ACCOMMODATION AND VERGENCE TESTING PROCEDURES

Lab Manual for:
V652
CLINICAL SCIENCES III:
Accommodation and Binocular Vision

INDIANA UNIVERSITY SCHOOL OF OPTOMETRY

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CONTENTS OF V652 LABORATORY MANUAL

INTRODUCTION

In the first part of the course you will continue to learn more of the procedures in a basic vision examination with emphasis on binocular vision evaluation. Then you will learn more of the auxiliary or alternative tests that you will need for Clinic and you will learn the conditions under which it will be advisable to use them.

This manual is designed to be the laboratory instructions for the course. At the end of the instructions for each lab you will find two copies of the laboratory report for that lab. One of these report forms needs to be turned in at the end of each lab period to the teaching assistant for the lab. These reports will be scored and returned to you with the points applied to the total course grade. All labs must be completed. Arrangements can be made for make-up in the case of illness or family emergency. See the course syllabus for more information on course grading and course policies.

Please refer to the table on page 7 for listings of page references in the reference books for each of the procedures being studied in the lab.

This manual originated as a set of lab handouts composed by Dr. Ted Grosvenor in the 1990s. Subsequent additions, modifications, and revisions have been made by Drs. Richard Meetz (2000-2001), Tracy Nguyen (2002-2003), and David Goss (2003-2015). Revisions in 2006 were made with the assistance of two students: Jaimie Kruger and Rana Zargar.

LAB SCHEDULE
V652 Clinical Sciences III
Fall Semester, 2015

Dates:

Aug. 24-27   Phorometry (Lab #1)

Aug. 31 - Sept. 3   Phorometry (Lab #2)

Sept. 8-10, 14   Nearpoint Tests & Test Sequencing (Lab #3)

Sept. 15-17   Practice (Tues., Wed., & Thurs. lab sections); Quiz during lab

Sept. 21-24   Practice Week; Quiz during lab

Sept. 28- Oct. 1   **Proficiency:** Prelims, Refraction & Phorometry

Oct. 5-8   **Proficiency:** Prelims, Refraction & Phorometry

Oct. 12-15   MEM Dynamic Retinoscopy & Accommodative Facility (Lab #4)

Oct. 19-22   Dynamic Retinoscopy & Alternative Phoria & Vergence Tests (Lab #5)

Oct. 26-29   Additional Accommodation & Binocular Vision Tests (Lab #6)

Nov. 2-5   Practice Week; Quiz during lab

Nov. 9-12   **Proficiency**: Auxiliary Tests, Dynamic Retinoscopy, Accommodation & Vergence Tests

Nov. 16-19   Cycloplegic Refraction & Bifocal Determination (Lab #7)

Nov. 23-27   Thanksgiving Break

Nov. 30 - Dec. 3   Cycloplegic Refraction & Bifocal Determination (Lab #7)

Dec. 7-10   Entering BV and Accommodation Findings in EHR (Lab #8)

TEXTS AND READINGS
V652 Clinical Sciences III
Fall Semester, 2015

Required Textbook:

      Goss, 3rd ed., **"Ocular Accommodation,**
      Convergence, and Fixation Disparity"

Recommended Texts:

      Carlson & Kurtz., 3rd ed., **"Clinical Procedures for Ocular**
      Examination"
      Eskridge et al., **"Clinical Procedures in Optometry"**
      Grosvenor, 5th ed., **"Primary Care Optometry"**

Additional Resources:

      Amos **"Diagnosis and Management in Vision Care"**
      Brookman **"Refractive Management of Ametropia"**
      Meetz Videocassettes: **"Subjective Refraction"**
      "Clinical Procedures: The Phorometry Series"

The following table gives pages in the Carlson and Kurtz, Eskridge et al., and Grosvenor books that are relevant to the topics studied in this lab.

Lab No.	Topic	Carlson and Kurtz, 3rd ed.	Eskridge et al.	Grosvenor, 5th ed.
1	Von Graefe distance phorias	164-169	81-82	224-225
	Risley distance fusional vergences	170-175	95-97	228-229
2	Near von Graefe phorias	176-181	82	225-226
	Near Risley fusional vergences	182-186	95-97	229-231
	Gradient phorias	177-178		235
	AC/A ratios			235-236
	BCC	189-190	200-201	231-232
	NRA & PRA	191-192		234
	Morgan's norms			229
3	Nearpoint findings for presbyopes			
	Order of binocular vision tests			
4	MEM dynamic retinoscopy	197-198	680-681	198-199
	Accommodative facility	193-196	687-697	
5	Nott dynamic retinoscopy		681	198
	Low neutral dynamic retinoscopy		(Dynamic ret. 677-686)	197-198
	Maddox rod	208-210	82-84	227
	Modified Thorington	211-213		227
	Prism bar vergences		92-95	
6	Mallett associated phorias	204-207	719-722	
	Disparometer		721-723	236-237
	Wesson fixation disparity card		721-723	238-239
	Worth dot	47-49	700, 703-704	239
	Hirschberg test	52-54	651-652	91
	Brückner test	55-56	653-654	120, 243-244
7	Cycloplegic refraction	128-130	666-667	219-222
	Bifocal add determination	146-150	198-205	254-256

V652 CLINICAL SCIENCES III

LAB #1: Binocular Vision Tests at Distance

Reference: Carlson and Kurtz, Clinical Procedures for Ocular Examination, 3rd ed., pp. 164-175; Goss, Ocular Accommodation, Convergence, and Fixation Disparity, 3rd ed., pp. 10-13, 24-25.

Equipment to Bring to Lab: Cover paddle, prism bar.

EQUIPMENT:

● Phoropter with Risley prisms in place
● Distance target
● Cover paddle (for Flash Method for lateral distance phoria)

BACKGROUND:

A. Lateral Distance Dissociated Phoria

      ● Position of rest of the eyes
      ● Position taken by the visual axes relative to the object of regard when all stimuli to fusion have been eliminated
      ● How to eliminate all stimuli to fusion:
            a) Exclusion→ Ex. Occluding one eye (*cover test*)
            b) Diplopia → Ex. Vertical dissociating prism before eye (*von Graefe test*)
            c) Distortion → Ex. Maddox rod in front of one eye (*Maddox rod test, modified Thorington test*)
            d) Dissimilar objects → Ex. Each eye sees a different object (*Maddox wing test, stereoscope phoria test*)

    ● Patient must use fusional vergence to compensate for the phoria to maintain single binocular vision
          Exophoria (XP): must use positive fusional vergence
          Esophoria (EP): must use negative fusional vergence

    ● Treatment options for a patient with distance lateral phoria:
        a) prescribe prism to reduce the demand on fusional vergence
         -Exophoria (XP): BI prism to reduce stress on positive fusional vergence
         -Esophoria (EP): BO prism to reduce stress on negative fusional vergence

        b) vision therapy to help the patient better handle the demand on fusional vergence

B. Vertical Distance Phoria

● Any amount of vertical phoria is significant
● Seen in less than about 5% of patients
● Vertical phoria requires the use of vertical fusional vergence reserve, in order to maintain single binocular vision

<u>VON GRAEFE technique of measuring the lateral dissociated phoria</u>

<u>PURPOSE:</u> To determine the relative horizontal position of the visual axes of the eyes at distance when fusion has been broken.

<u>SETUP:</u>

● Phoropter with patient's distance correction and patient's distance PD
● Distance target with a letter isolated one line above the BVA of the poorer eye (or vertical line of letters)
● Risley prism: 6Δ (*dissociating prism*) Base Up left eye
            12Δ (*measuring prism*) BI right eye
● Occlude one of patient's eyes when setting the prism powers.
● Overhead light on medium, stand light on full and placed in front of patient

12ΔBI
Measuring Prism

6ΔBU
Dissociating Prism
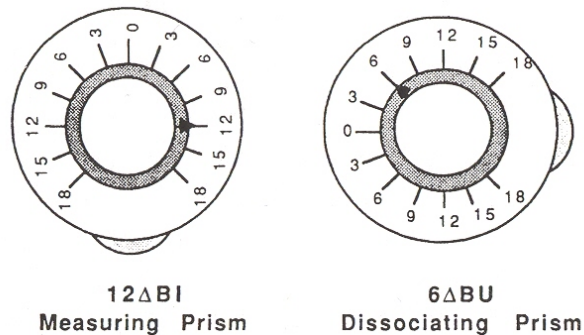
<u>PROCEDURE:</u> Alignment procedure

1. Ask patient: *"How many letters (lines) do you see?"*
        --Expected Answer: *Two*
        --Possible reasons for not seeing two letters:
                Misalignment of phoropter
                One eye still occluded
                Not enough dissociating prism power
                Deep suppression by patient
        --May need to alternately occlude each eye to help patient locate the two images.

2. Ask patient: *"Is the upper letter to the right or to the left of the lower letter?"*
        --Expected Answer: *Upper letter is to the right*
        --<u>Exception:</u> more than 12Δ of exophoria , patient will see the top letter to the left. Therefore, increase the amount of Base In prism until upper letter is seen to the right of the bottom letter.

3. Instruct patient: "W*atch the lower letter & keep it clear."*

4. Instruct patient: "*I will be moving the upper letter. Say 'now' when the top letter is directly above the bottom one in a straight line."*

5. Slowly reduce the amount of BI prism in front of right eye (about 2Δ per second).

6. Note the amount & direction of prism in front of right eye when the patient reports that the top letter is directly above the bottom one (without stopping the prism rotation).

7. Continue moving the prism in the same direction until the two letters are no longer aligned above one another. Then bring the prism back in the opposite direction and instruct the patient: "*say 'now' again when the two letters are aligned one above the other.*" Note the amount and direction of prism when the patient says they are aligned. Without stopping the prism rotation, return prism power to the starting point (12Δ BI).

8. Record the average of the two measurements as long as they are with in 3Δ of each other. This is the amount of lateral phoria. (Ex. 1Δ BI = 1Δ of exophoria). If they are not within 3Δ of each other, increase the dissociating prism to 9Δ BUOS, emphasize the instruction to keep the letters clear, repeat the test, and average those two values.

RECORDING:

Amount & base direction
Example 1: 3Δ BI
Example 2: 3.5Δ BO (average of 3Δ BO & 4Δ BO)

EXPECTED NORMS:

Distance lateral phoria: 0-2Δ BI (exophoria)

ALTERNATIVE PROCEDURE: Flash Method

Note: This procedure is used when unstable results are obtained using the alignment method due to attempts at using fusional movements or accommodation.

No eye movements should be occurring during either type of phoria measurement. Rather the upper letter is moving laterally across the visual field until alignment occurs. Theoretically, patients may be less likely to move their eyes with the flash method than with the continuous viewing method.

1. Follow procedures 1-3 from above.

2. Occlude the eye with the measuring prism (right eye) using a cover paddle or the phoropter auxiliary lens wheel while reducing the amount of BI prism by 3Δ.

3. Remove the cover paddle & ask patient: *"Is the upper letter to the right or to the left of the lower letter?"*

4. If patient reports that the letter is to the right, cover the right eye & repeat the procedure by reducing the amount of BI. Continue repeating the procedure until the patient reports that the two letters are aligned.

5. If the patient reports the top letter to the left, increase BI prism in 1Δ steps until the two letters are aligned.

VON GRAEFE technique for distance vertical dissociated phoria

PURPOSE: To determine the relative vertical position of the visual axes of the eyes at
distance when the fusion has been broken

SETUP:

● Phoropter with patient's distance correction and patient's distance PD
● Distance target with one isolated letter (or horizontal line of letters) one line above the BVA of the poorer eye
● Risley prism: 6Δ (*measuring prism*) Base Up left eye
            12Δ (*dissociating prism*) Base In right eye
● Occlude one of the patient's eyes when setting the prism powers
● Overhead light on medium, stand light on full and placed in front of patient

12ΔBI
Dissociating   Prism

6ΔBU
Measuring   Prism
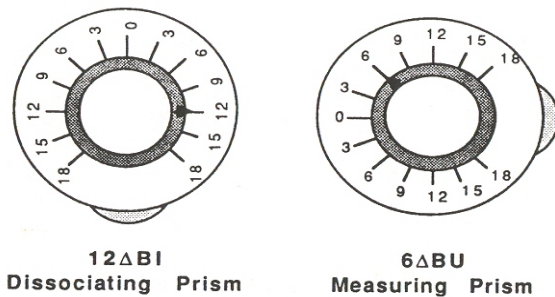
PROCEDURE:

1. Ask patient: *"How many letters (lines) do you see?"*

2. Ask patient: *"Is the upper letter to the right or to the left of the lower letter?"*
        --Expected Answer: *Upper letter is to the right*
        --Exception: 12Δ of exophoria or more, the patient will see the top letter to the
          left. Therefore, increase amount of Base In prism until upper letter is seen to
          right of the bottom letter.

3. Instruct patient: "*Watch the upper letter.*"

4. Instruct patient: *"I will be moving the lower letter, say 'now' when the two letters are directly side by side at the same height."*

5. Slowly reduce the amount of BU prism in front of left eye until patient reports that the two letters are directly side by side. Note the amount & direction of prism in front of the left eye which is equal to the amount of vertical phoria. (Ex. 1Δ BUOS = 1Δ of left hypophoria)

    Note: If the targets go into one on Von Graefe phoria testing, increase the dissociating prism.

6. Continue moving the prism in the same direction until the two letters are no longer aligned beside one another. Then bring the prism back in the opposite direction and instruct the patient: "*say 'now' when they align side by side again.*" At this point note the amount and direction of prism.

7. The result is the average of the two measurements as long as they are with in 2Δ of each other. If not, repeat the measurement and average the two closest values.

8. If a patient is found to have a vertical phoria re-check using *one* of the following:

    ● Suspect that the Risley prisms may be out of adjustment. To check this, re-take the vertical phoria by placing the measuring prism (6ΔBU) over the right eye and the dissociating prism (12ΔBI) over the left eye.

    ● Have patient wear his/her current Rx (first, checking the glasses for vertical prism) & use a hand Maddox Rod (without the refractor) to determine if the patient has a vertical phoria (lab #5).

    ● Check to see if the vertical phoria resulted from tilting of the phoropter by repeating the test with phoropter pinholes over both eyes.

RECORDING:

Record amount of prism, base direction, *and the eye the measuring prism is over.*

Example 1: 2Δ BDOS (2Δ left hyper or 2Δ right hypo)
**Note: vertical phorias are expressed relative to the hyper eye so that LH means left hyper.

EXPECTED NORMS:

Distance vertical phoria: Ortho

LATERAL FUSIONAL VERGENCE RANGES

BACKGROUND:

Fusional vergence→stimulated when there is retinal disparity & used to maintain single binocular vision.

Base-in prism when introduced gradually in front of the two eyes:

- Causes the eyes to diverge due to <u>negative fusional vergence</u>.
- When there is no more negative fusional vergence available, <u>accommodative divergence</u> will be used, resulting in a blur.

    Note: Accommodation should have been fully relaxed in the subjective refraction if the patient was not overminused. Therefore, there is no blur expected on the distance BI vergence range. If patient does report a blur, this indicates that accommodation was <u>not </u>fully relaxed in the subjective refraction and you may have <u>overminused</u> the patient's Rx.

- When accommodative divergence is no longer available, the result will be a **break**, & the eyes will revert to the phoria position.
- If the amount of base-in is gradually reduced, the eyes will make a fusional vergence movement resulting in **recovery** of single binocular vision.

    Do Base-in procedure before Base-out; otherwise you will get a "spill-over" of convergence stimulation (tonic vergence)!

Base-out prism when introduced gradually in front of the two eyes:

- Causes the eyes to converge due to <u>positive fusional vergence </u>.
- When there is no more positive fusional vergence available, <u>accommodative convergence</u> will be used, resulting in a **blur**.
- When accommodative convergence is no longer available, a **break** results and the eyes go back to the phoria (resting) position.
- If the amount of base out prism is gradually reduced, the eyes will make a positive fusional vergence movement. Therefore, there will be a **recovery** of single binocular vision.

Sheard's Criterion for visual comfort:
- Phoria = demand on fusional vergence (D)
- Base-out blur (*or break if no blur*) = fusional vergence reserve (R) in exophoria
- Base-in blur (*or break if no blur*) = fusional vergence reserve (R) in esophoria
- For visual comfort, the reserve (blur or, if no blur, break) should be <u>twice</u> the demand (phoria):

Exophoria → Base-out blur (or break if no blur reported) should be twice
the amount of the phoria.
Esophoria → Base-in blur (or break if no blur reported) should be twice
the amount of the phoria.

Prescribing prism for lateral phoria:
- Prism relieves stress on fusional vergence (positive fusional vergence for
  exophoria & negative fusional vergence for esophoria).
- For the amount of prism prescribed can use:

$$\boxed{\textbf{Sheard's Criterion: P = (2/3) D – (1/3) R}}$$

or
Associated Phoria (see lab #6)

DISTANCE LATERAL FUSIONAL VERGENCE RANGES:

PURPOSE: To measure the patient's ability to use horizontal fusional vergence to
maintain single binocular vision

SETUP:
- Phoropter with patient's distance correction and distance PD
- Isolate a letter one line larger than the poorer eye's BVA (or a vertical line of letters)
- Set both Risley prisms with the zero mark oriented straight up
- Overhead light on medium, stand light on full and placed in front of patient
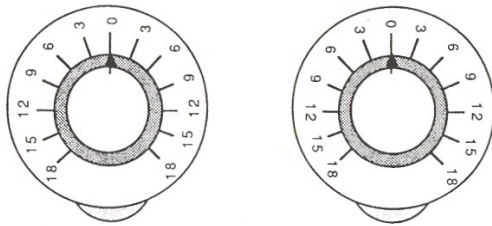
PROCEDURE: Base-In Negative Fusional Vergence

1. Have patient open both eyes and ask: "*How many letters do you see?*"
   Expected Answer: *One letter*
   If patient sees two: Add Base-Out prism if patient has high esophoria or
   Base-In prism if patient has high exophoria until
   patient sees one. If patient still sees two, end the test
   and record diplopia.

2. Instruct patient: "*Look at the letter & keep it clear.*"

3. Introduce Base-in prism equally before both eyes & instruct patient: "*Say 'blur' if the*

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letter blurs or 'two' if it breaks into two."

4. Note the total amount of prism before the two eyes when the patient first reports blur or break.

> Ex. If patient reports double with 3Δ in front of OD, & 3Δ in front of OS, the break point is 6Δ.

> Note: If blur is reported, one should suspect that the refraction may have been overminused.

5. Overshoot the break point slightly by adding about 3Δ more base-in prism over each eye.

6. Reduce the prism & instruct the patient: "*Say 'one' when it goes back into one again.*" At this point note the total amount of prism. This is the recovery point.

> Note: If any of the BI findings are on the BO side, such as continuing into BO to get a recovery, the amount of base-out is recorded as a negative number.

PROCEDURE: Base-Out Positive Fusional Vergence

1. Repeat steps 1-6 above, this time introducing Base-out prism before both eyes

> Note: this time a blur is likely to be reported.

RECORDING:
Base-in: blur/break/recovery
         X /   10 /   4
Base-out: blur/break/recovery
       12 /   20 /   10

Note: If no blur is reported, record X

EXPECTED NORMS:
Base-in: X / 5 to 9 / 3 to 5
Base-out: 7 to 11 / 15 to 23 / 8 to 12

VERTICAL FUSIONAL VERGENCE RANGES

BACKGROUND:
● Vertical fusional vergence ranges are expected to be less than lateral fusional vergence ranges.
● The vertical dissociated phoria is expected to be at the midpoint of the vertical fusional vergence ranges. Therefore, the vertical fusional vergence reserves can be used to check consistency with vertical phoria, using the following formula:

$$\frac{\Delta \textbf{ Base-down to break} - \Delta \textbf{ Base-up to break}}{2} = \textbf{Expected Vertical Phoria}$$

> *If the answer is positive, vertical phoria is expected to be base down
> *If the answer is negative, vertical phoria is expected to be base up

PURPOSE: To measure the patient's ability to use vertical fusional vergence to maintain single binocular vision.

SETUP:
● Phoropter with patient's distance correction and distance PD
● Isolate one letter (or horizontal line of letters) one line larger than the poorer eye's BVA
● Set both Risley prisms with the zero mark oriented horizontally
● Overhead light on medium, stand light on full and placed in front of patient
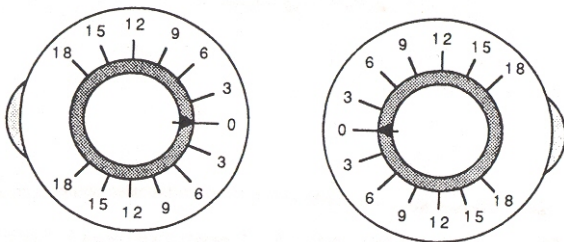
PROCEDURE: Vertical Vergence Reserve

1. Ask patient: "*Open both eyes. How many letters do you see?*"
    --Expected Answer: *One letter*

2. Add Base-down before the right eye & instruct patient: "*Say 'two' when the letter breaks into two.*" This measures right supravergence, meaning it makes the right eye go higher than the left eye.

    > Note: Unlike horizontal vergences, with vertical vergences it is only necessary to move prism before one eye. Supravergence measured in one eye should equal infravergence measured in the other eye.

3. Note the amount of Base-down prism before the right eye at the break point.

4. Overshoot the break point 2-3Δ in the same direction

5. Reduce the prism and instruct patient: "*Say 'one' when the letter goes back into one again.*" This is the recovery point. At this point note the amount of Base-down prism

6. Repeat steps 1-5 with Base-up prism before the right eye. This will measure right Infravergence.

RECORDING:

Supravergence (Base-down) = <u>break/recovery</u> = S __4__ / __1__ _ OD (eye measured)
Infravergence (Base-up) = break/recovery = I 4 / 1

<u>Note:</u> If patient reports recovery once you have passed the zero mark, this is recorded as a negative value.

