupil diameter in ambient conditions for a final decision.

Q: List all the reasons a patient may complain of new replacement glasses

A:

- Frame weight
- Appearance
- Improper refractrion
- Improper dispensing
- Improper vertex distance
- Improper pantoscopic tilt
- Change from plus to minus cylinder
- Inappropriate optical center true PD different from mechanical PD → induced prism
- Image jump or displacement from new bifocal
- Induced phorias
- Meridional magnification – tilting, change in astigmatic correction without adjustment

Q: Shown picture of non-central corneal scar

- Why is vision reduced?

A:

- Irregular astigmatism

Q: Shown gentelman with new bifocals. C/o the line being unsightly and the bifocal not being centered.

- What would you do?

A:

- Measure IPD at near through bifocal segment and adjust the centration of the lenses so mechanical PD = IPD at near for bifocal segments. Also consider progressive bifocals for cosmesis, or option of plain reading glasses and switching between the two.

Q: 26 yo myope –5.50 OU and 20/20 now aged 55 and –8.50 OD 20/50, -6 OS 20/20.

- What is going on?
- What would you do?
- If has cataract would yo take it out?

A:

- Ddx for progressive myopia is 1) cataract, 2) DM, 3) ROP, 4) Developmental glaucoma, 5) posterior staphyloma, 6) ant lens dislocation, 7) vitreoretinopathies
- Ptn most likley has NS cataract OD.
- Should check refraction again, do full SLE and DFE
- ECCE is dependant on patients personal and occupational impairment. If not interfering significanlty with ADLs or lifestyle than no need for operation, otherwise yes.

Q: Older ptn wearing +1.50 20/70 at distance and J 1+ at near c/o decreased vision. Refraction shows ptn is –1 OU for distance with OD: 20/20 / J3 and OS: 20/20 / J4

- Why?

A:

- 1) Distance refraction makes him lose 2.5 D of magnification and changes his focal length
- 2) Ptn probably has PSC cataracts which at near with induced miosis are more significant and decrease vision

Q: Child with stable hereditary macular degeneration. OD: -6 + 2 x 90 20/400 / J 15 – OS –4.50 +1 x 90 20/100/ J3

- What could you do to help near vision?

A:

- See above if teenager. If not teenager then his accomodation will be > 10-12 D and can accommodate to very near objects such as fine print up to and beyond 20cm. Accomodation is like simple magnifiers, adding plus power but also increasing the angular subtense. In teens will have ot progress to bifocal plus lenses + other Low Vision Aids see ? above

Q: Picture of trail frame glasses shown from side.

- What is the horizontal bar with mm markings used for?
- Why is it important?

A:

- Vertex distance measurement
- If greater than 4D of myopia or hyperopia can sig, change Rx if the distance is changed and must note it on the script.

Q: Photograph of Amsler Grid with progressive bifocal segment over it curving the lines.
- What type of distortion are experienced with bifocals?
- How would you select the proper bifocal type?
- What are the reasons for ptn disatisfaction?

A:
- Image jump – sudden image jump as eye descends from distance optical cnter to bifocal segment. Biggest for round top. Depends on distance of optical center of reading segment from start of segment (close for flat top, far for round top → more prismatic effect)
- Image displacement – displcement of image by total amount of prism effective in bifocal portion (i.e. contribution from both distance and near correction)
- So for Minus glasses – Flat top is better (think of prisms BD+BU), and round top is awful (BD+BD) and vice versa for Plus lenses where round top is better for displacement (executive worker) but worse for jump (waiter). (Just remember most people are myopes and most bifocals are execitive)
- Single vision readers best for: 1) bifocals failed, 2) cervical problems, 3) anisomtropia → big prismatic effects, 4) tight rope walking
- Progressive lenses ADV:
  1. No abrupt power change
  2. No image jump at line
  3. No diploplia at line
  4. Absence of non-cosmetic line
  5. Good for first time presbyopes do not require wide near viosn, and motivated

  Disadvantages
  1. Peripheral distortion (astigmatism generated by changing aspheric zones. Swimming sensation with ocular rotations.
  2. Peripheral degredation of acuity
  3. Battle between less distortion vs. less useful aberration distance and near acuity.
- Height of segment depends on how often you need to look down, mid pupil for often or kids.

Q: Picture of Jackson Cross
- What is it?
- How do you use it?
- What other ways are there for seeing if astigmatism is present?