    Ex. Supra 3/-1
       --it took 1Δ BU prism to get recovery on supravergences rather
        than 1Δ BD prism.

<u>EXPECTED NORMS:</u>
Break: 3-4Δ
Recovery: 1-2Δ

SUMMARY OF DISTANCE PHORIA AND VERGENCE TESTS

TEST	Set-up	Instructions	Results
1. Distance Lateral Phoria	-Distance RX -Distance PD -Single letter one line larger than BVA (or vertical line of letters) -**12 BI** OD (measuring prism), **6 BU** OS (dissociating prism)	"How many letters do you see?" "Is the upper letter to the right or left?" "Watch the **lower letter** and keep it clear." "I will be moving the upper letter. Say 'now' when the top letter is directly above the bottom one in a straight line." "Say 'now' again when the two letters are aligned one above the other."	-Average of the two if they are within *3 prism diopters* of each other. -If not w/in 3 prism diopters than repeat measurements and average two closest
2. Distance Vertical Phoria	-Distance RX -Distance PD -Single letter one line larger than BVA (or horizontal line of letters) -**12 BI** OD (dissociating prism) **6 BU** OS (measuring prism)	"how many letters do you see?" "Is the upper letter to the right or left?" "Watch the **upper letter**." "I will make the lower letter move; say now when the two letters are lined side by side at the same height." "I will be moving the letters back in the other direction say 'now' when they align side by side again"	-Average of two if they are within *2 prism diopters* of each other. -If not w/in 2 prism diopters then repeat measurements and average two closest.
3. Distance Vertical Vergences	-Distance PD -Risley prisms w/ **0 pointed sideways** before both eyes -Single letter one line larger than BVA (or horizontal line of letters)	"How many letters do you see?" (should see one). "When it breaks into two say 'two,' when it goes back into one again say 'one'."	-Introduce BD prism and record as supra, then introduce BU prism and record as infra. -Supra of one eye should = infra of other eye -If no vertical phoria then all 4 findings should be the same
4. Distance BI Vergences	-Distance PD -Risley prisms w/ **0 pointed up** before both eyes -Single letter one line larger than BVA (or vertical line of letters)	"How many letters do you see?" (should see one). "Look at the letter and try to keep it clear." "Say 'blur' if the letter blurs or 'two' if it breaks into two." "Say 'one' when it goes back into one again."	-**Introduce BI prism First** -Record: *Blur/Break/Recovery* -There should be no Blur because Accommodation should be relaxed so no accommodative divergence will occur
5. Distance BO Vergences	-Distance PD -Risley prisms w/ **0 pointed up** before both eyes -Single letter one line larger than BVA (or vertical line of letters)	"Say 'blur' if the letter blurs or 'two' if it breaks into two." "Say 'one' when it goes back into one again."	-Record: *Blur/Break/Recovery* -At BO there may be a blur due to accommodative convergence kicking in when there is no + fusional vergence left

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Laboratory Report 1: Binocular Vision Tests at Distance

Clinician Name: _____

Patient Name: _____

Date: _____

Distance Cover Test (Measured): _____

Lateral Dissociated Phoria (Alignment Method): _____

Lateral Fusional Vergences: BI____/____/____

BO____/____/____

Lateral Dissociated Phoria (Flash Method): _____

Vertical Dissociated Phoria: _____

Vertical Fusional Vergences: R S___/_____   L S___/_____

I___/_____   I___/_____

Questions:

1. How well did the results of the cover test agree with the results of the dissociated lateral phoria test? What reason(s) can you give for any disagreements of results?

_____
_____

2. How well did the results of the dissociated lateral phoria tests correlate using the alignment and the flash methods? What reason(s) can you give for any disagreements?

_____
_____

3. If your patient had a lateral dissociated phoria was the reserve sufficiently high in order to meet Sheard's criterion? If not, how much prism would have to be prescribed in order to meet Sheard's criterion?

_____
_____

Be sure to turn in lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III

Laboratory Report 1: Binocular Vision Tests at Distance

Clinician Name: _____

Patient Name: _____

Date: _____

Distance Cover Test (Measured): _____

Lateral Dissociated Phoria (Alignment Method): _____

Lateral Fusional Vergences: BI____/____/____
                                        BO____/____/____

Lateral Dissociated Phoria (Flash Method): _____

Vertical Dissociated Phoria: _____

Vertical Fusional Vergences: R S____/_____   L S____/_____
                                          I____/_____   I____/_____

Questions:

1. How well did the results of the cover test agree with the results of the dissociated lateral phoria test? What reason(s) can you give for any disagreements of results?

_____
_____

2. How well did the results of the dissociated lateral phoria tests correlate using the alignment and the flash methods? What reason(s) can you give for any disagreements?

_____
_____

3. If your patient had a lateral dissociated phoria was the reserve sufficiently high in order to meet Sheard's criterion? If not, how much prism would have to be prescribed in order to meet Sheard's criterion?

_____
_____

Be sure to turn in lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III

LAB #2: **Binocular Vision & Relative Accommodation Tests at Near**

Reference: Carlson and Kurtz, Clinical Procedures for Ocular Examination, 3rd ed., pp. 172-185, 188-193; Goss, Ocular Accommodation, Convergence, and Fixation Disparity, 3rd ed., pp. 10-13, 24-25.

Equipment to Bring to Lab: Cover paddle, near test card set, prism bars, calculator.

EQUIPMENT:
● Phoropter with Risley prisms in place
● Near target (ex. "Look Here" card or a reduced Snellen chart with a vertical line of letters and a horizontal line of letters @ 40 cm)

BACKGROUND:

A. Near Tests
  ● *Level of Illumination:* important for all near tests
      --Too High → decreases pupil size which causes increased depth of focus
      --Too Low → increases pupil size which causes decreased depth of focus
      --Recommended Light Source: **40-60 Watt** incandescent light bulb
        located **18-20 inches** from nearpoint card.

  ● To avoid large lag of accommodation the patient instruction "*keep the letters clear*" must be emphasized throughout the near tests

B. Lateral Near Dissociated Phoria
  ● Position of rest of the eyes when viewing target @ 40 cm when all stimuli to fusion have been eliminated.

  ● Patient must use fusional vergence to compensate for the phoria
      Exophoria (XP): must use positive fusional vergence
      Esophoria (EP): must use negative fusional vergence

  ●Treatment options for a patient with lateral phoria:
      a) prescribe prism to reduce the demand on fusional vergence
        -Exophoria (XP): BI prism to reduce stress on positive fusional vergence
        -Esophoria (EP): BO prism to reduce stress on negative fusional
                    vergence

      b) vision therapy to increase the reserve and thus help the patient better
          handle the demand on fusional vergence

      c) in esophoria at near, plus add to reduce accommodative convergence

C. Gradient AC/A Ratio

● Measurement of amount of change of phoria with increase or decrease in accommodation by the addition of + or - lenses

● The stimulus to proximal convergence is the same for the two phoria findings

● The accommodation is stimulated by placing the target at 40 cm and by the use of +/- 1.00 D Add

● If +1.00 D is added to the BVA and phoria is re-measured:
   - plus lenses relax accommodation
   - expect near phoria to become *more exo* or *less eso*

● -1.00 D can be added to BVA if near exophoria is greater than 6 BI
   - minus lenses cause increased accommodation
   - expect near phoria to become *less exo* or *more eso*

● Gradient AC/A ratio is calculated by finding the difference between the near phoria and near phoria through a +1.00 D or -1.00 D add

Equation: **Gradient AC/A = <u>(Near phoria) – (Near phoria through Add)</u>**
                                                      Add
   <u>Note</u>: Exo = negative value
   Eso = positive value

Example 1:   Near Phoria through BVA   4 exo
              Near Phoria through BVA +1.00D   8 exo

              Gradient AC/A = 4Δ/1D

--this patient's gradient AC/A is within the "expected" or normal range.

Example 2:   Near Phoria through BVA   6 eso
              Near Phoria through BVA +1.00D   2 exo

              Gradient AC/A = 8Δ/1D

--this patient would be expected to have headaches and discomfort while reading through the BVA lenses, due to the need for constant use of negative fusional vergence.
--if this patient was given +1.00 D Add for near work, he/she would need not have to use negative fusional vergence but rather a small normal amount of positive fusional vergence.

Example 3:   Near Phoria through BVA   10 exo
                        Near Phoria through BVA -1.00D   8 exo

                        Gradient AC/A = 2Δ/1D

--this patient would be expected to complain of tired eyes or sleepiness
  while reading
--if patient wore -1.00 D add for reading, the near would be 2Δ less than
  through the BVA lenses.
--wearing added minus lenses makes everything look smaller, the small
  decrease in the near exophoria would not be worth the trouble of
  wearing the added minus lenses. (In addition, minus adds are rarely
  used because of potential increased strain on accommodation).

D. Calculated AC/A

● Measurement of change in phoria from distance to near with reference to the
convergence stimulus and the accommodative stimulus of 2.50D

● Calculated AC/A ratio involves two phorias taken at two different distances
therefore the stimulus to proximal convergence differs for the two phoria
findings

● Accommodation is stimulated only by changing the testing distance

Equations:

Calculated AC/A=<u>convergence stimulus near target-distance phoria+near phoria</u>
                                                        2.5D

Convergence Stimulus =   <u>Distance PD x 10</u>
                                 Test distance (cm) + 2.7

Example 1:   Ortho at distance
                Ortho at near

                Calculated AC/A = 15Δ/2.5 D = 6Δ/1D

                ***15Δ value is for a person with a 64 mm PD

Example 2:   Ortho at distance
                Near phoria of 5 exo @ 40 cm

                Calculated AC/A = (15-0+(-5))/2.5 = 10/2.5 = 4Δ/1D

                --in this case in order to avoid double vision, 5Δ of fusional
                  vergence must be used at 40 cm distance.

Example 3:   Ortho at distance
                     Near phoria of 5 eso @ 40 cm

                     Calculated AC/A = (15-0+5)/2.5 D = 20/2.5 = $8\Delta/1D$

                     --in this case the amount of accommodative convergence is 5Δ
                       more than necessary. Therefore, 5Δ of negative fusional
                       vergence must be   used to avoid diplopia @ 40 cm.

     Note: Clinically determined AC/A ratios (gradient and calculated AC/A) are
                considered stimulus AC/A ratios because we can measure only the
                stimulus rather than the actual accommodative response.

VON GRAEFE technique of measuring the near lateral dissociated phoria

PURPOSE: To determine the relative horizontal position of the visual axes of the eyes at
              near when fusion has been broken.

SETUP:
● Phoropter with patient's distance correction and patient's near PD
● Near target @ 40 cm: "Look Here" card or a card with a vertical line of letters one line
above the BVA of the poorer eye
● Risley prism: 6Δ (*dissociating prism*) Base Up left eye
             12Δ (*measuring prism*) BI right eye
● Occlude one of patient's eyes when setting the prism powers
● Overhead light on medium, stand light on full with 40-60 watt bulb 18-20 inches from
test card

12ΔBI
Measuring Prism

6ΔBU
Dissociating Prism
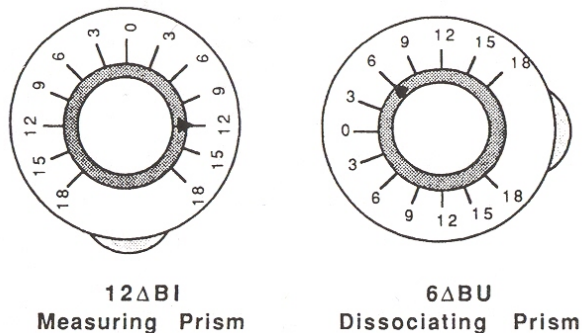
PROCEDURE: Refer to lab #1 for lateral dissociated phoria procedures (see pp. 10-11).

EXPECTED NORMS:

Near lateral phoria: $0\text{-}6\Delta$ BI (ortho to 6Δ exo)

VON GRAEFE technique for Gradient lateral dissociated phoria at near

PURPOSE: To determine the relative horizontal position of the visual axes of the eyes at near when accommodative stimulus is changed without changing proximal convergence.

SETUP:
● Phoropter patient's near PD and +/- 1.00 D over patient's distance correction
  (Most commonly a +1.00 D add is used, but a -1.00 D add can be used for patients with high exophoria at near)
● Near target @ 40 cm: "Look Here" card or a card with a vertical line of letters one line above the BVA of the poorer eye
● Risley prism: 6Δ (*dissociating prism*) Base Up left eye
          12Δ (*measuring prism*) BI right eye
● Occlude one of patient's eyes when setting the prism powers
● Overhead light on medium, stand light on full with 40-60 watt bulb 18-20 inches from test card

12ΔBI
Measuring Prism

6ΔBU
Dissociating Prism
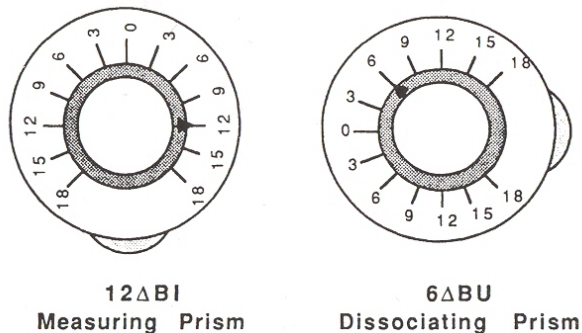
PROCEDURE: Refer to lab #1 for lateral dissociated phoria procedures (see pp. 10-11).

Note: Do not forget to add 1.00 D over distance correction

Record the gradient phoria in prism diopters BI or BO.

There is no norm for the gradient phoria itself, but there is a normal range for the gradient AC/A ratio.

EXPECTED GRADIENT AC/A RATIO NORMS:

Gradient AC/A: 3Δ/1D to 5Δ/1D

VON GRAEFE technique for near vertical dissociated phoria

PURPOSE: To determine the relative vertical position of the visual axes of the eyes at near when fusion has been broken.

SETUP:

● Phoropter with patient's distance correction and patient's near PD
● Near target @ 40 cm: "Look Here" card or a card with a horizontal line of letters one line above the BVA of the poorer eye
● Risley prism: 6Δ (*measuring prism*) Base Up left eye
         12Δ (*dissociating prism*) Base In right eye
● Occlude one of the patient's eyes when setting the prism powers
● Overhead light on medium, stand light on full with 40-60 watt bulb 18-20 inches from test card

12ΔBI
Dissociating Prism

6ΔBU
Measuring Prism
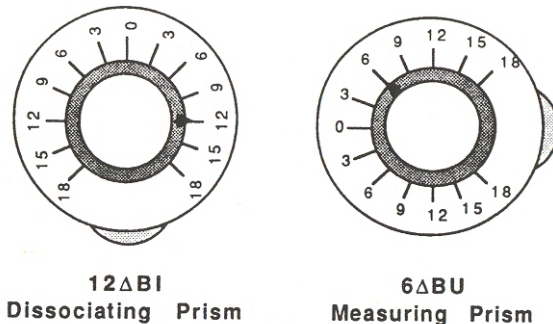
PROCEDURE: Refer to lab #1 procedure for vertical phoria (see pp. 12-13).

EXPECTED NORMS:

Near vertical phoria: Ortho

NEAR LATERAL FUSIONAL VERGENCE RESERVE:

PURPOSE: To measure the patient's ability to use horizontal fusional vergence to maintain single binocular vision

SETUP:
● Phoropter with patient's distance correction and near PD
● Near target @ 40 cm: "Look Here" card or a card with a vertical line of letters one line above the BVA of the poorer eye
● Set both Risley prisms with the zero mark oriented straight up
● Overhead light on medium, stand light on full with 40-60 watt bulb 18-20 inches from test card

PROCEDURE: Refer to BI and BO Fusional Vergence procedures in lab one (see pp. 15-16).

EXPECTED NORMS:

Base-in: 11 to 15 / 19 to 23 / 10 to 16
Base-out: 14 to 20 / 18 to 24 / 7 to 15

Note: At 40 cm, 2.50 D of accommodation is stimulated, therefore the patient is more likely to report a blur on the BI fusional vergence reserve test at near than at distance.

Note: If the patient sees the target sliding to one side, this suggests that one eye is not seeing the target, such as with suppression or occlusion.

Note: Some patient will be able to fuse through the maximum prism in the rotary prisms. In such cases, record the break as 40+ (if the maximum on each rotary prism is 20Δ) and record the recovery as X.

VERTICAL FUSIONAL VERGENCE RESERVES

PURPOSE: To measure the patient's ability to use vertical fusional vergence to
                    maintain single binocular vision.

SETUP:
● Phoropter with patient's distance correction and near PD
● Near target @ 40 cm: "Look Here" card or a card with a horizontal line of letters one line above the BVA of the poorer eye
● Set both Risley prisms with the zero mark oriented horizontally
● Overhead light on medium, stand light on full with 40-60 watt bulb 18-20 inches from test card
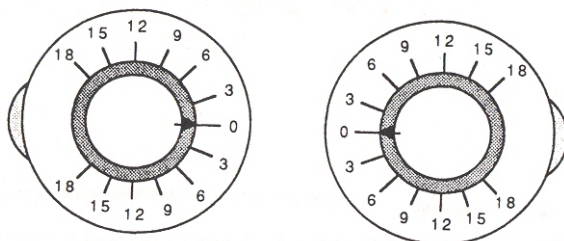
PROCEDURE: Refer to lab #1 procedure for Vertical Vergence Reserve (see pp. 17-18).
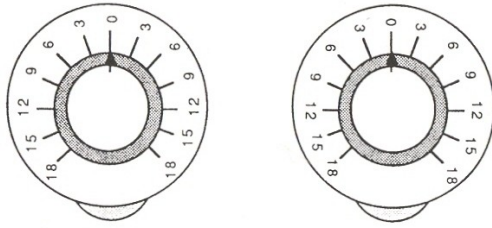
EXPECTED NORMS:

Break: 3-4Δ
Recovery: 1-2Δ

BINOCULAR CROSS CYLINDER (BCC) – AKA Fused Crossed Cylinder

BACKGROUND:
● This test finds the amount of plus that makes the accommodative stimulus and accommodative response equal

● Generally higher plus is found in high lag of accommodation and minus is found in lead of accommodation cases

● Presbyopes: this test provides the examiner with a tentative bifocal add

PURPOSE: To evaluate the accommodative response of a patient while viewing a near target under binocular conditions.

SET-UP:
● Phoropter at near PD setting
● crossed cylinder grid placed @ 40 cm
● Turn auxiliary to ±0.50 crossed cylinder
● Overhead light off, stand light illumination dimmed until the lighting on the near card appears orange

PROCEDURE:
1. Patient views grid binocularly. Plus sphere power is added to BVA (young patient: +1.75 D, absolute presbyope: +2.75 D) in order to place the interval of Sturm in front of the retina.

2. Ask the patient, *"Which lines are blacker and more distinct, the ones going up-and-down or the ones going across?"* (Expected Answer: *Up-and-Down*; if answer is across, add more plus until up-and-down reported)

3. If answer is "*Up-and-Down,"* plus is reduced by 0.25 D binocularly and the patient is asked, "*Which lines are blacker and more distinct?*"

4. The endpoint is when the two sets of lines are equally distinct or, if no equal, the first time the patient reports that the horizontal lines are darker.

5. The finding is recorded as the difference between the end point and BVA lens.

(Note: There is some variability among clinicians regarding the endpoint value recorded, but most authorities (e.g., Manas, 1965; Carlson and Kurtz, 2004; Saladin, 2006) recommend recording the add that yielded the first equal, or if no equal, the first horizontal response)

(Note: If the patient says that clarity changes back and forth between the vertical and horizontal lines without a lens change, or if unusual results occur, instruct the patient to look at the up-and-down lines and glance at the across lines)

EXPECTED NORMS:

Non-presbyope: +0.25 to +0.75 D

> **Note: Greater than +1.00D suggests high lag of accommodation. Therefore, the patient may need bifocals or reading Rx for visual comfort.**
>
> **Minus value indicates a lead of accommodation. Therefore the patient is overaccommodating.**

Presbyope: +0.75D for young presbyopes in their early 40's
+2.25 D for presbyopes in their 60's or older

> Note: It is good idea to use the BCC as the first nearpoint test for presbyopes because it tells you the tentative add that should be used for the remainder of the nearpoint tests.

NEGATIVE RELATIVE ACCOMMODATION (NRA)—Plus to Blur

BACKGROUND:

● "Relative Accommodation" indicates that the stimulus to accommodation is changed while the stimulus to convergence remains constant. Therefore, the distance of the test stimulus is not changed.
● During the NRA, accommodative convergence decreases along with the decrease in accommodation. Positive fusional vergence is used to maintain single binocular vision. Therefore, the NRA can be limited by the patient's positive fusional vergence capability.
● The occurrence of blur can indicate that the limit of positive fusional vergence has been reached. That is, the "accommodative divergence" can not be compensated by positive fusional vergence.
● If the patient has sufficient positive fusional vergence, a blur will not occur until the patient has decreased accommodation to zero.
● Plus lenses tend to make the letters look **larger**, which may be interpreted as being **closer**. This may limit the amount that accommodation can relax with the NRA test.

PURPOSE: To test the patient's ability to decrease accommodation under binocular

conditions when the total convergence demand is constant. Under these conditions, changes in accommodative convergence are compensated for by changes in fusional vergence.

SET-UP:
- Phoropter with distance correction and near PD
- Reduced Snellen chart @ 40 cm
- Overhead light on medium, stand light on full with 40-60 watt bulb 18-20 inches from test card

PROCEDURE:

1. Patient views 20/20 line of reduced Snellen chart @ 40 cm through BVA lenses.

2. Instruct the patient to *keep the 20/20 row of letters in sharp focus* but to report when the letters become blurred.

3. Start adding plus lenses binocularly, +0.25D at a time, (not too fast) until the patient reports a sustained blur.
> Note: Not looking for Blur-out but the first slight blur. The patient should still be able to read the letters.