A:
- Jackson Cross Cylinder Technique

- A special condition exists with certain lenses such as -1.00 +2.00 × 180, for the Spherical Equivalent of such a lens is 0. This type of lens is used in the Jackson cross cylinder, for the property of a lens with a spherical equivalent of 0 is very useful. The cross cylinder technique is probably used more often than the astigmatic dial. The standard is –0.37 + 0.75 x 180.
- Theory. The technique is based on maintaining the spherical equivalent in the same position relative to the retina, but using a spherocylindrical lens in different axis orientations to determine the refractive error. The concept is elegant and brilliant in its ability to manipulate the interval of Sturm by expansion and contraction without affecting its position relative to the retina. The position of the interval is such that the circle of least confusion is placed on the retina with spherical lenses. The ability of the patient to appreciate a clearer image when the interval of Sturm is contracted compared with when it is expanded is the basis for this test. Alignment of the cross cylinder is performed first to determine the position of the axis of the patient's cylinder. Once the axis is found, the alignment of the cross cylinder is shifted to determine the amount.
- Method. For the Jackson cross cylinder technique, the best target to use is a Snellen line of letters two or three lines larger than the best visual acuity allows. The eyes are examined separately, with only the eye being examined open to look at the target, the other occluded.
- The patient is instructed to observe the line of letters. The patient is told, "I will be showing you two lenses as you look at the line of letters. Please tell me which lens makes the line of letters clearer. At times neither lens will be very clear, but tell me which one is better. At times they may look about the same, please tell me if they do, but try to tell me which is clearer if you can".
- The best spherical equivalent is used to allow best acuity. This places the circle of least confusion on the retina. An additional plus 0.50 D is added to verify that the target becomes blurred and that the patient is not undercorrected. It is then removed.
- This first method allows us to find the presence of a measurable amount of astigmatism, refine the axis, and then find the amount. Initial presentation allows determination if there is measurable astigmatism in axis 90 or 180.
- The cross cylinder is placed in front of the eye to be tested. The Jackson cross cylinder is placed so that when "flipped" the axis marker will move from 90 to 180 or vise versa. If the patient states that neither is substantially better than the other, there is no significant with the rule or against the rule astigmatism. "With the rule" astigmatism is corrected with plus cylinder axis 90° or minus cylinder correction axis 180°. "Against the Rule" astigmatism is corrected by plus cylinder at 180° or minus cylinder at axis 90°. The axis alignment is now changed to flip between axis 45 and 135. Again, the patient is offered a choice.
- Wherever the patient prefers one more than the other, 0.25 D of cylinder is added aligned with the preferred axis. The patient is then given the opportunity to reject this added cylinder or to choose more until 0.50 cylinder is present.
- Refinement of Cylinder
- With the cylinder in place from the approach above, or beginning with the cylinder found by retinoscopy, refinement of both the axis and then the amount are begun.
- Axis

- Once it has been determined that there is a measurable amount of astigmatism, the axis must be refined with the straddling position of the Jackson cross cylinder. Refinement of the axis uses a bracketing technique, where progressively smaller changes in axis are presented as the patients actual cylinder axis is approached. The straddling choices present the patient with choices 45° on either side of the preliminary axis with the patient's preference determining the direction of refinement. The method places the cross cylinder so that the cylinder axis markers are exactly 45° on each side of the cylinder axis marker of the refractor. The patient is then given a choice, as the cross cylinder is flipped, as to the clearer image. The image will be clearer as it approaches the patient's true astigmatic axis. According to the patient's selection, the flip cylinder and the refractor cylinder are rotated in the direction of the clearer image. The endpoint is that where the patient is unable to see a difference in clarity between the two choices. This endpoint occurs where the refractor cylinder axis is aligned with the patient's actual astigmatic error axis and the flip cylinder plus and minus notations straddle the refractor axis. Once the axis is refined, the amount of cylinder may be determined.
- Amount
- As the amount of cylinder is being refined, one may view the process as a bartering or "selling" cylinder to the patient. The cross cylinder is positioned so that the power of the cross cylinder is aligned with the patient's cylinder. The patient is given the choice as the cross cylinder is flipped to accept more cylinder or reject the present amount of cylinder. The process is continued with the patient accepting or rejecting cylinder amounts until the lens choices presented appear equal to the patient. As the cylinder in the refractor is changed more than 0.50 D, the sphere must be compensated in the opposite direction to maintain the same spherical equivalent. In plus cylinder refraction, for every +1.00 D cylinder increase, reduce the sphere by 0.50 D.
- Once the process of astigmatism correction is completed, the sphere is rechecked for best visual acuity with the least amount of minus sphere (or most amount of plus) tolerated.
- Highlights of Jackson Cross Cylinder Refraction Technique
    1. Monocular test
    2. Target viewed without fog beginning with either
        a. best spherical equivalent
        b. retinoscopy findings
        c. previous spectacle correction in refractor
    3. Maximum plus sphere added to #2 that allows best acuity
    4. Target used is two or three lines worse than best acuity
    5. Find axis of cylinder first
        a. Find presence of cylinder using cross cylinder
        b. Refine cylinder from retinoscopy
    6. Find power in cylinder Remember to compensate with 0.25 sphere for each 0.50 cylinder change
    7. Refine sphere

- Alternative Methods for Astigmatism
- Astigmatic Clock Dial

- Theory. Spherical lenses cause rays in every axis to be focused equally. A plus lens added in front of an eye causes all rays to be brought into focus more anteriorly. A minus sphere causes rays to be focused more posteriorly in all axes. Cylindrical lenses have a different property, for they affect rays in one axis predominantly. A cylindrical lens, if placed with its axis at 90 degrees has an effect on rays which strike the lens in the horizontal plane. Those rays in the vertical plane pass through the lens unchanged. If one imagines a stack of rays (like pancakes) in horizontal orientation passing through a plus cylinder lens axis 90 degrees, it could be seen that each horizontal plane would form a point focus behind the cylinder lens. These point foci would form a vertical line. Therefore a cylindrical lens has its effect on light perpendicular to its axis, but forms an image parallel to its axis. Furthermore, if such a cylinder were to increase in power, the vertical line focus formed behind the lens would move anterior. It is understood then that a plus cylinder lens axis 90 degrees, if increased in power, will cause its vertical line focus to move anteriorly. Any cylinder placed with its axis in alignment with the orientation of focused rays on the retina may be used to manipulate these rays, plus to move them anteriorly and minus to move them posteriorly.
- Method. The astigmatic clock dial, or sunburst target, is used to determine first the axis of astigmatism and secondly the amount of astigmatism. The patient views the target monocularly, with no correction in the lens blank. Plus sphere lenses are added in front of the eye until the target is blurred or "fogged." This fogging is critical to the test, for it causes accommodation to be relaxed. It also creates a condition of myopia or compound myopic astigmatism. The manipulation of the Interval of Sturm so that all the rays are focused anterior to the retina (compound myopic astigmatism) allows the examiner to control the test. Creation of the "fog" creates a situation where accommodation is relaxed, for if the patient accommodates, the target will simply become even more blurred. The "fogged" target is evaluated by the patient. Under these conditions, the entire Interval of Sturm is anterior to the retina. The closest rays to the retina will be seen clearer than the more anterior rays. The axis of astigmatism can be determined by aligning the cylinder axis marker of the refractor with the clearer rays (with plus cylinder refractors). For example if the patient indicates that the lines as indicated on a clock dial are clearer from 12:00 to 6:00, the axis is then set at 90 degrees, coinciding with this vertical axis. If the clearer lines were 3:00 to 9:00 then the axis would be set at 180; if oblique, the axis would still be aligned with the oblique clock hours preferred by the patient. The Interval of Sturm is then collapsed using plus cylinder lenses to bring the posterior end up to the anterior end of the Interval. Once the Interval of Sturm is collapsed into a point focus, the lines are then all seen equally foggy. This point focus is then moved back to the retina with the use of minus sphere lenses.
- Highlights of Astigmatic Dial Refraction
  1. Monocular test
  2. Fogging of +1.00 to +1.50 diopters
  3. Ask the patient "which line is clearest" as on a clock dial.
  4. In plus cylinder refractors, line up the cylinder parallel to the line seen clearest by the patient. In minus cylinder refractors, line up the axis perpendicular to the line seen clearest by the patient.

5. Add cylinder until all lines are equally blurred. After each 0.50 cylinder added, compensate with opposite sign sphere to maintain the spherical equivalent.
6. The fogging sphere is then gradually reduced to best acuity.

- Stenopeic Slit
- Isolate the 2 best meridians with the slit and neutralize with two spherical corrections to yield a power cross which can be converted to a power cylinder.

Q: 9 yo child fails school exam. Visual acuity 20/60. MR = -3 + 4.50 x 60 ; -3 +4.50 x120.