4. If the patient reports a blur, wait about a second and ask if it is still blurry. If not, add plus until a blur is again reported.

5. The endpoint is reached when the letters remain blurred (in other words, the first sustained blur).

6. Record the amount of plus over the BVA.

EXPECTED NORMS:

Morgan's Norms: +1.75 D to +2.25 D

Note: With +2.50 D in place, the accommodative stimulus @ 40 cm is zero. If the NRA is greater than +2.50 it is likely that the patient's BVA has been overminused. Some patients with very small pupils (and thus very large depth of focus) can have NRA findings greater than +2.50 D without being overminused.

POSITIVE RELATIVE ACCOMMODATION (PRA)—Minus to Blur

BACKGROUND:

● During the PRA, accommodative convergence increases along with the increase in accommodation. Therefore, negative fusional vergence is used to maintain single binocular vision.
● The occurrence of a blur can indicate the limit of negative fusional vergence. That is, the "accommodative convergence" can not be compensated by negative fusional vergence.
● If the patient has sufficient negative fusional vergence, a blur will not occur until the patient has increased accommodation to its maximum (amplitude of accommodation).
● Minus lenses tend to make the letters look **smaller**, which may be interpreted as being **farther**. This may limit the amount that accommodation can be increased in the PRA test.

PURPOSE: To test the patient's ability to increase accommodation under binocular conditions when the total convergence demand is constant. Under these conditions, changes in accommodative convergence are compensated for by changes in fusional vergence.

SET-UP:
● Phoropter with distance correction and near PD
● Reduced Snellen chart @ 40 cm
● Overhead light on medium, stand light on full with 40-60 watt bulb 18-20 inches from test card

PROCEDURE:

1. Patient views 20/20 line of reduced Snellen chart @ 40 cm through BVA lenses.

2. Remove the added plus lens power from NRA test and ask patient, "*Are letters once again in sharp focus?*" At this point patient should report "*Yes*".

3. Instruct the patient to *keep the 20/20 row of letters in sharp focus* but to report when the letters become blurred.

4. Start adding minus lenses binocularly, -0.25D at a time (not too fast) until the patient reports a sustained blur.

> Note: Not looking for Blur-out but the first sustained blur. Therefore, the patient should still be able to read the letters.

EXPECTED NORMS:

Morgan's Norms: -1.75 D to -3.00 D

(Note: In the case of a low AC/A ratio, the PRA may often be greater than -3.00D. A PRA which is below -1.75 D is more of a concern than a PRA which is more than -3.00 D)

MORGAN'S NORMS

	Mean	**Standard Deviation**	**Normal Range**
Distance Phoria	1Δ exophoria	2	0 to 2 exophoria
Near Phoria @ 40cm	3Δ exophoria	5	0 to 6 exophoria
Distance base-in limit			
Blur	X		
Break	7Δ	3	5 to 9
Recovery	4Δ	2	3 to 5
Distance base-out limit			
Blur	9Δ	4	7 to 11
Break	19Δ	8	15 to 23
Recovery	10Δ	4	8 to 12
Near base-in limit @ 40cm			
Blur	13Δ	4	11 to 15, or no blur
Break	21Δ	4	19 to 23
Recovery	13Δ	5	10 to 16
Near base-out limit @ 40cm			
Blur	17Δ	5	14 to 20, or no blur
Break	21Δ	6	18 to 24
Recovery	11Δ	7	7 to 15
NRA (plus to blur)	+2.00	0.50	+1.75 to +2.25
PRA (minus to blur)	-2.37	1.12	-1.75 to -3.00
Gradient AC/A Ratio	4Δ/D	2	3 to 5
Amplitude of Accommodation	16.0 – (0.25)(age)	2.00	16.0 – (0.25)(age) +/- 1.00

SUMMARY OF NEAR PHORIA AND VERGENCE TESTS

TEST	Set-up	Instructions	Results
1. Near Lateral Phoria	-Near PD -"Look Here" target (or vertical line of letters) -**12 BI** OD (measuring prism), **6 BU** OS (dissociating prism)	"How many charts do you see?" "Is the upper chart to the right or left?" "Watch the **lower letters** and keep them clear." "I will be moving the upper letters. Say 'now' when the top chart is directly above the bottom one in a straight line." "Say 'now' again when the two charts are aligned one above the other."	-Average of the two if they are within *3 prism diopters* of each other. -If not w/in 3 prism diopters than repeat measurements and average two closest
2. Near Vertical Phoria	-Near PD -"Look Here" target (or horizontal line of letters) -**12 BI** OD (dissociating prism) - **6 BU** OS (measuring prism)	"how many charts do you see?" "Is the upper chart to the right or left?" "Watch the **upper letters**." "I will make the lower chart move and say now when the two charts are lined up side by side at the same height." "I will be moving the letters back in the other direction say 'now' when they align side by side again"	-Average of two if they are within *2 prism diopters* of each other. -If not w/in 2 prism diopters then repeat measurements and average two closest.
3. Near Vertical Vergences	-Near PD -Risley prisms w/ **0 pointed sideways** before both eyes -"Look Here" target (or horizontal line of letters)	"How many charts do you see?" (should see one). "Look at the letters and try to keep them clear." "When they break into two say 'two,' when it goes back into one again say 'one'."	-Introduce BD prism and record as supra, then introduce BU prism and record as infra. -Supra of one eye = infra of other eye -If no vertical phoria then all 4 findings should be the same
4. Near BI Vergences	-Near PD -Risley prisms w/ **0 pointed up** before both eyes -"Look Here" target (or vertical line of letters)	"How many charts do you see?" (should see one). "Look at the letters and try to keep them clear." "If the letters begin to blur say 'blur' when it breaks into two say 'two', when it goes back to one again say 'one'."	-**Introduce BI prism First** -Record: *Blur/Break/Recovery* -At near BI there may be blur due to accommodative divergence kicking in
5. Near BO Vergences	**-**Near PD -Risley prisms w/ **0 pointed up** before both eyes -"Look Here" target (or vertical line of letters)	"If the letters begin to blur say 'blur', when it breaks into two say 'two', when it goes back into one again say 'one'."	-Record: *Blur/Break/Recovery* -At BO there may be a blur due to accommodative convergence kicking in when there is no + fusional vergence left

SUMMARY OF NEAR PHORIA AND VERGENCE TESTS

TEST	Set-up	Instructions	Results
6. Gradient Phoria	-Near PD -"Look Here" target (or vertical line of letters) -**12 BI** OD (measuring prism), **6 BU** OS (dissociating prism) -**Add +1.00 D** to BVA l lenses or can **Add -1.00 D** if above 6 exo at near	"How many charts do you see?" "Is the upper letter to the right or left?" "Watch the **lower letters** and keep it clear." "I will be moving the upper letters. Say 'now' when the top chart is directly above the bottom one in a straight line." "Say 'now' again when the two charts are aligned one above the other."	-With a +1.00 D lens you expect less eso or more exo compared to near phoria with BVA due to decrease in accommodative stimulus -With a -1.00 D lens you expect less exo due to increase in accommodative stimulus
7. Binocular Cross Cylinder (BCC)	-Near PD -Turn auxiliary to **+/-0.50 crossed cylinder** -Use crossed cylinder grid -**Dim illumination** for orange glow --+1.75 D add for young patients; +2.75 D add for absolute presbyopes	"What lines are blacker and more distinct—the lines going up & down or the lines going across" If the vertical lines are darker. Say "tell me when the two sets of lines are equally distinct or when the lines going across are darker"	-Add -0.25D binocularly from the NRA until patient reports equal or reports horizontal lines are darker -Record the difference from BVA or tentative add
3. NRA (plus to blur)	-BVA or if presbyope, use the tentative Add -Near PD -**Near Snellen chart with 20/20 line target at 40 cm**	"Can you read the DLNGYS line?" "Try to keep that line of letters clear". "Tell me when these letters become blurred but you can still read them"	-Binocularly add **+0.25D** until patient reports sustained blur but can still read the line -Record the difference from BVA or tentative add
4. PRA (minus to blur)	-BVA or if presbyope, use the tentative Add -Near PD -**Near Snellen chart with 20/20 line target at 40 cm**	"Can you read the DLNGYS line?" "Try to keep that line of letters clear". "Tell me when these letters become blurred but you can still read them"	-Binocularly add **-0.25D** until patient reports sustained blur but can still read the line -Record the difference from BVA or tentative add

V652 CLINICAL SCIENCES III

Laboratory Report 2: Binocular Vision & Relative Accommodation Tests at Near

Clinician Name: _____

Patient Name: _____

Date: _____

Distance Lateral Dissociated Phoria (Alignment Method)): _____

Near Cover Test (Measured): _____

Near Lateral Dissociated Phoria (Alignment Method): _____

Gradient Phoria (Alignment Method):   _____

Near Lateral Fusional Vergences: BI____/____/____
                                                    BO____/____/____

Near Lateral Dissociated Phoria (Flash Method): _____

Near Vertical Dissociated Phoria: _____

Near Vertical Fusional Vergences: R S___/_____   L S___/_____
                                                     I___/_____   I___/_____

Gradient AC/A: _____

Calculated AC/A: _____

Binocular Crossed-Cylinder: _____

Negative Relative Accommodation: _____

Positive Relative Accommodation: _____

Questions:

1. How well did the results of the Cover Test agree with the results of the Dissociated Lateral Phoria Test? What reason(s) can you give for any disagreements of results?

_____
_____

2. If your patient had a near lateral dissociated phoria, what were the demand and the reserve? Was the reserve sufficiently high to meet Sheard's criterion? If not, how much prism would have to be prescribed in order to meet Sheard's criterion?

_____
_____

3. Was there a difference between the gradient and calculated AC/A ratios? If so, how can you explain this?

_____
_____

4. What would the NRA be equal to if accommodation was completely relaxed at the test endpoint? What would you think was happening if the NRA was higher than 2.50 D? What could cause the NRA to be low?

_____
_____
_____
_____

5. What factors affect the PRA?

_____
_____

6. What test findings were within normal ranges?

_____
_____

7. What test findings were outside normal ranges?

_____
_____

Be sure to turn in lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III

Laboratory Report 2: Binocular Vision & Relative Accommodation Tests at Near

Clinician Name: _____

Patient Name: _____

Date: _____

Distance Lateral Dissociated Phoria (Alignment Method)): _____

Near Cover Test (Measured): _____

Near Lateral Dissociated Phoria (Alignment Method): _____

Gradient Phoria (Alignment Method):   _____

Near Lateral Fusional Vergences: BI____/____/____
                                                   BO____/____/____

Near Lateral Dissociated Phoria (Flash Method): _____

Near Vertical Dissociated Phoria: _____

Near Vertical Fusional Vergences: R <u>S</u>____/_____ L <u>S</u>____/_____
                                                        <u>I</u>____/_____   <u>I</u>____/_____

Gradient AC/A: _____

Calculated AC/A: _____

Binocular Crossed-Cylinder: _____

Negative Relative Accommodation: _____

Positive Relative Accommodation: _____

Questions:

1. How well did the results of the Cover Test agree with the results of the Dissociated Lateral Phoria Test? What reason(s) can you give for any disagreements of results?

_____
_____

2. If your patient had a near lateral dissociated phoria, what were the demand and the reserve? Was the reserve sufficiently high to meet Sheard's criterion? If not, how much prism would have to be prescribed in order to meet Sheard's criterion?

_____
_____

3. Was there a difference between the gradient and calculated AC/A ratios? If so, how can you explain this?

_____
_____

4. What would the NRA be equal to if accommodation was completely relaxed at the test endpoint? What would you think was happening if the NRA was higher than 2.50 D? What could cause the NRA to be low?

_____
_____
_____
_____

5. What factors affect the PRA?

_____
_____

6. What test findings were within normal ranges?

_____
_____

7. What test findings were outside normal ranges?

_____
_____

Be sure to turn in lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III
**LAB #3: Binocular Vision Tests at Near, Sequencing, and Tentative Add for
Nearpoint Testing in Presbyopes**

Equipment to Bring to Lab: near test card set.

I. Near-point Findings for Presbyopes:

A. Concept of the tentative add

● The tentative add is the add through which the nearpoint findings are taken.
  The add that will be prescribed is based in part on the findings obtained with the
  tentative add.
●"Young" presbyopes will usually be able to read small letters at 40 cm
  through the BVA lenses, but the BVA is not the best reading lens, so nearpoint
  tests are done through some amount of plus over the BVA (the tentative add).
● "Older" presbyopes will require an add to see the small letters at 40 cm, so an
  add is necessary for nearpoint testing.

   Reminder: The term "add" refers to lens power in addition to or over the BVA.

B. Determining the Tentative Add for Young Presbyopes

● For individuals who are just becoming presbyopic (40 to 45 years old)
  or those who have not yet worn an add for near work, amplitude of
  accommodation provides an indication of the tentative add which will be used
  for the remainder of the near-point tests.
● This tentative add is based on the concept that a person should not have to
  make use of more than half of his/her accommodation.

      Formula: Tentative add=accomm. stim. for test dist. – (amp accomm. / 2)

      Example: Near-point of accommodation (taken through the BVA lenses) = 33 cm
              Amplitude of Accommodation = 3 D
              Accommodative stimulus for test distance = 100/40 cm = 2.50 D
              Half the amplitude = 1.50 D
              Tentative Add = 2.50 – 1.50 = +1.00 D

C. Determining the Tentative Add for Older Presbyopes

 ● For established presbyopes who are already wearing bifocals or reading
   glasses, it is necessary to place added plus lenses (combined with the BVA
   subjective lenses) in the refractor or trial frame in order to measure the near-
   point of accommodation.
● The most effective method of determining the tentative add is by using the
  Binocular Cross-Cylinder test.

D. Tests through the Tentative Add

Lateral Phoria at Near

● In the <u>very early</u> stages of presbyopia, the individual may be <u>esophoric</u> at near due to trying hard to accommodate in an attempt to see clearly and thus over-converging.
● After a short time, the esophoria at near leads to expohoria because there is no (or decreased) "accommodative effort". Therefore, there is little or no accommodative convergence.
● The expected near phoria for an advanced presbyope is around 10Δ of exophoria.

Plus and Minus to Blur

● For young presbyopes: plus and minus to blur tests (taken through the BVA lenses plus the tentative add determined by the amplitude of accommodation) will be relatively high.

    Example: +2.00 NRA and -1.75 PRA

● For older presbyopes: plus and minus to blur tests (taken through the BVA lenses plus the tentative add determined by Binocular Cross-Cylinder) will be lower.

    Example: +1.00 NRA and -0.75 PRA

● Rule of thumb:
    1. Final add should make the Plus to blur and Minus to blur findings equal.
    2. Final add should make Plus to blur slightly greater than Minus to blur, if they can't be balanced with an add which is a multiple of 0.25D.

Range of Accommodation

<u>PROCEDURE</u>:

1. Start at the 40 cm distance (with the patient wearing the BVA lenses with the tentative add), the near-point card is moved inward and the patient is asked to report when the 20/20 row of letters begins to blur.

2. The distance at which the blur occurs is mentally noted, and the card is then returned to 40 cm.

3. The patient is then instructed to watch the 20/25 row of letters, and report when the letters begin to blur as the card is moved outwards.

4. The checking of the range of accommodation is very subjective. It serves to demonstrate to the patient where they can expect to have clear vision. It also serves to

confirm to the examiner that the add power used will be effective at the patient's usual reading and working distances. The add power can potentially be altered based on the subjective report of the patient during range testing.

Trial Framing the Add and Checking the Patient's Preferred Working Distance

● For a "new" presbyope, who has not yet worn an add for near, use the distance BVA subjective plus the add in a trial frame and use a magazine or newspaper to refine the add.

● To check the patient's working distance, hold the card at 40 cm and allow the patient to reach out and touch the card. Then the patient should be asked if the card is at his/her usual reading distance, or is it too close or too far.

● For a "new" presbyope, who has not yet worn an add for near, use the distance BVA subjective plus the add in a trial frame and use a magazine or newspaper to refine the add.

● Patient may have to cope with more than one working distance
For example: reading done at a closer distance than computer work or household duties.
Therefore, remember to ask the patient about the various
working distances (other than "reading").

● In order to decide on the actual add to be prescribed, the tentative add is modified on the basis of the results of the plus and minus to blur findings, range of accommodation and the patient's preferred working distance.

II. Three Different Sequences for Binocular Vision Testing

The order in which tests are performed is important because the order can potentially affect the results through adaptation effects. The order can also affect the time and smoothness of the examination.

A. Some of the factors that can affect accommodation and vergence test results:
1. adaptation effects
2. smoothness and quickness of testing
3. clarity and completeness of instructions
4. target characteristics
5. illumination

B. Terms used to describe the change in tonic vergence after the use of fusional vergence:
1. prism adaptation
2. vergence adaptation
3. fusional after-effects
4. vergence carry-over

C. Terms used to describe the change in accommodative resting state after changes in accommodation:
- 1. accommodative adaptation
- 2. accommodative carry-over

D. General principles to reduce effects of adaptation or carry-over:
- 1. phorias before vergences
- 2. BI before BO
- 3. NRA before PRA
- 4. BCC before PRA
- 5. Don't allow the patient to look through prism or adds any longer than necessary (e.g., zero the prisms or close off one eye before recording)

E. Three specific sequences:

1. Dr. Grosvenor's order of binocular vision testing:

Non-presbyopes

Distance: Lateral Phoria
            Vertical Phoria
            BI Vergence Reserves
            BO Vergence Reserves
            Vertical Vergence Reserves

Near: Lateral Phoria
            Vertical Phoria
            BI Vergence Reserves
            BO Vergence Reserves
            Vertical Vergence Reserves
            Gradient Phoria
            Binocular Cross-Cylinder
            Plus to blur (NRA)
            Minus to blur (PRA)

Presbyopes

Distance: Lateral Phoria
               Vertical Phoria
               BI Vergence Reserves
               BO Vergence Reserves
               Vertical Vergence Reserves
  Near: Amplitude of Accommodation (for "new" presbyopes)
               Binocular Cross-Cylinder (for all presbyopes)
               Lateral Phoria
               Vertical Phoria
               BI Vergence Reserves
               BO Vergence Reserves
               Vertical Vergence Reserves
               Plus to blur (NRA)
               Minus to blur (PRA)

Note: Amplitude of Accommodation & Binocular Cross-Cylinder must be the first near tests, in order to determine the tentative add. All of the other near-point tests should then be done through the BVA subjective plus the tentative add.

* Associated phoria testing will be covered in lab #5.

2. Dr. Meetz's order of binocular vision testing:

Non-presbyopes

Distance: Lateral Phoria
               Vertical Phoria
               BI Vergence Reserves
               BO Vergence Reserves
               Vertical Vergence Reserves
  Near: Vertical Phoria
               Lateral Phoria
               Gradient Phoria
               Plus to blur (NRA)
               Binocular Cross-Cylinder
               Minus to blur (PRA)
               Vertical Vergence Reserves
               BI Vergence Reserves
               BO Vergence Reserves

.

Presbyopes

Distance: Lateral Phoria
                Vertical Phoria
                BI Vergence Reserves
                BO Vergence Reserves
                Vertical Vergence Reserves

Near: Amplitude of Accommodation (for "new" presbyopes)
                Minus to blur (will actually be a plus lens "least minus")
                Plus to blur (PRA)
                Binocular Cross-Cylinder
                Lateral Phoria
                Vertical Phoria
                Vertical Vergence Reserves
                BI Vergence Reserves
                BO Vergence Reserves

Note: For a presbyope or a presumed presbyope, the Amplitude of Accommodation (for "new presbyopes") should be done as the first near test. In order to determine the tentative add you must add plus lenses in order for the patient to see the near target. Therefore, the first lens that the patient can read the near target with is the "most minus, least plus", continue with the plus to the NRA then down to the BCC in order to determine the tentative add. All of the other near-point tests but the Gradient should then be done through the BVA subjective with the tentative add. The **Gradient Phoria** is not necessary on a presbyope.

3. Dr. Mallett's order of binocular vision testing:
Non-presbyopes

Distance: Lateral Phoria
                Vertical Phoria

Near: Vertical Phoria
                Lateral Phoria
                Gradient Phoria
                Plus to blur (NRA)
                Binocular Cross-Cylinder
                Minus to blur (PRA)
                Vertical Vergence Reserves
                BI Vergence Reserves
                BO Vergence Reserves

Distance: Vertical Vergence Reserves
BI Vergence Reserves
BO Vergence Reserves

Presbyopes

Distance: Lateral Phoria
Vertical Phoria

Near: Plus to blur (NRA)
Binocular Cross-Cylinder
Minus to blur (PRA)
Lateral Phoria
Vertical Phoria
Vertical Vergence Reserves (if patient has a vertical phoria)
BI Vergence Reserves
BO Vergence Reserves

Distance: Vertical Vergence Reserves (if patient has a vertical phoria)
BI Vergence Reserves
BO Vergence Reserves

Advantages and Disadvantages of Different Testing Sequences

Dr. Grosvenor: Sequence of Binocular Vision Tests

Advantage	Does all the distance testing first, and then ends with PRA. Quicker!
Disadvantage	Near Phoria is done after distance vergences and Gradient Phoria is done after near vergences (carryover). You must keep changing prisms from dissociated to fusing.

Dr. Meetz: Sequence of Binocular Vision Tests

Advantage	Does all the distance testing first. Uses Vertical Phoria to reduce carryover to Lateral and Gradient Phorias. Uses +1.00 Gradient lens for step up to NRA.
Disadvantage	Does near vergences last, after PRA. Therefore, you must reset the refractor and prisms.

Dr. Mallett: Sequence of Binocular Vision Tests

Advantage	Does all the phorias first. Therefore there is no carryover. Uses verticals (phoria and vergences) to reduce carryover during testing. Therefore, prisms are only reset once.
Disadvantage	Does distance testing then near and back to distance testing. Does vergences last after PRA. Must reset refractor after PRA.

TEST SEQUENCING

Grosvenor Sequence of Binocular Vision Tests

Phorias	HORIZ	Base	VERT	Base	Test Method	
Distance	1		2		Gradient Type	
Near	7		8		O +1.00	
Gradient	13				O -1.00	

Vergences-Lateral	Blur	Break	Recovery	Vertical OD/OS	Break	Recovery
DIV (BI) Dist.		3		Supra (BD) Dist.		5
CONV (BO) Dist.		4		Infra (BU) Dist.		6
DIV (BI) Near		9		Supra (BD) Near		11
CONV (BO) Near		10		Infra (BU) Near		12

BCC [14]   NRA [15]   PRA [16]

Meetz Sequence of Binocular Vision Tests

Phorias	HORIZ	Base	VERT	Base	Test Method	
Distance	1		2		Gradient Type	
Near	8		7		O +1.00	
Gradient	9				O -1.00	

Vergences-Lateral	Blur	Break	Recovery	Vertical OD/OS	Break	Recovery
DIV (BI) Dist.		3		Supra (BD) Dist.		5
CONV (BO) Dist.		4		Infra (BU) Dist.		6
DIV (BI) Near		15		Supra (BD) Near		14
CONV (BO) Near		16		Infra (BU) Near		13

BCC 11   NRA 10   PRA 12

Mallett Sequence of Binocular Vision Tests

Phorias	HORIZ	Base	VERT	Base	Test Method	
Distance	1		2		Gradient Type	
Near	4		3		O +1.00	
Gradient	5				O -1.00	

Vergences-Lateral	Blur	Break	Recovery	Vertical OD/OS	Break	Recovery
DIV (BI) Dist.		15		Supra (BD) Dist.		14
CONV (BO) Dist.		16		Infra (BU) Dist.		13
DIV (BI) Near		11		Supra (BD) Near		10
CONV (BO) Near		12		Infra (BU) Near		9

BCC 7   NRA 6   PRA 8

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V652 CLINICAL SCIENCES III

Laboratory Report 3: Binocular Vision & Relative Accommodation Tests
**   Sequencing**

Clinician Name: _____

Patient Name: _____

Date: _____

LAB PROCEDURE:
Perform the entire set of binocular vision tests on your lab partner using the three
different sequences. Record your findings on the practice exam forms. Compare your
speed and results on the three sequences.

Non-presbyope Sequencing: Grosvenor's Method
       Time: _____

Non-presbyope Sequencing: Meetz's Method
       Time: _____

Non-presbyope Sequencing: Mallett's Method
       Time: _____

Questions:
1. How well did the different sequences agree with each other? What reason(s) can you
give for any disagreement?

       _____
       _____
       _____

2. Did the calculated ACA ratios agree with each other from sequence to sequence?
How about the gradient ACA ratios?

       _____
       _____

3. Circle or highlight phorias and ACA ratios on the exam forms that were outside
normal ranges. Were there any that were outside normal ranges on all three sequences?

       _____
       _____

4. Circle or highlight vergence range, NRA, and PRA findings that were lower than the
normal ranges. Were there any that were low on all three sequences?

       _____
       _____

Turn in this lab report and the three exam forms at the end of the lab.

V652 CLINICAL SCIENCES III

Laboratory Report 3: Binocular Vision & Relative Accommodation Tests
                                    Sequencing

Clinician Name: _____

Patient Name: _____

Date: _____

<u>LAB PROCEDURE:</u>

Perform the entire set of binocular vision tests on your lab partner using the three different sequences. Record your findings on the practice exam forms. Compare your speed and results on the three sequences.

Non-presbyope Sequencing: Grosvenor's Method
          Time: _____

Non-presbyope Sequencing: Meetz's Method
          Time: _____

Non-presbyope Sequencing: Mallett's Method
          Time: _____

Questions:

1. How well did the different sequences agree with each other? What reason(s) can you give for any disagreement?

_____
_____
_____

2. Did the calculated ACA ratios agree with each other from sequence to sequence? How about the gradient ACA ratios?

_____
_____

3. Circle or highlight phorias and ACA ratios on the exam forms that were outside normal ranges. Were there any that were outside normal ranges on all three sequences?

_____
_____

4. Circle or highlight vergence range, NRA, and PRA findings that were lower than the normal ranges. Were there any that were low on all three sequences?

_____
_____

Turn in this lab report and the three exam forms at the end of the lab.

V652 CLINICAL SCIENCES III
LAB # 4: Monocular Estimation Method (MEM) Dynamic Retinoscopy and Accommodative Facility

References: Carlson and Kurtz, Clinical Procedures for Ocular Examination, 3rd ed., pp. 197-198; Eskridge et al., Clinical Procedures in Optometry, pp. 677-686; Grosvenor, Primary Care Optometry, 5th ed., pp. 198-199; Goss, Ocular Accommodation, Convergence, and Fixation Disparity, 3rd ed., pp. 70-77, 151-156.

Equipment to Bring to Lab: retinoscope, dynamic retinoscopy card set, trial lens set, lens holder, occlude, Saladin card, near test card set, timer to time one minute.

I. DYNAMIC RETINOSCOPY

BACKGROUND:

Dynamic Retinoscopy:
- Pioneered by Andrew J. Cross in the early 20th century.
- Used in assessment of nearpoint function in non-presbyopes, particularly important in diagnosis of accommodative disorders.
- Used to assess accommodative response and the patient's **lag** or **lead of accommodation**.
    - **Lag** → accommodative response lags behind the accommodative stimulus *(AR<AS)*
    - **Lead** → accommodative response leads in front of the accommodative stimulus *(AR>AS)*
- *Lenses:* Refractive error is known and corrected
- *Target:* Patient views a nearpoint target
- *Illumination Level*: High enough so that the patient can easily read the letters on near test cards
- Three common dynamic retinoscopy methods:

    1) Monocular Estimation Method (MEM):
        - most popular dynamic retinoscopy method
        - near card attached to retinoscope
        - retinoscope @ 40 cm

    2) Low Neutral Method:
        - only method that **does not** measure the actual lag or lead of accommodation,
        - finds lens power at which the accommodative response **equals** the accommodative stimulus
        - more variability and slightly higher standard deviation compared to the other two dynamic retinoscopy methods
        - near card attached to retinoscope
        - retinoscope @ 40 cm

3) Nott Method:
  - named after founder, Ivan Nott
  - near test card (Nott test card) held **separately** from retinoscope
  - near card on near rod @ 40 cm
  - retinoscope starts @ 40 cm then moved backward (if lag present) until neutrality is achieved

● Because the subjective refraction has usually been done before dynamic retinoscopy is done, it is expected that dynamic retinoscopy findings will be equal in the two eyes, although differences of 0.25 D are fairly common. Potential reasons for differences greater than that are incorrect binocular balance or an uncorrected cylinder, although sometimes there are differences in accommodation between the two eyes.

● Normal findings with dynamic retinoscopy **do not** completely rule out an accommodative disorder therefore a complete clinical work up of accommodative function should be done, including *accommodative facility* (accommodative rock)*, negative relative accommodation* (plus to blur)*, positive relative accommodation* (minus to blur)*, and accommodative amplitude*.

Lag of Accommodation:
  ● Normal Accommodation→falls slightly behind nearpoint target creating a slight lag of accommodation

  ● Accommodative Stimulus (amount of accommodation needed for exact focus on target):

    If BVA in place,
    AS = 1/(target distance in meters)
    Ex: the near card @ 40 cm, the AS = 1/0.40 meters = 2.50 D

  ● Accommodative Response (how much the patient actually accommodates):

    AR = 1/(location of plane of accommodation)
    Ex: if the patient's accommodation makes the retina conjugate w/ a point
       50 cm from the spectacle plane, the AR = 1/0.50 meters = 2.00 D

  ● Accommodation Lag or Lead = (Accommodative Stimulus – Accommodative Response)

    a) **Lag** = Accommodative response (AR) *less than* Accommodative
         stimulus (AS) = **(+) Dioptric Value**
       --normal to have small amount of lag
       --large lag of accommodation may be sign of accommodative
         problem such as *accommodative insufficiency*

b) **Lead** = Accommodative response (AR) *greater than* Accommodative stimulus (AS) = **(-) Dioptric Value**
--uncommon to have lead of accommodation
--sign of accommodative problem such as *accommodative excess* or *spasm*

Prescription Guidelines for Accommodative Anomalies:
- Dynamic Retinoscopy gives a starting point for amount of Add to prescribe to relieve accommodative symptoms. That add can be confirmed by trial framing to see if the patient notices more comfortable vision.

If the lag of Accommodation exceeds +0.75 D:
MEM:	**Lag - 0.25 D = ADD**
Nott:	**Lag - 0.25 D = ADD**

If the plus added to get to neutral exceeds +1.00 D:
Low Neutral:	**Plus to neutral - 0.50 D = ADD**

- The plus power can be put in *a bifocal* or can be added to the distance Rx for use in *single vision reading glasses*.

MONOCULAR ESTIMATION METHOD (MEM):

PURPOSE: To objectively measure the accommodative response in order to assist in the diagnosis and treatment of accommodative disorders.

SETUP:
- Patient wearing Habitual Rx or trial frame with BVA
- MEM near card attached to retinoscope
- Retinoscope in plane mirror mode with streak oriented vertically
- Usually out of the phoropter
- Target usually at 40 cm (or Harmon distance)
- Usually 20/20 or 20/30 letters or age appropriate words or figures
- Binocular conditions
- Normal room illumination (patient has to be able to read the letters)
- Examiner in patient's midline

PROCEDURE:

1. Examiner positioned so the MEM card and retinoscope are at 40 cm from patient (or at patient's customary working distance) and directly on the patient's midline.
--When examining children, the **Harmon Distance** (distance from child's elbow to his knuckles) is sometimes used as the working distance. (for an adult, the Harmon distance is usually about 40 cm)

2. Tell patient: *"Read the letters (or words) on the card out loud."*

3. With the retinoscope, sweep the streak across the horizontal meridian of the right eye. Observe the reflex in the center of the pupil.

4. Evaluate the retinoscope reflex for with, against, or neutral motion and **estimate** the dioptric value required to neutralize the observed motion.
   --**With** = Lag of Accommodation
   --**Against** = Lead of Accommodation

5. Confirm the estimate by **quickly (<1 second)** placing the predicted trial lens power in front of the patient's line of sight and reevaluate the retinoscope reflex.

   --Note: The lens must be quickly placed in front of patient while evaluating the reflex then immediately removed because if lens is in place too long it will induce an accommodative response and result in invalid data. *If the lens is in place greater than 1 second, remove lens and wait at least 3 seconds before estimating the reflex again.* After re-checking the estimate, another confirmation lens can be tried. Each time a confirmation lens is used, the estimate should be re-checked until the estimate is confirmed.

6. Repeat steps 2-5 for the left eye.

7. Record the estimate of the lag or lead which was confirmed by the lens power used to reach neutrality for both OD and OS.

RECORDING:
Ex. MEM: OD +0.50 D
          OS +0.75 D

EXPECTED NORMS:
Non-presbyopes: 0 to +0.75 D

II. ACCOMMODATIVE FACILITY

BACKGROUND:

● Accommodative facility testing is indicated for a child or young adult who has near-point complaints in spite of a normal amplitude of accommodation, normal lag of accommodation, or the absence of an obvious vision problem, especially when the patient reports transient distant blur after reading.
● Methods of measuring Accommodative Facility:
1) Lens Rock
2) Distance Rock
(Lens rock is used more often that distance rock)

LENS ROCK ACCOMMODATIVE FACILITY

PURPOSE: To measure speed of accommodative changes in cycles per minute to assist in the diagnosis and treatment of accommodative disorders

SET-UP:
● Patient wearing habitual Rx or trial frame with BVA
● 20/30 letters on near point card at 40 cm (the block of 20/30 letters on the Saladin card is a good target for lens rock)
● +2.00 D lenses on one side of the lens holder and -2.00 D lenses on the other side
● Timer to time one minute

PROCEDURE:

1. Tell patient to look at the 20/30 letters.

2. Begin with the plus lenses on the lens holder, and instruct the patient to read the letters out loud, in order, calling out one letter as soon as it clears up each time the lenses are flipped.

3. Each time the patient calls out a letter, the lens bar is flipped to the other side.

4. Continue to alternate between plus and minus for one minute.

5. The results are recorded in cycles per minute, with two flips constituting one cycle.

6. Test with both eyes first, then OD, then OS. For monocular testing, cover the non-tested eye with an occluder.

7. Note subjectively whether the patient is slower on the plus or minus side or about equal speed on the two sides.

RECORDING:
Example: Lens rock (+2/-2): 8 cpm OU / 9 cpm OD / 9 cpm OS
Slower on minus side OU, OD, OS

EXPECTED NORMS:
There are no universally accepted norms for the flipper test because some optometrists vary the testing procedure, and many variables, including lens power, test distance, letter size, etc., affect the results. For example, Loerzel et al. found that for every +/-0.50D decrease in lens flipper power, the mean rate increased 3-4 cpm.

For the testing procedures we will use (+2/-2 lenses, 20/30 letters at 40 cm), we will use the following norms:

● **Monocular at least 11 cpm,**
Binocular at least 10 cpm,
Monocular minus binocular difference no more than 4 cpm

Flippers are most commonly used in persons in the age range of 10 to 30 years old. Younger children often have difficulty understanding the test.
Adults over the age of 30 years have had enough of a reduction in amplitude of accommodation that the minus side of +/- 2.00 D flippers is difficult to clear even if accommodation is perfectly normal for the patient's age.

If both binocular and monocular flipper rates are low, the most likely diagnosis is an accommodative disorder. If the binocular rate is low but the monocular rate is normal, the most likely diagnosis may be a vergence disorder. For diagnostic purposes, it is also helpful to note if the patient was slower on the plus or minus side or not.

DISTANCE ROCK ACCOMMODATIVE FACILITY:

PURPOSE: To measure speed of accommodative changes in cycles per minute to assist in the diagnosis and treatment of accommodative disorders

SET-UP:
● Patient wearing habitual Rx or trial frame with BVA
● 20/20 line on distance chart
● Nearpoint chart with 20/20 letters at 40 cm
● Timer to time one minute

PROCEDURE:

1. Patient is instructed to read letters on the two charts in order, one at a time, as soon as each can be cleared, first one letter on the distance chart, then one letter on the near chart, one letter on the distance chart, etc., alternating back and forth.

2. Count the number of letters called in one minute.

3. Record the result in cycles per minute, with two letters constituting one cycle.

4. Test with both eyes first, then OD, then OS. For monocular testing, cover the non-tested eye with an occluder.

5. Note subjectively whether the patient is slower going to distance or going to near.

RECORDING:

Example: Distance rock: 25 cpm OU / 23 cpm OD / 23 cpm OS
Slower at near OU, OD, OS

EXPECTED NORMS:

Standard norms do not exist for this test. We will use a norm of at least 18 cpm OU, OD, and OS for 18 to 30 year olds.

Distance rock rates are dependent on age, with lower rates expected for young children.

V652 CLINICAL SCIENCES III
Laboratory Report 4: MEM Dynamic Retinoscopy and Accommodative Facility

Clinician Name: _____

Date: _____

MEM (7 patients; **make sure you see at least one higher than normal lag**):
Patient #1 Name: _____
MEM OD _____   Is Near Rx Recommended? Yes or No
      OS _____   If Yes, what near add is Recommended ?_____ D

Patient #2 Name: _____
MEM OD _____   Is Near Rx Recommended? Yes or No
      OS _____   If Yes, what near add is Recommended ?_____ D

Patient #3 Name: _____
MEM OD _____   Is Near Rx Recommended? Yes or No
      OS _____   If Yes, what near add is Recommended ?_____ D

Patient #4 Name: _____
MEM OD _____   Is Near Rx Recommended? Yes or No
      OS _____   If Yes, what near add is Recommended ?_____ D

Patient #5 Name: _____
MEM OD _____   Is Near Rx Recommended? Yes or No
      OS _____   If Yes, what near add is Recommended ?_____ D

Patient #6 Name: _____
MEM OD _____   Is Near Rx Recommended? Yes or No
      OS _____   If Yes, what near add is Recommended ?_____ D

Patient #7 Name: _____
MEM OD _____   Is Near Rx Recommended? Yes or No
      OS _____   If Yes, what near add is Recommended ?_____ D

Accommodative Facility (1 patient):
Lens rock:

_____ cpm OU / _____ cpm OD / _____ cpm OS
Slower on plus or minus? OU: no / + / - ; OD: no / + / - ; OS: no / + / -

Distance rock:

_____ cpm OU / _____ cpm OD / _____ cpm OS
Slower going to distance or going to near?
OU: no / dist / near ; OD: no / dist / near ; OS: no / dist / near-

Questions:
1. What range of lags did you see in the seven patients?

_____
_____

2. What aspects of the reflex were most useful in helping you estimate the amount of lag?

_____
_____
_____
_____

3. A high lag of accommodation can be a sign of what accommodative problem?

_____
_____

4. A lead of accommodation can be a sign of what accommodative problem?

_____
_____

5. Were the lens rock findings on your patient normal? If not, do the results suggest an accommodative disorder or a vergence disorder?

_____
_____

6. Were the distance rock findings on your patient normal?

_____
_____

Turn in one copy of lab report to AI at the end of today's lab.

Clinician Name: _____

Date: _____

MEM (7 patients; **make sure you see at least one higher than normal lag**):

Patient #1 Name: _____

MEM OD _____   Is Near Rx Recommended? Yes or No

       OS _____   If Yes, what near add is Recommended ?_____ D

Patient #2 Name: _____

MEM OD _____   Is Near Rx Recommended? Yes or No

       OS _____   If Yes, what near add is Recommended ?_____ D

Patient #3 Name: _____

MEM OD _____   Is Near Rx Recommended? Yes or No

       OS _____   If Yes, what near add is Recommended ?_____ D

Patient #4 Name: _____

MEM OD _____   Is Near Rx Recommended? Yes or No

       OS _____   If Yes, what near add is Recommended ?_____ D

Patient #5 Name: _____

MEM OD _____   Is Near Rx Recommended? Yes or No

       OS _____   If Yes, what near add is Recommended ?_____ D

Patient #6 Name: _____

MEM OD _____   Is Near Rx Recommended? Yes or No

       OS _____   If Yes, what near add is Recommended ?_____ D

Patient #7 Name: _____

MEM OD _____   Is Near Rx Recommended? Yes or No

       OS _____   If Yes, what near add is Recommended ?_____ D

Accommodative Facility (1 patient):

Lens rock:

_____ cpm OU / _____ cpm OD / _____ cpm OS

Slower on plus or minus? OU: no / + / - ; OD: no / + / - ; OS: no / + / -

Distance rock:

_____ cpm OU / _____ cpm OD / _____ cpm OS

Slower going to distance or going to near?

OU: no / dist / near ; OD: no / dist / near ; OS: no / dist / near-

Questions:

1. What range of lags did you see in the seven patients?

_____

_____

2. What aspects of the reflex were most useful in helping you estimate the amount of lag?

_____

_____

_____

_____

3. A high lag of accommodation can be a sign of what accommodative problem?

_____

_____

4. A lead of accommodation can be a sign of what accommodative problem?

_____

_____

5. Were the lens rock findings on your patient normal? If not, do the results suggest an accommodative disorder or a vergence disorder?

_____

_____

6. Were the distance rock findings on your patient normal?

_____

_____

Turn in one copy of lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III

LAB #5: Dynamic Retinoscopy & Alternative Phoria and Vergence Tests

Nott and low neutral dynamic retinoscopy; Maddox rod and modified Thorington dissociated tests; prism bar vergence ranges; vergence facility

References: Carlson & Kurtz, 3rd edition., pp. 208-213; Grosvenor, 5th ed., pp. 197-199, 227; Goss, Ocular Accommodation, Convergence, and Fixation Disparity, 3rd ed., pp. 13-14, 24-25, 77-78, 151-156.

Equipment to Bring to Lab: retinoscope, dynamic retinoscopy cards, nearpoint test cards, horizontal and vertical prism bars, trial lens set, flipper lens holder, penlight (or transilluminator), Maddox rod, Saladin card, calculator, timer to time one minute.

I. DYNAMIC RETINOSCOPY

Three common dynamic retinoscopy methods are MEM, Nott, and low neutral. In the last lab, we studied MEM dynamic retinoscopy. Emphasized this week will be Nott and low neutral dynamic retinoscopy.

NOTT METHOD:

PURPOSE: To objectively measure the accommodative response in order to assist in the diagnosis and treatment of accommodative disorders.

SETUP:
● Phoropter with patient's distance Rx, set at near PD
● Nott near card (reading card with a center hole surrounded by print; e.g., Saladin card) placed @ 40 cm on the phoropter near rod
● Retinoscope in plane mode with streak oriented vertically
● Test card separated from retinoscope
● Room lights on

PROCEDURE:

1. Examiner positioned so the Nott card and retinoscope are at 40 cm from patient (or at patient's customary working distance) and directly on the patient's midline.

2. Tell patient: *"Read the letters on the card out loud."*

3. With the retinoscope, sweep streak across the horizontal meridian of the right eye.

4. Evaluate the retinoscope reflex for with, against, or neutral motion.

--If **With** = Lag of Accommodation➔Examiner must move back away from card with retinoscope until neutral is first seen.

--**Against** = Lead of Accommodation➔Examiner records that a lead was observed (amount not needed to be determined).

5. Measure the distance from the spectacle plane to the retinoscope when neutrality is reached and convert it into the dioptric accommodative response value.

- Accommodative Response = 1/(distance of retinoscope from spectacle plane)
- Ex: AR = 1/0.67 m = 1.50 D

6. Determine the lag of accommodation by subtracting the accommodative response from the accommodative stimulus.

- Ex: Accommodative Stimulus at 40 cm = 1/0.40m = 2.50
  Accommodative Response at 67 cm = 1/0.67 = 1.50
  Lag of Accommodation = 2.50 D – 1.50 D = +1.00 D

7. Repeat for the left eye.

RECORDING:
Ex. Nott: +1.00 D

EXPECTED NORMS:
Non-presbyopes: 0 to +0.75 D

LOW NEUTRAL METHOD (aka Cross Method):

PURPOSE: To objectively measure the lens power needed to reach the point where the accommodative response equals the accommodative stimulus; done in order to assist in the diagnosis and treatment of accommodative disorders.