- What do you do?
- Cyc. Rx = -0.50 + 5.00 x 60; -0.50 + 5.00 x 120 – what do you do?
- Final vision is 20/40 OU what do you think vision will be on f/u

A:

- Cycloplegic refraction
- Give cyc Rx
- Expect him to return with better vision maybe even 20/20 or 20/25

Q: Photograph of A-Scan being performed.

- What measurement is being done?
- How does this relate to IOLs?
- Cannot insert PCIOL have to place ACIOL what adjustment in power would you make?

A:

- Axial length measurement using an A-Scan
- Power of IOL lens determined by 3 factors
  1. Refracting power of cornea
  2. Position of retina (axial length)
  3. Position of IOL relative to cornea.
- The SRK Formula is one of the simplest formulas
- P = A - (2.5 x Axial length) – (0.9 x Average K)
- A is surgeon specific. Manufacturer specific, variable for ACIOL vs PCIOL and for lens shape (biconvex vs, convex-plano, vs meniscus)
- So for ACIOL vs PCIOL ACIOL power = PCIOL power – (A constant difference) remember CAP (PCIOL closer to retina, therefore more plus)
- Also remember D iol = P (for emmetropia) – (R / 1.5) where R is desired post-op refraction
- Different types of Formula are slightly better for shorter or longer eyes – SRK II, Binkhorst, Holloday, Thompson.

Q: What kind of drops would you use for cycloplegia in a 9 yo.

A:

- Usually Cyclopentaloate 1% (Max cyclo 15-45 mins, dur = 6-8 hrs, resid. Acc. 1-2 D)
- Alternatively Atropine if still big residual acc or very pigmented individual with poor response qhs x 3 nights – (Max cycl 2hr-2 weeks, dur 2 weeks, resid <1 D)
- Remember for all SE are
    1. Nausea
    2. Dry mouth
    3. Flushing, fever
    4. Tachycardia
    5. Psychic stimulation/depression
    6. Hallucinations
    7. Rare circulatory collapse
    8. Topical – immediate/delayed hypersensitivity, SPK
    9. Closed angle glaucoma
- Also for long lasting drops beware use in children with spastic paralysis, brain damage and DOWN syndrome
- For toxicity treat in poison control center – physostigmine 0.03 mg/kg in kids, 0.5-2.00 mg in adults, IM or IV → 15% seizyre rate when used for this purpose

Q: A 40 yo myope walks into your office and says wants CL.

- What problems would you discuss?

A:

- Specifically in this age group 2 things are of particular concern
    1. Pushing over into reading glasses more quickly by increasing accomodation demands. (Opposite would be the case for hyperopes).
    2. Higher incidence of dry eyes and CL intolerance
    3. Will not alter the need for reading glasses or alternative approaches eventually – monovision vs. bifocal CL

Q: What are the causes for induced hyperopia?

A:

- Retina moves forward
    1. CSR
    2. Retroblbar tumor
    3. CME
- Lens moves back
    1. Dislocation
    2. Cataract

- Cornea Flatter
    1. RGP lenses – orthokertology
- Presbyopia

Q: What are the causes of irregular astigmatism? What is the treatment?
A:

- Lid
    1. Hemangiomas
    2. Ptosis
    3. Chalazia and other tumors
- Conj
    1. Pterygia
    2. Limbal dermoids
- Cornea
    1. Scars
    2. Kconus – globus
    3. Pellucid Degen
    4. Marginal corneal degen – Moorens etc.
    5. Surgery – cataract, PK, PRK, RK, Lasik
- Lens
    1. Cataract
    2. Dislocation/tilt

- Treatment depends on etiology e.g lid and conj and lens remove lesion for cornea
- Consider CL – RGP, Hard BiToric, for Kconus – special lenses (Sopper, McGuire, NiCone) or piggyback.

Q: Picture of Snellen Chart (NOTE: This question has appeared numerous times)
- What visual angle is subtended by a 20/20 letter at 20'?

A:

- At 2" letter measures 8,9 mm and subtends 5' of arc. Each gap in the E is 1' = minimum seperable angle. A 20/40 letter at 40 feet would also subtend 5' arc.
- Minimum visual angle discriminable by a ptn is the inverse of their snellen acuity. E.g for 20/100 min resolvable/seperable angle 5'.
- Snellen fration = Test distance Snellen letter subtends 1' (20) / Distance identified letter must be held to subtend 1' (e.g 40 feet)

Q: Hand surgeon using loops for years switches to opertaing microscope. Does not want to take off bifocals because cannot see sutures without them, but having trouble focusing through scope.

- What should he do?