SETUP:
● Phoropter with patient's distance Rx, set at near PD
● Near dynamic retinoscopy card attached to retinoscope
● Retinoscope in plane mirror mode with streak oriented vertically
● Test card and retinoscope in same plane
● Room lights on
● Examiner in patient's midline

PROCEDURE:

1. Examiner positioned so the near card and retinoscope are at 40 cm from patient (or at patient's customary working distance).

2. Tell patient: *"Read the letters (or words) on the card out loud."*

3. With the retinoscope, sweep streak across the horizontal meridians of **both** eyes.

4. Evaluate the retinoscope reflex for with, against, or neutral motion.

> --If **with** motion observed in **both** eyes, **plus lenses** (+0.25 D) are added **binocularly**.

> --If **against** motion observed in **both** eyes, **minus lenses** (-0.25 D) are added **binocularly**.

7. After each +/-0.25 D addition, reevaluate the retinoscope reflex.

8. Stop at the first time a neutral reflex is observed and *record the amount of plus or minus added to achieve neutrality.*

> Ex: A test distance of 40 cm is used and an addition of +0.75 D over the distance refractive correction is required for neutrality. Record +0.75 D.

>> Note: In this case, the accommodative stimulus and accommodative response would be 1.75 D:
>> Accommodative Stimulus = (1/0.40 meters) – (0.75 D)
>> Accommodative Stimulus = 2.50 D – 0.75 D = +1.75 D
>> *The Accommodative Stimulus of 2.50 D was reduced by 0.75 D by the addition of +0.75 D over the distance Rx so this is the point where the accommodative response equals the accommodative stimulus.*

> **Note: If neutrality is observed in one eye before the other, add no more lens power in front of the eye with neutrality. Continue to add lenses in front of the other eye until neutral is seen in both eyes. Record the added lens power needed for neutrality in each eye. *(Differences of 0.25 D between the eyes on any of the three dynamic retinoscopy procedures are common, but in the case of larger differences, it is appropriate to recheck the binocular balance or cylinder findings before assuming interocular difference in accommodation).*

RECORDING:
Ex. Low Neutral: +0.75 D

EXPECTED NORMS:
Non-presbyopes: 0 to +1.00 D

Review of dynamic retinoscopy

	MEM	Nott	Low neutral
In or out of phoropter	Out of phoropter	In phoropter, set at near PD	In phoropter, set at near PD
Lenses in place	Habitual Rx or BVA in trial frame	BVA	Start at BVA
Target	MEM card on retinoscope, usually 40 cm	Nott-type card (e.g., Saladin card) on reading rod at 40 cm; with BVA lenses & card at 40 cm, AS= 2.50 D	MEM card on retinoscope at 40 cm
Illumination	Room lights on	Room lights on	Room lights on
Meridian	Scope horizontal meridian only	Scope horizontal meridian only	Scope horizontal meridian only
Procedure	Estimate lag or lead; can use lens in place < 1 sec to confirm estimate	Start with ret. in plane of card; if lag present, move retinoscope back behind card until neutral seen; convert distance of ret. from patient into AR	If with motion seen, add plus binocularly until neutral seen; if against motion seen add minus until neutral seen
What is measured	Estimated motion = lag	AS – AR = lag	Plus or minus needed to make AS = AR
Normal range	0 to 0.75 D lag	0 to 0.75 D lag	0 to +1.00 D add
General guideline for near plus Rx	Lag – 0.25 D	Lag – 0.25 D	plus to neutral – 0.50 D

Sources of error in dynamic retinoscopy:
1) uncorrected anisometropia or astigmatism
2) testing at an incorrectly estimated distance
3) poor instructions to patient or patient inattention
4) improper illumination level
5) off-axis scoping
6) having lens in place too long on MEM

II. DISSOCIATED PHORIA MEASUREMENT

● Measures the amount of misalignment of the visual axes when binocular fusion is prevented. The alternating cover test and the von Graefe test are two common dissociated phoria tests.

● Two additional methods of measuring dissociated phorias

1) **Maddox Rod**
- For fixation at distance, use a light mounted on the wall at the end of the room or a spot of light from the projector.
- For fixation at near, use a penlight or transilluminator @ 40 cm on the reading rod or in free space.

2) **Modified Thorington**
- There are separate cards for distance and near with a hole in the center
- The numbers on each card are calibrated to read in prism diopters when the card is held at a specific distance from the patient.
- A penlight or transilluminator is held behind the card so it is seen by the patient through the hole.
- *Most repeatable of all the current subjective dissociated phoria tests*.

MADDOX ROD:

PURPOSE: To measure the lateral and vertical dissociated phoria at distance and at near.

SETUP:
● Spot of light from projector for distance testing; penlight or transilluminator held at 40 cm for near testing
● Can be with or without phoropter
● BVA lenses in place if in phoropter; if out of phoropter, patient wears habitual Rx or BVA put in trial frame
● Maddox rod (hand held or on auxiliary lens wheel on phoropter)
● Prisms (Risley prisms, prism bars, or hand held prisms)
● Overhead light off, stand light low (enough light for examiner to see prisms)

PROCEDURE:

Lateral Phoria

1. Orient Maddox rod with striations horizontal in front of right eye, and place a 15Δ BI measuring prism (prism bar or Risley prism) in front of the right eye.

2. The fixation object is a spot of light, which appears to the patient, through the Maddox rod, as a red streak. Instruct the patient to look at the light but to be aware of the red line. (The left eye sees the spot of light and the right eye sees the red line)

3. The examiner gradually reduces the amount of BI prism, instructing the patient to report when the red streak (which is vertical) is in the center of the spot of light. The amount of prism power and the base-direction indicates the amount of lateral dissociated phoria.

> **Note**: The lateral Maddox rod phoria is not reliable or diagnostic and it is used only to confirm a questionable finding. The problem with lateral phorias measured with the Maddox rod is that there are no letters or fine features for control of accommodation. Therefore, accommodation tends to localize at an intermediate distance; with the result that the distance lateral phoria tends to be <u>too much Eso</u> and the near lateral phoria tends to be <u>too much Exo</u>.

Vertical Phoria

1. A similar procedure is used, with the exception that the Maddox rod is oriented with striations vertical.

2. Starting with 6Δ BU, the examiner gradually reduces the amount of BU prism, instructing the patient to report when the red streak (which is now horizontal) is in the center of the spot of light. The amount of prism power and the base direction indicates the amount of vertical phoria.

> **Note**: Unlike the lateral Maddox rod phoria, the vertical is reliable and as such is a confirmatory test for any vertical finding on von Graefe.

<u>RECORDING:</u>

● Record the lateral & vertical phorias separately
● Record the size of the deviation in prism diopters
● Record the direction of the deviation
● For vertical phorias, also record the eye the measuring prism is over

Ex. 1) 1Δ eso or 1Δ BO
    2) 6Δ exo' or 6Δ BI', 2Δ R hyper' or 2Δ BD OD'

Note: P or T should not be used in recording Maddox rod (or von Graefe or Modified Thorington) because you can't distinguish between P and T based on those tests.

MODIFIED THORINGTON TEST

PURPOSE: To measure the lateral and vertical dissociated phoria at distance and near.

SETUP:
● Penlight (or transilluminator turned low)
● Maddox rod
● Thorington cards for distance & near. A penlight is held behind the small hole in the center of the card in order to provide the light source.
● Room lights on so patient can see numbers on card
● Usually out of phoropter, patient wearing habitual Rx or trial frame with BVA

PROCEDURE:

Lateral Phoria

1. A Maddox rod (oriented with striations horizontal) is used, and the eye without the Maddox rod sees a chart having numbers on either side of the light. The test card is held at the distance for which it is calibrated.

2. The patient is instructed to look at the light in the center of the card. The patient is then instructed to report which letter or number the red streak (which is vertical) goes through with reference to the light: left, right or through the light. The distance between each letter or number represents one prism diopter.

> Example: If the patient reports that the red streak goes through the light, the patient has no deviation (ortho).
>
> If patient reports that the red streak goes through the number 2 on the right side, then the phoria is 2 Δ eso.
>
> If patient reports that the red streak goes through the number 3 on the left side, then the phoria is 3 Δ exo.

> Note: The patient must report which side of the light the red streak is located. This indicates whether the phoria is eso or exo.

> Note: when done out of the phoropter, the gradient phoria can be done by having the patient hold a +1.00 D trial lens over the left eye.

Vertical Phoria

1. The Maddox rod (oriented with striations vertical) forms a horizontal streak.

2. The Thorington chart used for vertical phoria measurement is the set of numbers (or numbers and letters) above and below the light.

3. The patient is instructed to look at the light in the center of the card. The patient is then instructed to report which letter or number the red streak (which is horizontal) goes through with reference to the light: up, down or through the light.

Example: If the patient reports that the red streak goes through the light, the patient has no deviation (ortho).

If patient reports that the red streak goes through the number 2 above the light, then the phoria is 2 Δ left hyper.

If patient reports that the red streak goes through the number 3 below the light, then the phoria is 3 Δ right hyper.

RECORDING:

● Record the size and direction of the phoria

Ex. 6 Δ exo/2 Δ left hyper

III. PRISM BAR VERGENCES

● To determine fusional vergence ranges at distance and near.
● For near testing, the target held up at a position that allows the patient to see it through the center of the individual prism.
● Watch the patient's eyes – prism bar vergences can be used as an objective measure of the break and recovery point.
● Targets, lighting, and instructions are the same as for vergence ranges with Risley prisms in the phoropter.

SETUP:
● Single letter or line of letters one line above VA for poorer eye for distance test; Look Here card for near test
● Patient holds card for near test
● BVA lenses in trial frame or habitual Rx
● Prism bars

PROCEDURE:

1. The examiner holds the prism bar in front of the non-dominant eye, starting with 1Δ of BI.

2. Give same instructions as vergences in phoropter.

3. Prism power is increased one prism step every 2-3 seconds time until the patient reports seeing double.

> Note: A blur is less likely on prism bar vergences than on phoropter rotary prism vergences. However, you should still ask the patient to report a blur if it occurs.

> Note: Hold prism bar straight up and down. Tilting it will induce some vertical prism.

4. Once the patient reports seeing double, reduce one prism at a time, until recovery of single vision has occurred.

> Note: If the target briefly breaks into two and then goes back into one without a change in prism power, that should not be considered a break.

5. Record blur / break / recovery, with an X for blur if no blur is reported.

6. Same procedure is done with BO prism.

7. Use vertical prism bars for vertical vergences.

IV. VERGENCE FACILITY

● Measures speed of vergence changes in cycles per minute to assist in the diagnosis and treatment of vergence disorders
● Will be low in fusional vergence dysfunction (as well as other vergence disorders) so can be useful when symptoms suggest vergence disorder but phorias are normal

SET-UP:
● Patient wearing habitual Rx or trial frame with BVA
● 20/30 letters on near point card at 40 cm (the block of 20/30 letters on the Saladin card is a good target)
● 3 BI on one side of the lens holder and 12 BO on the other side
● Binocular conditions
● Timer to time one minute

PROCEDURE:

1. Tell the patient to look at the 20/30 letters.

2. Begin with the BI side on the lens holder, and instruct the patient to read the letters out loud, in order, calling out one letter as soon as it clears up and is one each time the prisms are flipped.

3. Each time the patient calls out a letter, the flipper bar is flipped to the other side.

4. Continue to alternate between BI and BO for one minute.

5. The results are recorded in cycles per minute, with two flips constituting one cycle.

6. Note subjectively whether the patient is slower on the BI or BO side or about equal speed on the two sides.

RECORDING:
Example: Vergence facility (3 BI/12 BO): 6 cpm
Slower on BO side

EXPECTED NORMS:
Minimum 12 cpm

V652 CLINICAL SCIENCES III

Laboratory Report 5: Dynamic Retinoscopy & Alternative Phoria and Vergence Tests

Clinician Name: _____

Patient Name: _____

Date: _____

Binocular Cross Cylinder (BCC): OU _____

Dynamic Retinoscopy:

MEM Method: OD _____   Is Near Rx Needed? Yes or No
                  OS _____   If Yes, what is the Near ADD?_____

Nott Method: OD _____   Is Near Rx Needed? Yes or No
                  OS _____   If Yes, what is the Near ADD?_____

Low Neutral Method: OD _____   Is Near Rx Needed? Yes or No
                  OS _____   If Yes, what is the Near ADD?_____

Dissociated Phorias:
Lateral von Graefe Phoria Dist._____/Near_____
Near von Graefe with +1.00 D Add _____
Vertical von Graefe Phoria Dist._____/Near_____
Lateral Maddox Rod Phoria Dist._____/Near_____
Vertical Maddox Rod Phoria Dist._____/Near_____
Lateral Modified Thorington Phoria Dist._____/Near_____
Near Modified Thorington with +1.00 D Add _____
Vertical Modified Thorington Phoria Dist. _____/Near_____

Prism Bar Vergences:
Dist. Lat. Vergences BI ____/____/____   Near Vergence BI ____/_____/_____
                     BO ____/____/____   BO____/____/_____

Vertical Vergences S ____/____ R/L   Vergences N' S____/____ R/L
                    I ____/____   I ____/____

Vergence Facility:
_____ cpm; Slower on BI / BO / equal

Questions:

1. How do the results compare for the 3 methods of dynamic retinoscopy and the binocular crossed cylinder test?

_____
_____
_____
_____

2. How well did the results of the three dissociated lateral phoria tests compare? What reason(s) can you give for any disagreement?

_____
_____
_____
_____

3. What calculated and gradient AC/A ratios did you get with the modified Thorington phorias?

_____
_____
_____
_____

4. What calculated and gradient AC/A ratios did you get with the von Graefe phorias?

_____
_____
_____
_____

5. Using the modified Thorington dissociated phoria and the prism bar vergences, was Sheard's criterion met at near? If not, what prism is needed to meet it?

_____
_____
_____

Turn in one copy of the lab report to AI at end of today's lab.

V652 CLINICAL SCIENCES III

Laboratory Report 5: Dynamic Retinoscopy & Alternative Phoria and Vergence Tests

Clinician Name: _____
Patient Name: _____
Date: _____

Binocular Cross Cylinder (BCC): OU _____

Dynamic Retinoscopy:

MEM Method: OD _____   Is Near Rx Needed? Yes or No
                   OS _____   If Yes, what is the Near ADD?_____

Nott Method: OD _____   Is Near Rx Needed? Yes or No
                   OS _____   If Yes, what is the Near ADD?_____

Low Neutral Method: OD _____   Is Near Rx Needed? Yes or No
                    OS _____   If Yes, what is the Near ADD?_____

Dissociated Phorias:
Lateral von Graefe Phoria Dist._____/Near_____
Near von Graefe with +1.00 D Add _____
Vertical von Graefe Phoria Dist._____/Near_____
Lateral Maddox Rod Phoria Dist._____/Near_____
Vertical Maddox Rod Phoria Dist._____/Near_____
Lateral Modified Thorington Phoria Dist._____/Near_____
Near Modified Thorington with +1.00 D Add _____
Vertical Modified Thorington Phoria Dist. _____/Near_____

Prism Bar Vergences:
Dist. Lat. Vergences BI   ____/____/____   Near Vergence BI ____/_____/_____
                     BO ____/____/____   BO____/____/_____

Vertical Vergences S ____/____ R/L   Vergences N' S____/____ R/L
                    I ____/____   I ____/____

Vergence Facility:
_____ cpm; Slower on BI / BO / equal

Questions:

1. How do the results compare for the 3 methods of dynamic retinoscopy and the binocular crossed cylinder test?

_____
_____
_____
_____

2. How well did the results of the three dissociated lateral phoria tests compare? What reason(s) can you give for any disagreement?

_____
_____
_____
_____

3. What calculated and gradient AC/A ratios did you get with the modified Thorington phorias?

_____
_____
_____
_____

4. What calculated and gradient AC/A ratios did you get with the von Graefe phorias?

_____
_____
_____
_____

5. Using the modified Thorington dissociated phoria and the prism bar vergences, was Sheard's criterion met at near? If not, what prism is needed to meet it?

_____
_____
_____

Turn in one copy of the lab report to AI at end of today's lab.

V652 CLINICAL SCIENCES III
LAB #6: Additional Binocular Vision Tests

**Mallett, Leica, Saladin, Borish, and Bernell Associated Phorias;
Hirschberg & Brückner tests; Suppression tests**

References: Carlson and Kurtz, 3rd ed., pp. 47-49, 52-56, 193-196, 204-207;
Grosvenor, 5th ed., pp. 91, 120, 236-238, 243-244; Goss, 3rd ed., pp. 81-100.

**Equipment to Bring to Lab: occluder, Saladin card, Maddox rod, polaroid glasses,
red-green glasses, transilluminator attachment for Worth dot test, transilluminator,
ophthalmoscope, prism bars, trial lens set.**

I. ASSOCIATED PHORIA MEASUREMENT

- Measures the amount of prism required to neutralize a misalignment of the
  visual axes under **binocular** viewing conditions. (Amount of prism needed to
  reduce fixation disparity to zero)
- Determines the amount of prism to prescribe for patients with vertical
  imbalances and also often for lateral imbalances
- Does not measure amount of fixation disparity
- Sometimes called aligning prism
- Some common associated phoria tests:
  - 1) **Mallett units**
    Among the first clinical associated phoria tests, they were
    introduced in 1964, by Mallett, a British optometrist, in the form of
    two testing devices, one for distance and one for near.
  - 2) **Vectographic projector charts**
    Most distance projectors have associated phoria targets
  - 3) **Saladin card**
    Has targets for lateral and vertical associated phoria at near
  - 4) **Borish card**
    Has targets for lateral and vertical associated phoria at near
  - 5) **Bernell lantern**
    Has distance and near slides

MALLETT TEST

● The distance Mallett unit is wall-mounted, and the stimulus is made of the letters **O X
O**, which provides a central fusion lock, and two red lines (one above and one below the
X), which are polarized so that one is seen with each eye. The **O X O** are seen with both
eyes. The X is the fixation point.
● The unit is used in fully illuminated surroundings to provide a normal visual
environment.

Note: When the unit is oriented so that the **O X O** is in the horizontal meridian, it is used to measure the <u>lateral</u> associated phoria. The unit can then be rotated 90 degrees to measure the <u>vertical</u> associated phoria. Some units have lines for both lateral and vertical without rotating the target.

<u>MALLETT TEST PROCEDURE:</u>

Mallett Lateral Associated Phoria at distance

1. While wearing the BVA subjective lenses and Polaroid filters, the patient's attention is called to the distance Mallet unit. Instruct the patient to concentrate on the **X** and ask if he/she can see two red lines, one above and one below the **X**.

2. The patient is then asked if the top line is directly above the bottom line, or if it is displaced to one side. The amount of displacement expected is very small (no more than 5 to 15 minutes or arc), so the patient is urged to look for a <u>very slight</u> displacement.

3. If the top line (seen by the right eye) is to the left of the bottom line, the patient has Exo fixation disparity; whereas, if the top line is to the right of the bottom line, the patient has Eso fixation disparity. If the lines are perfectly aligned, the patient has zero associated phoria.

4. If the patient has <u>Exo fixation disparity</u>, the examiner introduces <u>BI prism</u> over the non-dominant eye starting with the lowest amount of prism on the prism bar. The examiner asks the patient about alignment on each step of prism (every one or two prism diopters depending on the prisms used) until the lines are aligned. The amount and base-direction of the prism necessary to eliminate the fixation disparity (i.e., to align the two red lines) is the associated phoria.

> **Note:** According to Mallett, the fact that there is an associated phoria means that the patient has a dissociated phoria which is uncompensated and the amount of prism that eliminates the fixation disparity is the amount of prism to be prescribed.

5. If the patient has <u>Eso fixation disparity</u>, the examiner slowly introduces <u>BO prism</u> and the associated phoria is the amount of prism to eliminate the fixation disparity. Record the amount and base direction of the prism. (Usually the associated phoria will be in the same direction (BI or BO) as the dissociated phoria and will be smaller in magnitude.

Mallett Vertical Associated Phoria at distance

1. The distance Mallett unit is rotated 90 degrees, and a similar procedure is used to detect vertical fixation disparity and measure the associated phoria. The associated phoria and therefore the amount of prism to be prescribed is indicated by the amount and base-direction of vertical prism necessary to cause the two red strips to be aligned.

2. Record the amount of prism and the prism base direction. For vertical associated phorias, it is also necessary to record the eye over which the prism was placed.

Mallett Lateral and Vertical Associated Phorias at Near (for your information; we won't do near Mallett associated phorias in lab)

The Mallett unit for near is used. The procedures for measuring the lateral and vertical associated phorias at near are similar to the procedures used for distance, with the following exceptions:

1. The Mallett unit for near provides separate stimuli for lateral and vertical measurements. The O X O foveal stimulus is surrounded by a paragraph which provides a peripheral fusion lock. Only the O X O and the lines used for alignment (which are green, in the near unit) are internally illuminated; the paragraph of type must be illuminated by means of the refracting unit lamp.

2. The patient wears his/her BVA subjective lenses in a trial frame with polarized glasses over the top and holds the near unit at a distance of 40 cm.

3. If the patient is found to have Eso fixation disparity at near, the examiner may wish to prescribe a plus add for near rather than BO prisms. Plus lens power is added, 0.25 D at a time, to the BVA lenses until the patient reports that the two green strips are aligned. According to Mallett, the amount of plus power needed to align the strips is the amount of add to be prescribed.

DISTANCE ASSOCIATED PHORIA WITH LEICA PROJECTOR

The Leica projector has two associated phoria targets, one with a central fusion lock and one without a central fusion lock. Use the target with the central fusion lock. With polaroids, the top line and the right line are seen with the right eye, and the bottom line and left line are seen with the left eye.

Leica Projector Lateral Associated Phoria
1. Place the phoropter set with the patient's subjective refraction, distance PD, and polaroids in front of the patient.

2. The patient is instructed to look at the dot in the center and to judge whether the top line is exactly above the bottom line. If so, the associated phoria is zero.

3. If the top line is to the right of the bottom line, even slightly, the patient has an eso fixation disparity. The Risley prism over the non-dominant eye is moved into place and set at 1Δ BO. The patient is again asked about alignment. The BO prism is increased 1Δ at a time until alignment is achieved. The amount of prism and base direction at first alignment is the associated phoria.

4. If the top line is to the left, the patient has exo fixation disparity. The patient is asked about alignment with each 1Δ addition of BI prism with the Risley prism over the non-dominant eye. The amount and base direction of the prism where alignment first occurs is the associated phoria.

Leica Projector Vertical Associated Phoria
1. Instruct the patient to look at the dot in the center and judge whether the line on the left and the line on the right are perfectly aligned. If so, the vertical associated phoria is zero.

2. If the line on the right is higher, the patient has a left hyper fixation disparity. Prism BUOD or BDOS (depending on which eye is the non-dominant eye) is increased in 1Δ steps, allowing the patient to judge alignment at each step, until alignment is achieved. The amount of prism, the base direction, and the eye the prism was over are recorded as the associated phoria.

3. If the line on the left is higher, the patient has a right hyper fixation disparity. Prism BDOD or BUOS (depending on which eye is the non-dominant eye) is increased in 1Δ steps, allowing the patient to judge alignment at each step, until alignment is achieved. The amount of prism, the base direction, and the eye the prism was over are recorded as the associated phoria.

NEAR ASSOCIATED PHORIA WITH SALADIN CARD

Near associated phorias can be measured with the Saladin card using the same basic procedures as with the Mallett unit.

Saladin Card Lateral Associated Phoria
1. The lateral associated phoria target is the circular window all the way to the left in the row across the top of the card. Place your penlight on the back of the card and shine it through this window.

2. The patient wears Polaroid goggles, looks at the dot in the center, and judges whether the vertical lines are aligned.

3. If the vertical lines do not appear to be lined up to the patient, prism is added until they are aligned.

4. That amount of prism is the associated phoria. Record the amount of prism BI or BO.

Saladin Card Vertical Associated Phoria
1. The vertical associated phoria target is the top window in the column along the left side of the card. The patient looks at the dot in the center and judges the alignment of the horizontal lines.

2. If the horizontal lines are aligned, the associated phoria is zero.

3. If the horizontal lines are not aligned, the amount of prism needed to align them is the associated phoria. Record the amount of prism and the eye over which the prism was held. (e.g., 2 BD OD)

NEAR ASSOCIATED PHORIA WITH BORISH CARD
The target for associated phorias on the Borish card has a pair of vertical lines and a pair of horizontal lines with an X in the middle. There are also some Os around the lines. The X and the Os are seen with both eyes during the test.

Borish Card Lateral Associated Phoria
1. The patient wears Polaroid goggles, looks at the X in the center, and judges whether the vertical lines are aligned.

2. If the vertical lines do not appear to be lined up to the patient, prism is added one step at a time over the non-dominant eye until they are aligned.

3. That amount of prism is the associated phoria. Record the amount of prism BI or BO.

Borish Card Vertical Associated Phoria
1. The patient wears Polaroid goggles, looks at the X in the center, and judges whether the horizontal lines are aligned.

2. If the horizontal lines are aligned, the associated phoria is zero.

3. If the horizontal lines are not aligned, the amount of prism needed to align them is the associated phoria. Record the amount of prism, the prism base direction, and the eye over which the prism was held. (e.g., 2 BD OD)

NEAR ASSOCIATED PHORIA WITH BERNELL LANTERN
The slide for near on the Bernell lantern has one area for lateral associated phorias and one area for vertical associated phorias. The numbers 21012 are seen by both eyes and are the fusion lock.

Bernell Lantern Lateral Associated Phoria
1. The patient wears Polaroid goggles, looks at the 0 in the center and judges whether the top green line is exactly above the bottom green line.

2. If the top green line is to the right (eso fixation disparity), BO prism is added to alignment. If the top green line is to the left (exo fixation disparity), BI prism is added to alignment.

3. The amount of prism is the associated phoria. Record the amount of prism BI or BO.

Bernell Lantern Vertical Associated Phoria
1. The patient wears Polaroid goggles, looks at the 0 in the center, and judges whether the two horizontal green lines are perfectly aligned.

2. If the horizontal lines are aligned, the vertical associated phoria is zero.

3. If the horizontal lines are not perfectly lined up, add prism over the non-dominant eye until they are. That amount of prism is the associated phoria. Record the amount of prism, the prism base direction, and the eye over which the prism was held.

II. AUXILIARY TESTS TO DETECT STRABISMUS

BACKGROUND:
Strabismus→**manifest** deviation of the eyes   vs.   Phoria→**latent** deviation of the eyes

- Adaptations that occur in Strabismus to prevent diplopia:
    1) Suppression
    2) Amblyopia
    3) Eccentric Fixation
    4) Anomalous Retinal Correspondenece

- Detection and Measurement of Strabismus:
    1) Cover Test:
        --Unilateral CT: **detects** strabismus
        --Alternating CT: used to **measure angle of deviation** in strabismus with prism bars

    2) Hirschberg Test (a.k.a. Corneal Light Reflex Test):
        --For preschool kids who fail to cooperate for cover test.
        --Amount the light reflex is from the center of the cornea monocularly is *angle lambda*.
        --**Detects** and **estimates angle of deviation** in strabismus.

    3) Brückner Test:
        --For preschool children or infants who cannot cooperate for cover Test or Hirschberg test testing, but can fixate a light source.
        --**Detects:** a) Strabismus
                    b) Anisometropia
                    c) Media opacities
                    d) Posterior pole anomalies

HIRSCHBERG TEST (aka. Corneal Light Reflex Test):

EQUIPMENT:
● Transilluminator
● Occluder

PURPOSE: To determine the approximate positions of the visual axes of the two eyes under binocular conditions. This test is used to identify a strabismus when other more precise methods cannot be used.

SETUP:
● Patient without glasses

PROCEDURE:

1. From a distance of about 50 cm hold the transilluminator in the patient's midline and direct the light toward the patient's nose. Instruct the patient, "*Look at the light.*"

2.Occlude patient's OS.

3. Place your eye directly behind the transilluminator and observe the location of the corneal light reflex in the OD. This gives an estimate of angle lambda. If the corneal reflex is nasal to pupil center, angle lambda is positive; if the corneal reflex is temporal to pupil center, angle lambda is negative. Estimate how far the corneal reflex is from pupil center.
--Average: ½ mm nasal to center of pupil (positive angle lambda; denoted +0.5)

4. Remove the occluder. Continue to position your eye directly behind the transilluminator. Observe the location of the corneal light reflex in the right eye of the patient under binocular conditions.

5. Occlude patient's OD and repeat step 3.

6. Remove the occluder. Continue to position your eye directly behind the transilluminator. Observe the location of the corneal light reflex in the left eye of the patient under binocular fixation.

7. Compare the locations of the corneal reflexes in each of the two eyes when fixating binocularly relative to where they were located when each eye was fixating separately.

> (-) strabismus--if reflexes are in the same position in each eye compared to their monocular positions
> (+) strabismus--if the reflexes are not in the same relative positions compared to when they were viewed monocularly

--each mm of difference in displacement between the two eyes compared to the difference in displacement under monocular conditions indicates **approximately 22 pd** of strabismus

--Nasal Displacement = EXO
--Temporal Displacement = ESO
--Superior Displacement = HYPO
--Inferior Displacement = HYPER

EXAMPLES:

Locations of the corneal light reflexes under monocular conditions in each of the cases below:

Compare the above to the following locations of the corneal light reflexes under binocular conditions:

This eye is out = Exo

This eye is in = Eso

This eye is up = Hyper

This eye is down = Hypo
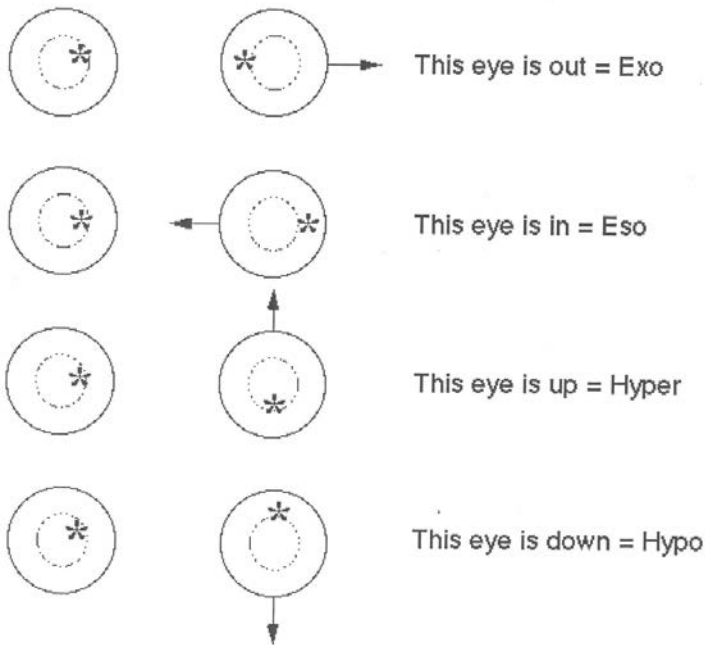
RECORDING:
If No Strabismus: *Symmetry* or *Aligned*

If Strabismus Present:
        Angle Lambda: OD, +0.5; OS, +0.5
        Hirschberg: OD, +1.5; OS, +0.5
        (this would suggest right exotropia of about 22 pd)

BRÜCKNER TEST:

EQUIPMENT:
● Direct Ophthalmoscope

PURPOSE: To assess the symmetry of binocular fixation by comparing the brightness of the red reflex between the two eyes.

SETUP:
● Patient without glasses
● Dim room illumination

PROCEDURE:
1. Instruct patient, "*Look at my light.*" Hold the ophthalmoscope in the patient's midline and direct the light toward the patient's nose from a distance of about 1 meter so that the beam of light illuminates both pupils at the same time.

2. Look through the ophthalmoscope and dial in to the lens that gives a clear view of the patient's pupils.

3. Compare the brightness of the red reflexes in the two eyes.
   --If equally bright: Normal binocular fixation
   --If Not equally bright:
       a) Darker Dimmer Red Reflex:
           -Fixating Eye,
           -Media Opacity, or
           - Lower refractive error in significant anisometropia
       b) Brighter, Lighter, Whiter Reflex
           -Nonfixating Eye (Strabismic Eye) or
           -Higher refractive error in significant anisometropia

RECORDING:
Record the eye that appears brighter
Ex. Brückner Test: OD=OS
Ex. Brückner Test: OD brighter than OS, or OD>OS

III. SUPPRESSION TESTS

There are many tests that assess the presence and depth of suppression. Three examples are:

> 1) Worth Dot Test
> 2) Vis-à-vis Test
> 3)   Four Prism Diopter Base Out Test

WORTH DOT TEST:

EQUIPMENT:
- Worth 4 Dot wall target or handheld flashlight
- Red-Green Glasses

SET-UP:
- Pt wearing habitual Rx.
- Pt wearing red-green glasses over his habitual Rx with red lens over OD and green lens over OS.

PROCEDURE:

1. From 3 meters, show the patient the Worth 4 Dot Target with the white dot at the bottom and the red dot at the top. (*Do Not tell patient this is the Worth 4 Dot Test; rather say it is the Worth Dot Test in order to avoid telling patients how many dots they should see.*)

2. Ask patient, "*How many spots of light do you see?*"
> a. If patient reports seeing **4 dots**: **Normal Fusion**
> b. If patient reports seeing **2 red dots**: **Suppression OS**
> c. If patient reports seeing **3 green dots**: **Suppression OD**
> d.If patient reports seeing **5 dots**, **Diplopia:** ask patient, "*Are the green dots to the right, left, above, or below the red dots*?

> ***Note: With Red/Green glasses with red lens over OD and green lens over OS:*
> > *--Red Dots seen by OD*
> > *--Green Dots seen by OS*

> > --If red dots to right of green dots → **Eso** Deviation
> > --If red dots to left of green dots → **Exo** Deviation
> > --If red dots below green dots → **Right Hyper** Deviation
> > --If red dots above green dots → **Left Hyper** Deviation

3. Repeat Steps 1-2 for near testing by holding the Worth 4 Dot target/flashlight at 40 cm from patient.

4. Perform steps 1-3 in both light and dark. Seeing 2 or 3 in both light and dark indicates a deep suppression. Seeing 2 or 3 in light but 4 in dark indicates a suppression which is not as deep.

If suppression was found only at distance or only at near:
1. Hold the Worth dot flashlight at the place at which there was no suppression (3 m or 40 cm).

2. Instruct the patient, "*Continue looking at the flashlight and tell me if the number of dots changes from 4 dots to either 2 or 3 dots at any time.*"

3. Slowly begin to move toward the place where there was suppression (3 m or 40 cm) and continually ask the patient, "*How many dots do you see*?"

4. Stop either when reaching a distance of 3 meters from the patient (or more in a larger exam room) if moving out, or at 40 cm if moving in, or when the patient reports a change in number of dots.

> --If see 4 dots from 40 cm to 3 meters = **No suppression**
> --If patient reports change in number of dots, note the distance that the
>   suppression occurs and determine which eye is suppressing.
>
> **Note: One explanation for suppression at distance but not at near is central suppression. The farther away from the patient before the patient notes suppression, the smaller the central suppression scotoma is (the closer the Worth dot target is from the patient the larger the angular separation of the dots).

RECORDING:
Record number of dots seen.
Ex:

	Distance	Near
Light	4	4
Dark	4	4

If see 2 dots: also record distance at which suppression 1st occurs.
Ex: Fusion @ 3 meters + suppression OS @ 100 cm

If see 3 dots: also record distance at which suppression 1st occurs.
Ex: Fusion @ 40 cm + suppression OD @ 3 m

If see 5 dots: also record Eso, Exo, or Hyper (*if vertical deviation record hyper eye*)
Ex: Diplopia, eso @ 40 cm

VIS-À-VIS TEST:

EQUIPMENT:
● Two pairs of Polaroid goggles

SET-UP:
● Patient wears Polaroid goggles over habitual Rx
● Examiner also wears Polaroid goggles
● Overhead light on full, stand light on

PROCEDURE:
1. Ask the patient, *"Do you see both of my eyes?"*

2. If the answer is no, ask the patient, *"Which of my eyes appears darkened?"*

3. The examiner's left eye is seen by the patient's right eye, and the examiner's right eye is seen by the patient's left eye (assuming proper orientation of the polaroids). A yes answer to the first question indicates no suppression. A no answer to the first question indicates suppression. The answer to the second question indicates which eye is suppressing: if left eye darkened, suppression OD; if right eye darkened, suppression OS.

RECORDING:
Vis-à-vis: (+), suppression OD
Or
Vis-à-vis: (-), no suppression

FOUR PRISM DIOPTER BASE OUT TEST:

EQUIPMENT:
● Loose 4 prism diopter prism

PURPOSE: To confirm or rule out the presence of a small central suppression scotoma; makes use of Hering's Law of Equal Innervation (which states that yoked muscles for movement of both eyes in same direction are equally innervated)

SET-UP:
● Patient wearing distance correction
● Single isolated letter one line above BVA in the patient's poorer seeing eye on the distance visual acuity chart

PROCEDURE:
1. Instruct patient, "*Keep looking at the letter even if it appears to move and try to keep the letter single at all times.*"

2. Quickly place a 4Δ prism with the base out in front of the patient's better seeing eye. Watch for movement of the other eye. The normal response is movement of the eye without the prism out (temporally) and then back in (nasally); this indicates no central suppression.

3. Now quickly place the 4Δ prism with the base out in front of the patient's poorer seeing eye. Again watch for movement of the eye without the prism. The normal response is movement of the eye without the prism out and then back in; this indicates no central suppression.

4. Interpretation of abnormal responses:
   a. eye without prism moves out but not back in: eye without the prism is suppressing
   b. eye without the prism does not move: eye with the prism is suppressing

RECORDING:
4 p.d. BO: (+), suppression OD
   Or
4 p.d. BO: (-), no suppression

ILLUSTRATION OF NORMAL RESULT ON FOUR PRISM DIOPER BASE OUT TEST: (diagram from von Noorden GK. Atlas of Strabismus)

95
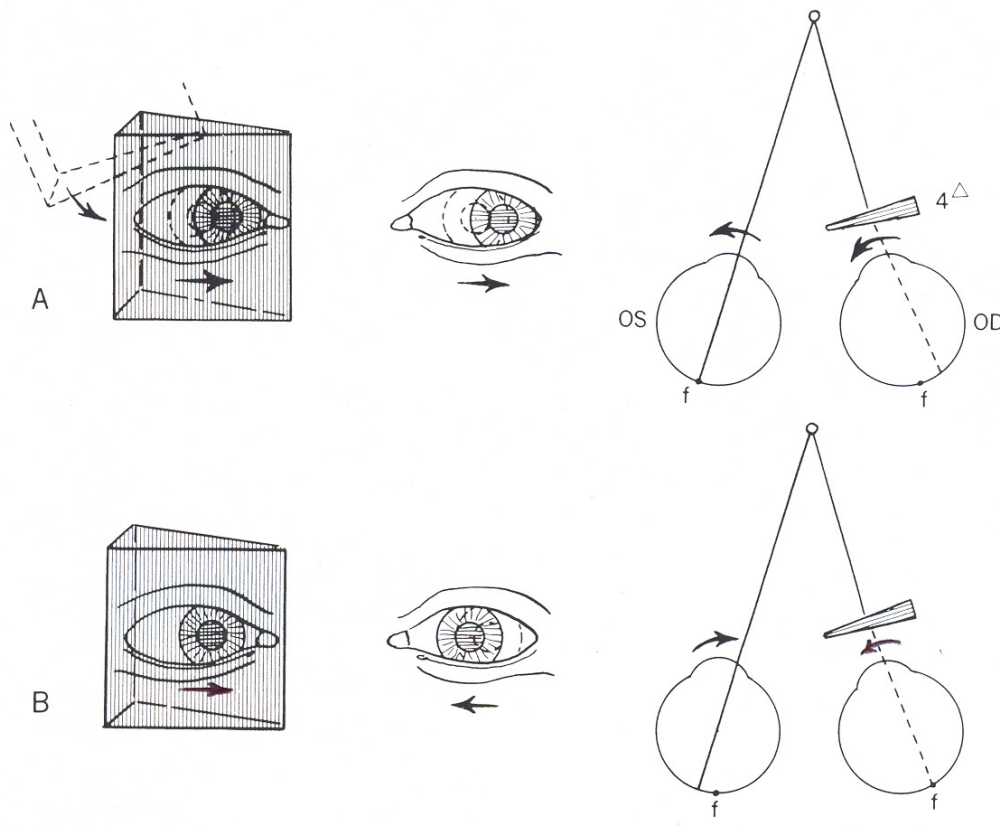
ILLUSTRATION OF RESULT INDICATING OS SUPPRESSION SCOTOMA ON FOUR PRISM DIOPER BASE OUT TEST: (diagram from von Noorden GK. Atlas of Strabismus)
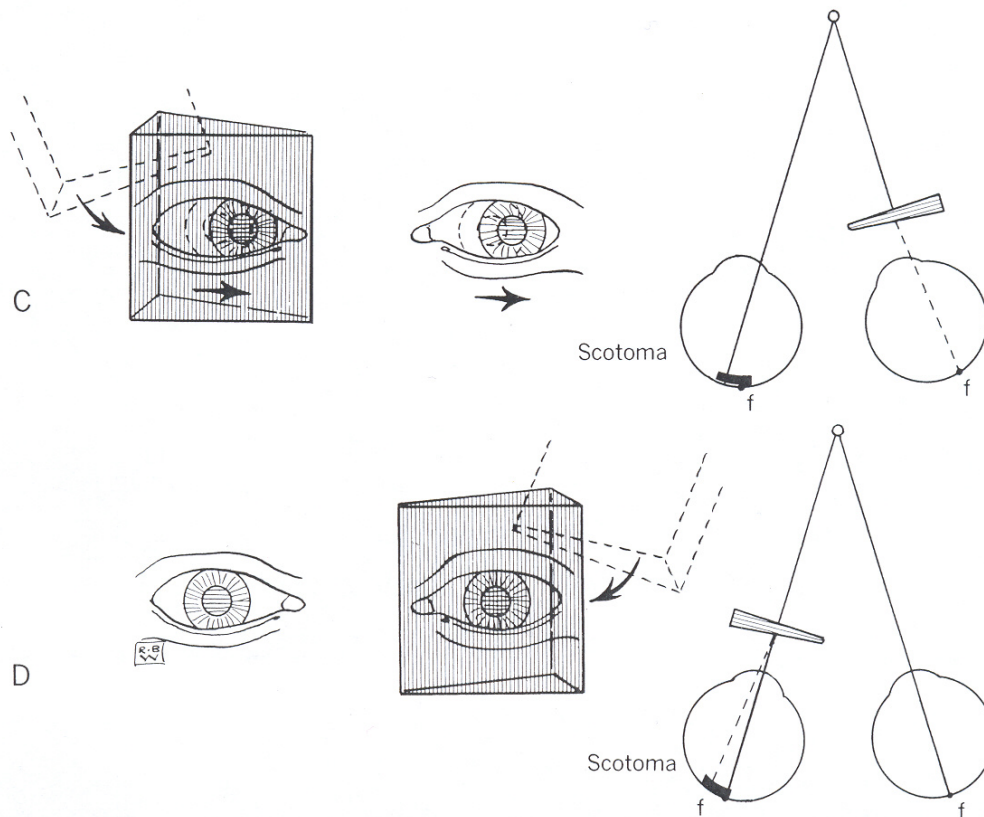
COMMENTS ON SUPPRESSION TESTS:

● Suppression may occur on some tests and not on others. If it occurs only on tests with more natural conditions, it is said to be a shallow suppression. If it occurs also on tests with less natural conditions, it is said to be a deep suppression. Suppression on vis-à-vis but not on Worth dot would be a shallow suppression. Suppression on vis-à-vis and on Worth dot in light and dark would be a deep suppression.