A:
- Adjust the microscope appropriately
    1. Choose working distance and then appropriate objective lens for this distance (15,175, 200mm)
    2. Set eyepieces at zero
    3. Go to highest mag
    4. Fine focus object
    5. Go to lowest mag
    6. Fog each eyepiece with plus
    7. One eypiece at a time add minus till focused monocularly
    8. Do binocular balance and IPD

Q: Have an esotropic ptn wearing +1 lenses
- what would you do?

A:
- Since esotrope correct full hyperopia, consider cyc. Refraction and treat full amount, push plus (opposite for exotrope then only give absolute hyperopia).

Q: With a hand held magnifier what would happen to the power when the distance to the page is increased or decreased?

A:
- The power of the lens is standardized for 25cm and does not alter with viewing distance = M = D/4
- However if alter distance then image size would appear different
    - M2 = (25 / D2) * M1

Q: Picture of lens system with lens +4 + 2 x 90
- What is sph. Equiv?
- What is focal length of lens?
- Object placed 50 cm to left where would its image be?
- What is the conoid of sturm?

A
- +5
- 2 focal lines 25 cm horizontal and 100/6 cm vertical, circle of least confusion at 20cm (dioptерically midway)
- U + D = V → -2 + 5 = -3 → 33 cm to left of lens
- Conoid of sturm is complex conical image space bounded by 2 focal lines of the spherocylinder. Draw power X the vertical line → horizontal focal line and vice versa

Q: What is the DDx of monocular diploplia?

A:

- Same as the differential for acquired astigmatism → ghost images/distortion
- Lid
    1. Hemangiomas
    2. Ptosis
    3. Chalazia and other tumors
- Conj
    1. Pterygia
    2. Limbal dermoids
- Cornea
    1. Scars
    2. Kconus – globus
    3. Pellucid Degen
    4. Marginal corneal degen – Moorens etc.
    5. Surgery – cataract, PK, PRK, RK, Lasik
- Lens
    1. Cataract
    2. Dislocation/tilt
- Vitreous opacities
- Cerebral Polyopia (tumor, stroke, AV malformation – post hemisphere → multiple images +/- hallucinations and palinopsia)

Q: What are the difficulties encountered by aphakic patients wearing glasses?

A:

- Aphakia with spectacle correction is equivalent to a Galilean telescope with big – lens (the eye) + weaker plus lens at vertex distance magnification from 15-25%. Making uniocular glasses for aphakia impossible due to ANISEKONIA.
- Smaller VF covers larger retinal area →
- Ring Scotoma about 10 deg big VF space at 30'
- Jack in the Box phenomenom pops out of scotoma
- Best way to deal with above is move head not eyes otherwise get roving scotoma
- VF isopters and blind spot move closer in
- Visual acuity testing inaccurate 20/20 is actually 20/25
- When reading have big BO effect requiring extra convergence → improve with segment decentration and design
- When not looking at optical center → increased vertex distance and bluring → adjust by using aspheric lenses
- Pincushion distortion door and table four edges bow inward
- Cosmesis

Q: Duochrome snellen chart

- What is the duochrome test?
- How does it work?
- What is the name for when they sides are equal?
- Will color-blindness affect the test?

A:

- A method used to refine the sphere in refraction
- It works because of chromatic aberration in the lens, refracting green light more than red. There is a difference of 0.75 D between the two (Green 0.37 D in front, Red 0.37 behind), and the end point is when both are equally sharp and yellow holds the emmetropic position on the retina.
    - Monocular testing here. Fog the start point by +0.75 D. Should be "in the green" now. Add minus till equally sharp on both sides. Isochromic?
- No good for patient's with < 20/40 must be able to discriminate 0.37 D difference
- No good for pseudo/aphakic because green looks so much brighter now
- Color deficiency makes no difference as it is the physical characteristics of the light not the color which are important.

Q: Prism shown

- How do you place prisms into glassses?
- What are Fresnel prisms?
- How does an optician grind in prism?

A:

- Always try temporary prisms first as deviation may change or benefit may not be present and may have to change amount
- Fresnel prisms operate on the principle that power of prism is related to apex angle only and so can reduce base thicness by using lots of tiny prisms in linear order which can be glued onto the back of a lens
- Problems are reduced acuity, peeling, dirt, discoloration, chromatic aberration

Q: What is the definition of legal blindness?

A:

- Best corrected vision in best eye is worse than 20/200 or best VF is worse than 20°

Q: Telescope shown

- What is the magnification of a telescope?
- What is its reference point?

A:

- Galilean telescope has + objective lens and – eyepiece
- M(angular) = - D (eye) / D(objective)
- Image on retina is inverted but perceived upright (M is positive)
- Separation of telescope is difference between focal lengths (1/Do – 1/De)
- For Astronomical formula is same but D (eye) is negative so M is negative and percieved image is upside down and add their focal lengths for sep. of telescope
- Accomodation through telescope = Normal accomodation * Ma^2
- For whatever working distance you need add 100/distance (cm) in diopters in front of the objective lens and M would be reduced to De/Do+working distance lens (e.g +2 for 50 cm or +4 for 25 cm)

Q: Patient has accomodative spasm – how would you mange her?

A:
- Treatment often foster the psychologic crutch that these patient lean on
- Make sure not central cause – especially after trauma
- Explanation and reassurance
- Cycloplegia + bifocals
- Vicious cycle of – lenses, overaccomodation → return for another –1.50 D.
- Best treatment is clip=on minus lenses with least amount to meet licencse requirements

Q: What is a Purkinje Shift?

A:
- This transition period between photopic and scotopic vision results in a shift in the spectral sensitivity of the human retina toward shorter wavelengths of light.
- This shift in spectral sensitivity from the photopic peak of approximately 550 nm to the scotopic peak sensitivity of approximately 507 nm is known as the Purkinje shift
- Blues are brighter at dusk and reds at dawn.

Q: What is the Stiles-Crawford effect?

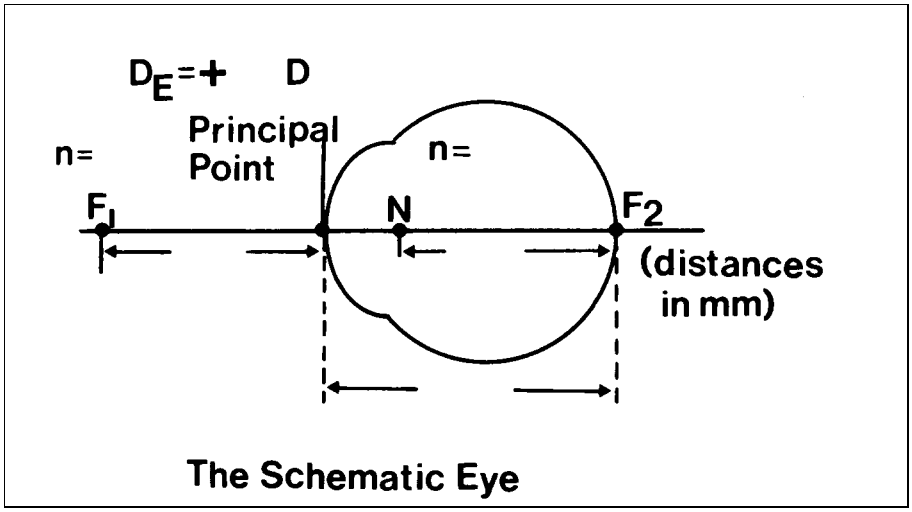
A:
- Light entering the eye through the physiologic center of the pupil parallel to the visual axis will be maximally effective in stimulating the central retinal cones, resulting in best contour discrimination, contrast, and therefore the best visual acuity.
- As light deviates from the physiologic center of the pupil, these functions are degraded by the alteration of the light ray-receptor orientation so that the foveal cones no longer act as efficient wave guides.
- By moving the light point of entry only 3 mm from the physiologic center of the pupil, photopic retinal image resolution is reduced by more than one-half that obtained when the light rays enter through the physiologic center of the pupil.
- This effect appears to be present only for the retinal cones, in that light entering obliquely has only a minor effect in decreasing scotopic stimulus values.

- The Stiles-Crawford effect greatly decreases the significance of pupil size for photopic visual functions.
- Consequently, the Stiles-Crawford effect can be used to evaluate photoreceptor alignment or misalignment in retinal disease.

Q: List the refractive indices of water, lens, cornea, crown glass etc.

A:
- Air = 1
- lens = 1.42
- crown glass = 1.5 = PMMA IOL
- Aqueous = 1.33
- Cornea 1.376

Q: Picture of Gullstand's eye



- What is this?
- Where are the ant and post focal points?
- Pinciple plane?
- What are the distances?

A:
- Gullstrand's schematic eye
- 17 mm in front of eye and on the retina 22.6 mm behind cornea
- The principle plane is the cornea, nodal point is 5.6 mm from cornea