● The 4Δ BO test has the advantage that it is objective, unlike other suppression tests. However, its repeatability is poor, so diagnosis of central suppression should not be based on it alone.

● Suppression can be suggested from other tests that you have learned so far. For example: (a) patient sees only one of the alignment lines on associated phoria tests, (b) patient doesn't see red line on Maddox rod test (deep suppression), (c) target slides to one side on fusional vergence range testing (BI – target moves away from suppressing eye; BO – target moves toward suppressing eye).

IV. FIXATION DISPARITY MEASUREMENT

● Fixation disparity is a condition in which the images of a binocularly fixated object do not stimulate corresponding retinal points but still fall within Panum's fusional areas, the object is therefore seen singly.

● The existence of fixation disparity indicates that there is a slight overconvergence (eso fixation disparity) or underconvergence (exo fixation disparity) of the lines of sight under binocular conditions.

● When measuring fixation disparity, we are dealing with very tiny angles, specified in minutes of arc as opposed to measuring associated phorias which are specified in prism diopters.

● Methods of measuring fixation disparity

1) Saladin card

-The windows along the top of the card are used for lateral fixation disparity (except for the one on the left which is used for associated phoria).
-The windows along the left side of the card are used for vertical fixation disparity (except for the top one which is used for associated phoria).
-Each window has a pair of lines, with the lateral or vertical separation of the lines varying from window to window.
-The patient wears Polaroid goggles.
-The patient is instructed to tell the examiner the window in which the lines appear to be perfectly aligned.
-The examiner looks at the back of the card to see the amount of fixation disparity for that window.

2) Wesson Fixation Disparity Card

- Designed for the actual measurement of fixation disparity.
- Consists of an upward-pointing arrow in the lower half of the stimulus array, with colored vertical lines in the upper half.
- Each colored line represents a different amount of fixation disparity.
-The patient wears Polaroid goggles.
- The patient is instructed to tell the examiner which colored line the arrow points to. The amount of fixation disparity is read in minutes of arc from the upper-right corner of the card.

Summary of differences between dissociated phoria, fixation disparity, and associated phoria

	Dissociated phoria	Fixation disparity	Associated phoria (a.k.a. aligning prism)
Binocular Fusion?	NOT present *	Present	Present
Is it an angle of misalignment?	Yes	Yes	No, an amount of prism
Unit of measurement	Prism diopters	Minutes of arc**	Prism diopters
How direction recorded for lateral	BI or BO, exo or eso***	Exo or eso	BI or BO
How direction recorded for vertical	RH or LH, BUOS or BDOS, BUOD or BDOD	RH or LH	BUOS or BDOS, BUOD or BDOD
Instruments, tests	Alternating cover test, von Graefe, Maddox rod, modified Thorington	SheedyDisparometer, Wesson Fixation Disparity Card, the rows of windows on Saladin card	Mallett units, Bernell lantern targets, Borish card, associated phoria window on Saladin card
Its measured value can give recommendation for prism Rx power	No****	No	Yes

*prevented by occlusion, diplopia, distortion, or dissimilar targets
** 10 minutes of arc = about .3 prism diopters, so fixation disparity almost always much less than dissociated phoria
***exception is cover test; recording for it must include P or T as determined by unilateral cover test
**** By itself it does not give a useful recommendation for the power of a prism prescription; however, with additional information, as in Sheard's criterion or 1:1 rule formulas, it may

V652 CLINICAL SCIENCES III

Laboratory Report 6: Additional Accommodation & Binocular Vision Tests

Clinician Name: _____
Patient Name: _____
Date: _____

Dissociated Phoria:
Modified Thorington at distance _____
Modified Thorington at near _____

Associated Phoria Tests:

Mallett Dist. Associated Phorias   Lateral _____   Vertical _____
Leica Dist. Associated Phorias   Lateral _____   Vertical _____
Saladin Card Near Associated Phorias   Lateral _____   Vertical _____
Borish Card Near Associated Phorias Lateral _____   Vertical _____
Bernell Near Associated Phorias   Lateral _____   Vertical _____

Suppression Tests:

Worth Dot Test:

	Distance	Near
Light		
Dark		

Vis-à-vis test: _____

4Δ BO test: _____

Auxiliary Strabismus Detection Tests:

Hirschberg Test: _____

Brückner Test: _____

Questions:

1. How do the results of the different near associated phoria techniques compare to each other? How do the results of the two distance associated phoria tests compare to each other?

_____
_____
_____
_____

2. Using the modified Thorington dissociated phoria and the Mallett associated phoria, what was the Mallett classification at distance?

_____
_____

3. Using the modified Thorington dissociated phoria and the Saladin card associated phoria, what was the Mallett classification at near?

_____
_____

4. Name some situations in which you would consider using each auxiliary strabismus test.

_____
_____
_____
_____

Turn in one copy of lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III

Laboratory Report 6: Additional Accommodation & Binocular Vision Tests

Clinician Name: _____
Patient Name: _____
Date: _____

Dissociated Phoria:
Modified Thorington at distance _____
Modified Thorington at near _____

Associated Phoria Tests:

Mallett Dist. Associated Phorias   Lateral _____   Vertical _____
Leica Dist. Associated Phorias   Lateral _____   Vertical _____
Saladin Card Near Associated Phorias   Lateral _____   Vertical _____
Borish Card Near Associated PhoriasLateral _____   Vertical _____
Bernell Near Associated Phorias   Lateral _____   Vertical _____

Suppression Tests:

Worth Dot Test:

	Distance	Near
Light		
Dark		

Vis-à-vis test: _____

4Δ BO test: _____

Auxiliary Strabismus Detection Tests:

Hirschberg Test: _____

Brückner Test: _____

Questions:

1. How do the results of the different near associated phoria techniques compare to each other? How do the results of the two distance associated phoria tests compare to each other?

_____
_____
_____
_____
_____

2. Using the modified Thorington dissociated phoria and the Mallett associated phoria, what was the Mallett classification at distance?

_____
_____

3. Using the modified Thorington dissociated phoria and the Saladin card associated phoria, what was the Mallett classification at near?

_____
_____

4. Name some situations in which you would consider using each auxiliary strabismus test.

_____
_____
_____
_____

Turn in one copy of lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III

LAB #7: Cycloplegic Refraction, Bifocal Determination, & Multi-focal Demo

References: Jose et al., Optometric Pharmacology; Bartlett & Jaanus, Clinical Ocular Pharmacology; Carlson and Kurtz, 3rd ed., Clinical Procedures for Ocular Examination, pp. 128-130, 146-150; Goss, Ocular Accommodation, Convergence, and Fixation Disparity, 3rd ed., pp. 138-142.

Equipment to Bring to Lab: nearpoint test cards, retinoscope, calculator.

Cycloplegic Refraction:

BACKGROUND:

- Cycloplegia→ state of induced "paralysis" of the ciliary muscles (actually just diminished activity of ciliary muscles, not total paralysis)
  - -- topical cycloplegic pharmaceutical agents are used to control accommodation
  - -- cycloplegic refraction is used as an adjunct to the routine manifest (dry) refraction
  - -- *latent hyperopia* or *accommodative esotropia* are the two most common scenarios in which cycloplegic refraction is needed

- Cycloplegic Refractive Techniques:
  - -- objective techniques are most heavily relied upon with cycloplegic refraction
  - -- visual acuities may be reduced (often by one line or more) due to large pupils which cause increased aberrations
  - -- *Residual Accommodation* is a measurement of the amplitude of accommodation under cycloplegic conditions.
  - -- *Residual Accommodation* must be estimated in order to decide if the cycloplegia is adequate for a reliable refraction

    ** **>2.00 D** residual accommodation = unreliable cycloplegic refraction

  - -- Measuring Residual Accommodation:
    Place a target at the patient's near point with +2.50 D (if at 40 cm) over patient's BVA and move the target toward the patient then away from the patient until it blurs.

    ** **Residual Accommodation = (100/ near point in cm) – (100/far point in cm)**

  - -- In latent hyperopia or with large amounts of hyperopia, cycloplegic refraction can result in much more plus than what the patient will take on manifest.

Latent hyperopia example:
        Manifest refraction: +3.00 D sph
        Cycloplegic refraction: +5.00 D sph

        Manifest hyperopia = 3.00 D
        Total hyperopia = 5.00 D
        Latent hyperopia = 2.00 D

- Indications for cycloplegic refraction:
    1) suspected latent hyperopia or pseudomyopia
    2) accommodative esotropia
    3) accommodative spasm

- Contraindications or cautions to the use of cycloplegia:
    1) Down's syndrome
    2) seizure disorders
    3) cerebral palsy
    4) narrow anterior chamber angles
    5) pregnancy
    6) taking systemic anticholinergic drugs
    (Note: Do not participate as a patient in this lab exercise if any of these apply to you)

- Common cycloplegic agents
    Atropine (strongest)
    Cyclopentolate
    Tropicamide (weakest)

    Weaker cycloplegia means more residual accommodation, but shorter duration and less likelihood of side effects

- Factors that influence Agent Choice:
    1) Age: younger patients need stronger cycloplegic agent
    2) Eye Color: darker eyes need stronger cycloplegic agent
    3) Esotropia: need stronger cycloplegic agent
    4) Timing: schedules of some patients may require shorter duration

- Cycloplegic Agents:
    -- parasympatholytic (anti-cholinergic) autonomic drugs
    -- cause dilation (*mydriasis*) and partially paralyze accommodation (*cycloplegia*)

Note: In clinical practice, all accommodation and binocular vision tests must be done before cycloplegia.

	Atropine	Scopolamine	Homatropine	Cyclopentolate	Tropicamide
Peak Effect	30 – 40 Minutes	20-45 Minutes	20-90 Minutes	20-45 Minutes	20-30 minutes
Duration	1-2 wks	4-7 days	2-3 days	24 hours	3-6 hours
Uses	Amblyopia Tx Uveitis Tx	Uveitis Tx **Used in patients sensitive to Atropine	Uveitis Tx **Often 1st line drug for Uveitis Tx **Rarely used for refractive cycloplegic due to slow incomplete cycloplegia	Cycloplegia Refraction **Most commonly used cycloplegic agent for cycloplegic refraction	Mydriatic (DFE) Screen for latent hyperopia **Not good agent for cycloplegia in children because of an incomplete cycloplegic effect.
Side Effects	Blurred Vision Eye Irritation Dry Mouth Flushing Fast pulse Mental confusion **Use with caution due to CNS side effects in small kids, Down's and cerebral palsy patients if given in high doses	Blurred Vision Fast Pulse Breathing Difficulties **Higher rate of toxic reactions vs. Atropine (but no deaths reported)	Blurred Vision Eye Irritation Flushing Tiredness Fast Pulse	Blurred Vision Transient Psychosis in kids after multiple doses of 2% **Use with caution in kids with emotional problems, Down's syndrome, and Cerebral Palsy	Blurred Vision Fast Pulse Flushing Tiredness **Side Effects similar to Atropine but much less likely

Table from: The Wills Eye Manual, 3rd Edition, 1999, p. 507.

Presbyopia Tests:

BACKGROUND:

To simulate presbyopia in young adults give two drops of 1% tropicamide OU. In most young adults this will result in an amplitude of accommodation of about 1 D.

Tests to perform at near:

1) BCC (tentative add determination)
2) NRA
3) PRA (may be in plus direction over BVA in presbyopes)
4) Acuity through BVA with tentative add
5) Lateral and Vertical Phorias at Near through tentative add
6) Negative and Positive Fusional Vergence Reserves at Near through tentative add
7) Range of Accommodation

(Refer back to lab #3 for information on tentative add determination for presbyopes)

***Note: For absolute presbyopes (no accommodation), what is measured as a range of
accommodation is due to <u>depth of focus</u>.*

Reminder of procedure of balancing NRA and PRA around BCC to figure recommended
Add:

      Example 1: BCC +1.50 over BVA
                    NRA +1.50 over BCC
                    PRA -1.00 over BCC

                    ADD: **+1.75 DS** (NRA is +1.25 from Add; PRA is -1.25 from Add)

      Example 2: BCC +1.75 over BVA
                    NRA +0.75 over BCC
                    PRA -1.50 over BCC

                    ADD: **+1.25 DS** (NRA is +1.25 from Add; PRA is -1.00 from Add)*

                    **If the BCC doesn't balance evenly between PRA and NRA with
0.25 D steps, then add should be closer to PRA.*

HOFSTETTER'S FORMULAS for Prediction of Amp of Accommodation as Function of Age:

Maximum = 25 – (0.4) (AGE)
Probable = 18.5 – (0.3) (AGE)
Minimum = 15 – (0.25) (AGE)

You can use Hofstetter's formula to estimate the patient age corresponding to the level of
presbyopia simulated in this lab. Substitute your measured amplitude after cycloplegia
for probable amplitude in the formula and then calculate age.

<u>LABORATORY PROCEDURES for Cycloplegic Refraction, Bifocal Add Power Determination, and Multifocal Demonstration:</u>

This lab will be scheduled for two sessions over two weeks. One week, you will be the
examiner and the other week, you will be the patient.

*Tropicamide has unknown teratogenic risks (category C) so anyone who is or may be
pregnant will not be allowed to be a patient for this lab.*

The purposes of this laboratory are to (1) observe reduction in amplitude of accommodation over time with tropicamide, (2) perform a cycloplegic refraction, (3) simulate presbyopia and determine a bifocal add power, and (4) demonstrate multifocals to your cyclopleged partner.

PROCEDURE:

1. Perform a "dry" refraction (retinoscopy and subjective) on your partner.

2. Measure the amplitude of accommodation for each eye by finding the NPA (near point of accommodation) while the patient wears his or her BVA subjective lenses. Convert the NPA to amplitude.

-- Amplitude = 100/(NPA in cm)

3. Grade patient's anterior chamber angles using Van Herrick system.

4. Instill two drops of 1% tropicamide in each eye (wait 60 seconds between the two drops of tropicamide).

5. At 5 minute intervals, measure the near point of accommodation (NPA) and the far point of accommodation (FPA) while the patient wears +2.50 DS over his or her BVA subjective lenses. This can be done in the phoropter. Use the reading rod to measure the near point and the far point and determine the amplitude of accommodation. Use the 20/20 line for the near point and the 20/30 line for the far point.

--Amplitude = (100/NPA in cm) – (100/FPA in cm).

6. The amplitude measurements are continued every 5 minutes for 25 minutes or until the amplitude reaches 1 D or less (which ever occurs first).

7. After 25 minutes or when the amp has reached 1D or less, the "wet" refraction (retinoscopy and subjective) is performed and recorded along with the corrected visual acuities.

8. Now perform the tests for presbyopia listed below.

       a) BCC (tentative add determination)
       b) NRA and PRA (PRA may be in plus direction over BVA, but should be in minus direction from the tentative add)
       c) Acuity through BVA with tentative add
       d) Lateral and Vertical Phorias at Near through tentative add
       e) Negative and Positive Fusional Vergence Reserves at Near through tentative add
       f) Range of Accommodation

9. After measuring the range of "accommodation", ask the patient to reach out and touch
The card and ask, *"Is this the distance at which you do most of your reading, or
should it be closer or farther away?"* Record the patient's habitual reading distance.

10. After determining the reading addition or "add" for your partner, select from the "no-
line" demonstrator set, a pair of the progressive addition lenses (PALs). Slide them
into the special holder and align them properly on your patient. Then give your
patient some "real" reading material and have the patient practice looking from far to
near and reading across a page.

11. Finally, change the PALs to flat top lenses (FT) and repeat the same
tasks.

****Note how the PALs give a more normal focus function in the presbyopic state but
have limited reading area with increased distortion in the peripheral field. In
contrast, the flat top lens has very sharp optics at near with no distortion with a wider
reading field of view.*

V652 CLINICAL SCIENCES III

Laboratory Report 7: Cycloplegic Refraction and Bifocal Determination

Clinician Name: _____

Patient Name: _____

Date: _____

DRY REFRACTION: Retinoscopy: OD_____   20/_____
                                      OS_____   20/_____

                Subjective Refraction:OD_____   OU
                                      OS_____   20/_____

ACCOMMODATION (Before Drops):   OD: NPA_____cm Amp_____D
                                   OS: NPA_____cm Amp_____D

ANTERIOR CHAMBER ANGLE (Van Herrick):   OD_____   OS_____

**Instill 2 drops of 1% Tropicamide in each eye once the angles are confirmed to be open.

AFTER DROPS (w/ +2.50 D Add):

 5 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
         OS NPA_____ cm   Far Point_____cm   Amplitude_____D

10 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
         OS NPA_____ cm   Far Point_____cm   Amplitude_____D

15 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
         OS NPA_____ cm   Far Point_____cm   Amplitude_____D

20 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
         OS NPA_____ cm   Far Point_____cm   Amplitude_____D

25 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
         OS NPA_____ cm   Far Point_____cm   Amplitude_____D

"WET" REFRACTION: Retinoscopy: OD_____   20/_____
                                     OS_____   20/_____

                Subjective Refraction:OD_____   OU
                                      OS_____   20/_____

NEAR TESTS FOR PRESBYOPIA (use for BCC for tentative add):

BCC: _____

Following tests performed through Tentative Add:

Near VA: OD 20/_____   OS 20/_____   OU 20/_____

NRA: _____   PRA: _____

Lateral Phoria:_____   Vertical Phoria: _____

Range of Accommodation: Near _____ cm   Far _____ cm

BI Vergences: _____   BO Vergences: _____

Patient's Habitual Reading Distance: _____ cm

Questions:

1. Over which five minute interval did the greatest decrease in amplitude of accommodation occur? _____

2. How did the manifest and cycloplegic refraction results compare?
_____
_____
_____

3. What add would you prescribe for this presbyopia simulation patient based on balancing the NRA and PRA? _____

4. What is an important aspect in which a *young cyclopleged adult* differs from a *presbyope*?_____
_____

5. What power multifocals did your patient try? What were his/her impressions of the flat-tops?, of the progressives?
_____
_____
_____

Turn in one copy of lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III

Laboratory Report 7: Cycloplegic Refraction and Bifocal Determination

Clinician Name: _____

Patient Name: _____

Date: _____

DRY REFRACTION: Retinoscopy: OD_____   20/_____
                                                     OS_____   20/_____

                     Subjective Refraction: OD_____   OU
                                                     OS_____   20/_____

ACCOMMODATION (Before Drops):   OD: NPA_____cm   Amp_____D
                                                     OS: NPA_____cm   Amp_____D

ANTERIOR CHAMBER ANGLE (Van Herrick):   OD_____   OS_____

**Instill 2 drops of 1% Tropicamide in each eye once the angles are confirmed to be open.

AFTER DROPS (w/ +2.50 D Add):

 5 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
            OS NPA_____ cm   Far Point_____cm   Amplitude_____D

10 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
             OS NPA_____ cm   Far Point_____cm   Amplitude_____D

15 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
             OS NPA_____ cm   Far Point_____cm   Amplitude_____D

20 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
             OS NPA_____ cm   Far Point_____cm   Amplitude_____D

25 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
             OS NPA_____ cm   Far Point_____cm   Amplitude_____D

"WET" REFRACTION: Retinoscopy: OD_____   20/_____
                                                     OS_____   20/_____

                     Subjective Refraction: OD_____   OU
                                                     OS_____   20/_____

NEAR TESTS FOR PRESBYOPIA (use for BCC for tentative add):

BCC: _____

Following tests performed through Tentative Add:

Near VA: OD 20/____   OS 20/____   OU 20/____

NRA: _____   PRA: _____

Lateral Phoria:_____   Vertical Phoria: _____

Range of Accommodation: Near ____ cm   Far ____ cm

BI Vergences: _____   BO Vergences: _____

Patient's Habitual Reading Distance: _____ cm

Questions:

1. Over which five minute interval did the greatest decrease in amplitude of accommodation occur? _____

2. How did the manifest and cycloplegic refraction results compare?
_____
_____
_____

3. What add would you prescribe for this presbyopia simulation patient based on balancing the NRA and PRA? _____

4. What is an important aspect in which a *young cyclopleged adult* differs from a *presbyope*?_____
_____

5. What power multifocals did your patient try? What were his/her impressions of the flat-tops?, of the progressives?
_____
_____
_____

Turn in one copy of lab report to AI at the end of today's lab.

V652 CLINICAL SCIENCES III

Laboratory Report 7: Cycloplegic Refraction and Bifocal Determination

Clinician Name: _____

Patient Name: _____

Date: _____

DRY REFRACTION: Retinoscopy: OD_____   20/_____
                                                  OS_____   20/_____

                   Subjective Refraction:OD_____   OU
                                                  OS_____   20/_____

ACCOMMODATION (Before Drops):   OD: NPA_____cm Amp_____D
                                                    OS: NPA_____cm Amp_____D

ANTERIOR CHAMBER ANGLE (Van Herrick):   OD_____   OS_____

**Instill 2 drops of 1% Tropicamide in each eye once the angles are confirmed to be open.

AFTER DROPS (w/ +2.50 D Add):

 5 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
          OS NPA_____ cm   Far Point_____cm   Amplitude_____D

10 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
           OS NPA_____ cm   Far Point_____cm   Amplitude_____D

15 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
           OS NPA_____ cm   Far Point_____cm   Amplitude_____D

20 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
           OS NPA_____ cm   Far Point_____cm   Amplitude_____D

25 min: OD NPA_____ cm   Far Point_____cm   Amplitude_____D
           OS NPA_____ cm   Far Point_____cm   Amplitude_____D

"WET" REFRACTION: Retinoscopy: OD_____   20/_____
                                                  OS_____   20/_____

                   Subjective Refraction:OD_____   OU
                                                  OS_____   20/_____

NEAR TESTS FOR PRESBYOPIA (use for BCC for tentative add):

BCC: _____

Following tests performed through Tentative Add:

Near VA: OD 20/____   OS 20/____   OU 20/____

NRA: _____   PRA: _____

Lateral Phoria:_____   Vertical Phoria: _____

Range of Accommodation: Near ____ cm   Far ____ cm

BI Vergences: _____   BO Vergences: _____

Patient's Habitual Reading Distance: _____ cm

Questions:

1. Over which five minute interval did the greatest decrease in amplitude of accommodation occur? _____

2. How did the manifest and cycloplegic refraction results compare?
_____
_____
_____

3. What add would you prescribe for this presbyopia simulation patient based on balancing the NRA and PRA? _____

4. What is an important aspect in which a *young cyclopleged adult* differs from a *presbyope*?_____
_____

5. What power multifocals did your patient try? What were his/her impressions of the flat-tops?, of the progressives?
_____
_____
_____

Turn in one copy of lab report to AI at the end of today's lab.

V652 Practical Examinations

Notes concerning practice times for the practical examinations:

1) You may not practice in room 101 when other regularly scheduled classes are using the room.

2) On the weekend before the first week of proficiencies, the students taking proficiency exams in the first week have precedence over students taking proficiency exams in the second week.

3) During evenings, students taking their proficiency exam the next day have precedence over students taking their proficiency exams later in the week or the following week.

4) If someone is waiting to use a phoropter/chair/stand, you have 75 minutes to work at the one you are using.

(No food or drink in room 101 please)

V652 Practical Examination #1
Fall 2015

Lab Sec. Circle: M, T, W, R   Date: _____

Student's Name _____

Grader's Name _____

Patient's Name_____

I. PROFESSIONALISM (3 pts.)

	Yes	No	Points
Did the student greet the patient? 1 pt			/1
Is the student dressed appropriately? 1 pt			/1
Did the student wash his/her hands before the exam? 1pt.			/1

II. PRELIMINARY TESTS (60 pts.) Time est. 20 min

Start time: _____	Yes	No	Point(s)
A. Visual Acuity (7)			
1. Did the student clean the occluder? 1 pt.			/1
2. Did the student give proper patient instructions? 1 pt.			/1
3. Did the student perform test correctly? D & N' ___ obs pat.___illum___ cc & sc___ 4 pts.			/4
4. Record finding correctly? 1 pt.			/1
B. External (2)			
1. Did the student use proper illumination? (penlight & stand) 1 pt.			/1
2. Record finding correctly? 1 pt.			/1
C. Pupils (5)			
1. Did the student give proper patient instructions? 1pt.			/1
2. Did the student use proper illumination? (light, dim & dark) 1pt.			/1
3. Did the student perform test smoothly and correctly? size & shape___, D& C___APD___ACC___ 2 pts.			/2
4. Record finding correctly? 1 pt.			/1
D. Versions (5)			
1. Did the student give proper patient instructions? 1 pt.			/1
2. Did the student perform test smoothly and correctly? (scRx, @40cm?) 2 pts.			/2
3. Recording finding correctly? 1 pt.			/1
4. Ask about pain or diplopia? 1 pt			/1

	Yes	No	Point(s)
E. Cover Test (13)			
1. Did the student give proper patient instructions? 1 pt.			**/1**
2. Did the student perform correctly (unilateral then alternating) with enough cycles to fatigue Dist&N'? 4 pts.			**/4**
3. Did the student rotate near target to break fusion smoothly? 1pt.			**/1**
4. Record finding correctly? 2 pt.			**/2**
5. Able to detect and measure phoria? Note "phi" if 0? (measure near by prism neutralization within 2Δ) 2 pts.			**/2**
6. Was the CT test done smoothly and efficiently? 0-3 pts.			**/3**
F. Near Point of Convergence (4)			
1. Did the student give proper patient instructions? 1 pt.			**/1**
2. Perform test correctly? (Illum__target__speed__) 2 pts.			**/2**
3. Record finding correctly? (both break and recovery)? 1 pt			**/1**
G. Near Point of Accommodation (4)			
1. Did the student give proper patient instructions? 1pt.			**/1**
2. Did the student perform test correctly (mono then bino, ccRx & well illuminated?) 2 pts.			**/2**
3. Record findings correctly (cm, OD, OS, OU)? 1 pt.			**/1**
H. Stereo (6)			
1. Did the student clean the stereo glasses? 1pt			**/1**
2. Did the student give proper patient instructions? 1 pt.			**/1**
3. Did the student use proper illumination? (full light) 1 pt.			**/1**
4. Did the student perform test smoothly and correctly? 2 pts.			**/2**
5. Record findings correctly? 1pt.			**/1**
I. Color (5)			
1. Did the student give proper patient instructions? 1pt.			**/1**
2. Did the student use or know about proper illumination? 1pt.			**/1**
3. Did the student perform test smoothly and correctly? 2 pts.			**/2**
4. Record findings correctly? 1 pt.			**/1**

III.   REFRACTION Time est. 15 min.

Start time: _____	Yes	No	Point(s)
A. Keratometry (18)			
1. Focus the eyepiece prior to taking the measurements? 1 pt.			**/1**
2. Did the student clean the chin and head rest?			**/2**
3. Were the proper instructions given to the patient?			**/2**
4. Locate the principal meridians of OD accurately? $\pm 15°$ (must rotate) 2 pts.			**/2**
5. Measure the corneal curvature of OD accurately? $\pm 0.37D$ 2 pts. (Grader's K reading, OD_____)			**/2**
6. Locate the principal meridians of OS accurately? $\pm 15°$ (must rotate) 2 pts.			**/2**
7. Measure the corneal curvature of OS accurately? $\pm 0.37D$ 2 pts. (Grader's K reading, OS_____)			**/2**
8. Reticule centered? 2 pts.			**/2**
9. Did the student describe the quality of the mires?			**/2**
10. Record measurements properly? 1pt.			**/1**
B. Set Up (5)			
1. Did the student measure the patient's P.D. correctly? (w/in 2 mm) 1 pt. (Grader's PD_____)			**/1**
2. Did the student clean the face plate of the refractor? 2 pts.			**/2**
3. Did the student align the refractor: On the bubble? 1pt. Face plane parallel? 1pt.			**/2**

C. Retinoscopy (24)			
1. Did the student check for a 20/60 fog for each eye? 1 pt/eye			**/2**
2. Did the student use a large enough fixation target? (20/200-20/400) 1 pt.			**/1**
3. Were the proper instructions to the patient given? 1 pt.			**/1**
4. Did the student use the proper examining position and at patient's eye level? 2 pts.			**/2**
5. Did the student use proper illumination (dim)? 1 pt.			**/1**
6. Recorded finding correctly? 1 pt.			**/1**
7. Did the student take V.A.s through the net retinoscopy finding? 1 pt.			**/1**
8. Did the student perform the test in a smooth & efficient manner? 0 to 3 pts.			**/3**

	Yes	No	Points
9. Retinoscopy finding within: Sphere: +/- 0.25 D = 2 pts.　　　$\geq$ 1.00 D = 0 pt.　　+/- 0.50 D = 1 pt.　　+/- 0.75 D = ½ pt.			**OD:** /2　　**OS:** /2
10. Retinoscopy finding within: Cylinder: +/- 0.25 D = 2 pts.　　$\geq$ 1.00 D = 0 pt.　　+/- 0.50 D = 1 pt.　　+/- 0.75 D = ½ pt.			**OD:** /2　　**OS:** /2
11. Retinoscopy finding within: Axis : +/- 5˚ = 2 pts.　　> 15˚ = 0 pt.　　+/-10˚ = 1 pt.　　+/-15˚ = ½ pt. Full credit (2 pts) for axis if grader gets sphere or 0.25 D cylinder			**OD:** /2　　**OS:** /2
Grader's Retinoscopy:　　Student's Retinoscopy: OD_____OD_____ OS_____ OS_____			
D. Monocular Sphere Check (9)			
1. Did the student use proper illumination? 1 pt.			**/1**
2. Did the student "fog" to the correct V.A. line? 1pt./eye			**/2**
3. Did the student give the proper instructions? 1 pt			**/1**
4. Did the student come to the correct end pt.? 1 pt./eye			**/2**
5. Did the student perform the test in a smooth & efficient manner? 0 to 3 pts?			**/3**

E. J.C.C. (27)			
1. Did the student use the correct V. A. line? 1 pt.			**/1**
2. Did the student give adequate and clear instructions? 1 pt			**/2**
3. Did the student line up the J.C.C. properly for axis first? 1pt./eye			**/2**
4. Did the student give the patient proper time to respond? 1pt./eye			**/2**
5. Did the student follow "the red" and in 15° steps? 1 pt./eye			**/2**
6. Did the student find reverse and return in 5° steps? 1 pt./eye			**/2**
7. Did the student come to the correct end point for axis? 2 pts./eye			**/4**
8. Did the student align and properly present the power check? 1 pt./eye			**/2**
9. Did the student maintain the proper sphere power during the check? 2pts./eye			**/4**
10. Did the student come to the correct end point for cylinder power? 2pts./eye			**/4**
11. Did the student elicit cyl, if appropriate? 1 pt./eye			**/2**
Comments:			

	Yes	**No**	**Points**
F. MPMA (8)			
1. Did the student use the correct V.A. line? 1 pt./eye			**/2**
2. Did the student give clear and adequate instructions? 1 pt.			**/1**
3. Did the student come to the correct MPMA end point? 1pt./eye			**/2**
4. Did the student perform the test in a smooth & efficient manner? 0 to 3 pts.			**/3**
Comments:			
G. Binocular Balance (14) Method used _____			
1. Did the student use the proper starting point (fog if required)? 1 pt			**/1**
2. Did the student use the proper target? 1 pt.			**/1**
3. Did the student give clear and adequate instruction? 1 pt.			**/1**
4. Was the student able to balance the patient? Or if not, leave the dominant eye clearer (circle)? Reduce fog and recheck? 2 pts.			**/2**
5. Did the student perform the test correctly, step down to an appropriate end point and check for over-minus? 2 pts.			**/2**
6. Did the student check V.A. OD, OS, OU? 3 pts.			**/3**
7. Did the student record results correctly?			**/1**
7. Did the student perform the test in a smooth and efficient manner? 0 to 3 pts.			**/3**
Patient Type: Routine/ Difficult Explain: _____			

Final Refraction (12)			

Student's Refraction: OD: _____
                    OS: _____
Grader's Refraction: OD: _____
                    OS: _____			

1. Spherical refraction findings within: +/- 0.25 D = 2 pts. +/- 0.50 D = 1 pt. $\geq$ 0.75 D = 0 pt.			**OD: /2** **OS: /2**
2. Cylinder refraction findings within: +/- 0.25 D = 2 pts. +/- 0.50 D = 1 pt. $\geq$ 0.75 D = 0 pt.			**OD: /2** **OS: /2**
3. Axis findings: if <1.00D, then +/- 10˚ = 2 pts., +/- 15˚ = 1 pt. if from 1.00 to 2.25 D, then +/- 5˚ = 2 pts., +/- 10˚ = 1 pt. if > 2.50 D, then +/- 3˚ =2 pts., +/- 5˚ = 1 pt. Full credit (2 pts) for axis if grader gets sphere or 0.25 D cylinder			**OD: /2** **OS: /2**

IV. BINOCULAR VISION TESTING Time est. 15 min
Start time:_____

	Yes	No	Point(s)
A. Phorias (18)			
1. Was the proper target used for test one letter (2 pts.) OR horizontal line for vertical phoria (1 pt) and vertical line for horizontal phoria) (1 pt.)			**/2**
2. Did the student give clear instructions to the patient? 2 pts.			**/2**
3. Use the correct dissociating prisms? (approx. 12BI & 6 BU) 1 pt.			**/1**
4. Ask the patient to fixate on non-moving target and keep the letters clear? 4 pts			**/4**
5. Use appropriate speed for target? Horizontal ____ (1 pt) Vertical (1 pt) ____			**/2**
6. Recheck if poor response or >3Δ difference? 1 pt.			**/1**
7. Change P.D. before near phorias? 1 pt.			**/1**
8. Uses or knows use of pinhole or flash technique when needed? 1pt.			**/1**
9. Records all phorias correctly? Distance ____ (2 pts.) Near ___ (2 pts.)			**/4**
.			

B. Gradient phorias (9)			
1. Does the student use the correct lens power? (either +1.00 or –1.00 for high exos; +1.00 for all others) 1 pt.			**/1**
2. Give clear instructions to the patient? 1 pt.			**/1**
3. Use appropriate speed? 1 pt.			**/1**
4. Did the student record correctly 1 pt.			**/1**
5. Perform smoothly and efficiently? 0 to 3 pt.			**/3**
6. Can give correct gradient AC/A estimation? 1 pt.			**/1**
7. If gradient AC/A estimate does not look appropriate, did the student recognize it, recheck lens power, or recheck the gradient phoria? 1 pt.			**/1**
C. NRA/PRA (13)			
1. Does the student use the 20/20 line or one line above BVA line? 1pt. NRA/ 1pt. PRA			**/2**
2. Does the student step the lens at appropriate rate? 1pt.NRA/ 1pt. PRA			**/2**
3. Does the student give proper instructions and use proper procedure for each test? 2 pts. NRA/ 2pts. PRA			**/4**
4. Does the student use blur end point rather than blur out (ask if still can read)? 1pt. NRA/ 1pt. PRA			**/2**
5. Did the student remove the cross cylinder and turn lights back up after the BCC? 3 pts.			**/3**

	Yes	No	Points
D. B.C.C (10)			
1. Does the student set the illumination correctly? (overhead off, stand light turned down) 2 pts.			**/2**
2. Does the student set the refractor and target correctly? 3 pts. (cross cyl _____ plus added _____ cross grid target _____			**/3**
3. Does the student give clear instructions? 2 pts.			**/2**
4. Was the procedure done at rate appropriate for test? 1 pt.			**/1**
5. Did the student use the appropriate end pts? (1st horizontal or 1st same) 1 pt.			**/2**
E. Vergences (26)			
1. Did the student set up the refractor properly for the distance procedures? (targets___, lighting___, PD___, prisms___) 4 pts			**/4**
2. Did the student give clear instructions? 1 pt.			**/1**

	Yes	No	Points
3. On distance horizontal vergences: • Perform the distance vergences at constant rate & equal? 2 pts • Does BI before BO vergences? 1 pt. • Asks for blur / two / one? 1 pt.			**/4**
4. On vertical vergences: • Moves prism slower for vertical? 1 pt. • Asks for just two / one? 1pt. • Records supra (BD) and infra (BU) correctly? 1pt.			**/3**
5. On near horizontal vergences: • Was the refractor set up properly for the procedure? (targets___,lighting___,PD___,prisms___) 4 pts. • Does BI before BO? 1 pt. • Asks for blur / two / one? 1 pt. • Perform the near vergences at constant rate and equal? 2 pts.			**/8**
6. Occlude an eye when adjusting prisms? 2 pts.			**/2**
7. Did the student record all findings correctly? 4 pts.			**/4**
Sequence used? _____			
TIME (14)			
1. End of test time: _____			
2. Time to completion: ≤50 minutes = 14 pts. For every minute over = -1pt. All time points lost at 60 minutes. Skipped test: = -2 time pts. each Difficult patient modifier: for every 3 minutes over -1 pt.			**/14**

	Yes	No	Points
RECORD (7)			
1. Taken in an organized & smooth fashion? 0 to 3 pts.			**/3**
2. Recorded legibly and easy to follow format? 3 pts.(–1 per error)			**/3**
3. Was the record complete? 1 pt.			**/1**

		Percent		Score
ASSESSMENT & PLAN (10)				
1. Could the student identify the significant or inconsistent findings? For the prelims? 1 pt. For the refraction? 1 pt. For the binocular vision tests? 1 pt.				**/3**
2. Does the student know what the normal findings are? 2 pts.				**/2**
3. Does the student know the appropriate retest to correct or confirm a vergence/phoria finding or problem(s)? 2 pts.				**/2**
4. Could the student give the correct binocular assessment? 1 pt.				**/1**
5. Could the student determine calculated and gradient AC/A ratios? 1 pt.				**/1**
6. Could the student give the correct assessment of BCC, NRA, and PRA findings? 1 pt.				**/1**
		Percent		**Score**
Totals:				
I. Professionalism (3) ------>Record total pts. in score box				
II. Preliminary Tests (51) Percentage: total points/51 Score: total points/3				
III. Refraction (105) Percentage: total points/105 Score: total points/3				
Final Refraction (12) ------>Record total pts. in score box				
IV. Binocular Vision Testing (76) Percentage: total points/76 Score: total points				
Time (14) ------>Record total pts. in score box				
Record (7) ------>Record total pts. in score box				
Assessment & Plan (10) ------>Record total pts. in score box				
TOTAL TEST POINTS (add pts. in score box)				
TOTAL PERCENT (total test points/174)				

V652 Practical Examination #2
Fall 2015
100 points

Student's Name _____

Date: _____

Lab: M, T, W, R (circle one)

NEARPOINT TESTS & ALTERNATIVE TESTS (54 points)

Three of the following will be demonstrated:

Lens Rock Accommodative Facility
Worth Dot Test (distance & near)
Modified Thorington (distance or near)
Maddox Rod Phorias (40 cm, lateral or vertical)
Mallett Associated Phorias (distance, lateral and vertical)
Bernell Lantern Associated Phorias (near, lateral and vertical)
Saladin Card Associated Phorias (lateral and vertical)
Borish Card Associated Phorias (lateral and vertical)
Prism bar vergences (40 cm lateral)
Hirschberg
Brückner
Leica Projector Associated Phorias (lateral and vertical)

	Yes	No	Points
1. Test Procedure _____ **Grader's Name _____**			
1. Knows when to use test 2 pts.			**/2**
2. Was the set up correct for the test? (lighting, pt. ed., WD) 3 pts.			**/3**
3. Technique done correctly? Pt. instructions 2 pts. Procedure 3 pts. End point 1 pt.			**/6**
4. Record finding correctly? 1 pt.			**/1**
5. Interpret findings (Give A & P) 2 pts.			**/2**
6. Performed the test in a smooth & efficient manner? 3 pts.			**/3**
7. Proper equipment hygiene 1 pt.			**/1**

	Yes	No	Points
2. Test Procedure _____ **Grader's Name** _____			
1. Knows when to use test 2 pts.			**/2**
2. Was the set up correct for the test? (lighting, pt. ed., WD) 3 pts.			**/3**
3. Technique done correctly? Pt. instructions 2 pts. Procedure 3 pts. End point 1 pt.			**/6**
4. Record finding correctly? 1 pt.			**/1**
5. Interpret findings (Give A & P) 2 pts.			**/2**
6. Performed the test in a smooth & efficient manner? 3 pts.			**/3**
7. Proper equipment hygiene 1 pt.			**/1**
3. Test Procedure _____ **Grader's Name** _____			
1. Knows when to use test 2 pts.			**/2**
2. Was the set up correct for the test? (lighting, pt. ed., WD) 3 pts.			**/3**
3. Technique done correctly? Pt. instructions 2 pts. Procedure 3 pts. End point 1 pt.			**/6**
4. Record finding correctly? 1 pt.			**/1**
5. Interpret findings (Give A & P) 2 pts.			**/2**
6. Performed the test in a smooth & efficient manner? 3 pts.			**/3**
7. Proper equipment hygiene 1 pt.			**/1**

DYNAMIC RETINOSCOPY (44 points)

	Yes	No	Points
1. Knows when to use the test? 2 pts.			**/2**
2. Knows the procedural & theoretic differences in the 3 techniques? 2 pts.			**/2**
3. Explains the purpose to the patient? At appropriate level? 1 pt.			**/1**
4. Proper equipment hygiene? 1 pt.			**/1**
1. Technique _____ **Grader's Name** _____			
1. Was the set up correct for the technique? (Rx, distance, lighting, target) 4 pts.			**/4**
2. Technique done correctly? Instructions 2 pts. Procedure 3 pts.			**/5**
3. Finding within +/- 0.25 D? 2 pts.			**/2**
4. Record finding correctly? 2 pts.			**/2**
5. Interpret findings? (Give A&P and Rx est)? 3pts.			**/3**
6. Did the student perform the test in a smooth & efficient manner? 0 to 3 pts.			**/3**

	Yes	No	Points
2. Technique _____			
1. Was the set up correct for the technique? (Rx, distance, lighting, target) 4 pts.			**/4**
2. Technique done correctly? Instructions 2 pts. Procedure 3 pts.			**/5**
3. Finding within +/- 0.25 D? 2 pts.			**/2**
4. Record finding correctly? 2 pts.			**/2**
5. Interpret findings? (Give A&P and Rx. Est)? 3pts.			**/3**
6. Did the student perform the test in a smooth & efficient manner? 0 to 3 pts.			**/3**
Total Points:			**Score**
Was the student dressed appropriately? 1 pt.			**/1**
Did the student wash hands at beginning? 1 pt.			**/1**
Nearpoint and Alternative Tests total (54)			
Dynamic Retinoscopy (44)			
Total test score (100)			

Name _____

Date _____

Lab Sec. M, T, W, R

Test #1 _____

    Findings: _____

    A: **P:**

Test #2 _____

    Findings: _____

    A: **P:**

Test #3 _____

    Findings: _____

    A: **P:**

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Dynamic Retinoscopy:

Method #1_____

       RE_____   A:

       LE_____
                                                          P:

                                                          Rx:

Method #2_____

       RE_____   A:

       LE_____
                                                            P:

                                                          Rx: