AmbujaNeotia

THE NEOTIA UNIVERSITY

ज्ञानम् आत्म प्रदीपाय

UGC Enlisted & Recognised

Department of Optometry

School of Health Science

Bachelor of Optometry

(B. OPTOM)

Clinical Refraction - III

Practical Manual

Course Code: BO 472

Created by: Supriyo Chatterjee, HoD Optometry

2021

Certificate

This is to certify that Mr./Ms. …… with UID number …… of Bachelor of Optometry 3RD Semester has satisfactorily completed the practical prescribed by the Neotia University for the year ……

…… ……

Signature of Student Signature of Faculty

Date of Submission:

Practical Manual in Clinical Refraction - III

B.Optom 3rd Semester

Course Code-BO 472

Serial No.	Experiment No.	Name of the Experiment
1	1	Revision of all procedures of Clinical Refraction I & II
2	2	Practice of Retinoscopy – Static & Dynamic
3	3	Cycloplegic Refraction
4	4	Borish Delayed Method
5	5	Maddox Rod, Wing and Howell Phoria Card
6	6	Other Methods for Heterophoria Evaluation & AC/A Ratio by Gradient Method
7	7	Practice of Autorefractometry
8	8	Practice of Direct Ophthalmoscopy
9	9	Clinical Pearls

Reference books & Resources:

1. Theory and Practice of Optics and Refraction - A.K. Khurana
2. Duke-Elder's Practice of Refraction - Abrams
3. E-Resources by PDF
4. Video-assisted Clinical Skill Transfer

NB: All students and teachers must wear an apron, mask, gloves, and sanitize shoe in sanitary lotion or use separate shoes before entry in the laboratory. Strictly maintain social distance (6 ft. apart from each other) .Bags not allowed. Use an individual instrument after sanitization (Don't share it with others).

EXPIREIMENT 1

All students will have to revise the followings with the help of the Lab Manuals of CR-I and CR-II:

- History Taking
- Visual Acuity Assessment
- Primary Examination of Anterior Segment & Pupillary Response by a Pen Torch
- Extra-ocular Motility Function Test & its recording
- Assessment of Nearpoint of Accommodation and Convergence
- Cover Test at Distance and Near to Assess Heterophoria
- Static Retinoscopy to Assess the Distance Ametropia (if any) and record
- Dynamic Retinoscopy to Assess the Accommodative Response (Lag/Lead)
- Subjective Acceptance to BCVA
- Jackson Cross Cylinder Examination for Assessment of Astigmatism
- Duochrome Test
- Assessment of Presbyopia and Determination of Near Addition

The students are expected to perform all these Tests on their fellow students at first and then gradually start examining actual patients in the General Refraction Lab. The average time to perform all these Tests should not exceed 30 minutes initially – with the aim to reduce the examination time without compromising with the quality of Assessment. Guidance will be given to those who are not able to put up quality work by the Clinical Instructor/Faculty in each step.

EXPERIMENT 2

PRACTICE OF RETINOSCOPY (STATIC & DYNAMIC)

STATIC RETINOSCOPY (before this the students must review the principles of the same as taught earlier)

Apparatus required

1. A streak Retinoscope
2. Trial lens set
3. Trial frame
4. Distance vision chart

Procedure

- ✧ As a prerequisite illumination of the testing room is made dim.
- ✧ The patient is made to sit comfortably and the examiner has to at the same line with the patient. The examiner also needs to adjust the height of the chair so that the patient's eyes and the examiner's eyes are at the same level.

- ✧ The distance illumination chart is switched on and the patient is instructed to look at the distance vision chart.
- ✧ The patient's right eye should be examined with the examiner's right eye and the Retinoscope should be held in right hand and vice versa.
- ✧ In the beginning the Retinoscopy streak with plane mirror shined into the patient's eye and the streak is moved from side to side in primary meridians.
- ✧ The movement of the pupillary reflex is noted whether it is with or against the Retinoscopy reflex.
- ✧ If the movement is width it is neutralized with 'Plus' lenses and in case of against movement the reflex is neutralize with 'Minus' lenses.
- ✧ The reflex is assessed in different meridian by rotating the axis of the streak. If the reflex is having the same brightness and width all around, the patient has spherical power.
- ✧ In case of spherical power the reflex is neutralized with a spherical lens in trial frame and the power is added until bright light fills the pupillary area without any movement.
- ✧ The net spherical power is obtained by subtracting the working distance from the gross spherical value.

In Astigmatism:

- ✧ In presence of astigmatism along the primary meridians, there will be difference in width, brightness and speed of the pupillary reflex. In this case one meridian is neutralized first with a spherical lens in one meridian and the meridian 90° away from it is neutralized with a cylinder.
- ✧ If the axis of the cylinder is other than the primary meridians, an oblique movement of the pupillary reflex is noted while moving the streak side by side. The streak is rotated until the movement of the pupillary reflex is parallel to the motion of the streak. Now the eye is neutralized with the way it is done in presence of astigmatism.
- ✧ The working distance is subtracted from the spherical power to get the final prescription.
- ✧ The procedure is repeated in the other eye.

Results & Observations

RE: Gross value - Working distance in Dioptre

LE: Gross value - Working distance in Dioptre

The Point of neutrality is indicated by

a. Absence of movement in the pupillary area
b. Whole pupillary area is brighter
c. Reversal of the movement after placing 0.25D lens in trial frame

The characteristics of the pupillary reflex

1. **Direction**: With movement needs to be neutralized with plus lens whereas against movement is neutralized with minus lens.
2. **Width**: The reflex is narrower if the power is more and vice versa.
3. **Speed:** Speed of the reflex is slower in higher power and vice versa.
4. **Brightness and Colour**: In case of higher power the reflex is dim where as the reflex is brighter in low power. The colour of the reflex is orange and it varies with the brightness.

ONLINE TUTORIAL WILL BE PROVIDED WITH RETINOSCOPY SIMULATOR – available in the website of American Academy of Ophthalmology. The major important points in Astigmatic detection through the techniques of – BREAK/SKEW/STRADDLING will be discussed and demonstrated.

DYNAMIC RETINOSCOPY (before this the students must review the principles of the same as taught earlier)

MONOCULAR ESTIMATE METHOD (MEM)

Monocular Estimate Method and is a dynamic **Retinoscopy**, meaning the patient is doing an active visual process while being observed. Unlike standard **Retinoscopy** that we use to find a distance prescription, **MEM Retinoscopy** reveals the focusing system's work or effort (accommodative response to Nearpoint targets).

MEM stands for **Monocular Estimate Method** and is a dynamic Retinoscopy, meaning the patient is doing an active visual process (i.e. accommodation and convergence) while being observed. Unlike standard Retinoscopy that we use to find a distance prescription, MEM Retinoscopy reveals the focusing system's work or effort (accommodation). Ideally the patient will under-accommodate for a target; **+0.50D to +0.75 "lag" of accommodation at near is considered normal**. A higher than normal lag of accommodation means that the focusing system is under-accommodating at an abnormal level and a "lead" of accommodation means that the system is over focusing. **The lead or the lag is not the real problem, but an adaptation of the visual system to deal with excessive visual strain.** It is quite common for people with binocular visual issues to develop accommodative lag or lead to compensate for their focusing inefficiency. For example, a patient with **Esophoria** (an over-convergence of the eyes when focusing together) may have a high lead of accommodation at first because their accommodative and vergence system are over-acting due to the stress on the system. When this finally takes a toll on the eyes, a high lag forms in an effort to reduce the action and reduce the stress. Dr. S sums it up nicely when she says **"it's not the lag or lead that causes the stress - it's the lag or lead that occurs because of stress."** Don't view a lag or a lead of accommodation as the problem, but evidence that a problem exists that the patient's focusing system is fighting to overcome.
The **ideal target stimulus is the age appropriate MEM Retinoscopy cards** that usually come with your scope set when you purchased them at school. They are arranged with varying degrees of difficulty that you can select based on the patient's grade level. In very young children the picture card would be most appropriate. Remember, you want the patient actively engaged, so if they seem bored or reading too quickly it could mean that your target is too easy. Stop and go up to the next difficulty level. With the picture cards you can even make a matching game by telling the child to "find the bicycle" or "find the cake". You need to measure your patient's response during the "finding" part and not when they have found the target to get meaningful data, so you have to be on your toes with this method. With your retinoscope in one hand, held at your patient's working distance, your other hand is now going to be ready to "dip" trial lenses in place to neutralize the reflex. You only want to keep a lens in place for about a second at a time to not disrupt the patient's response, so again this is an act-fast skill.

STREAMLINED MEM METHOD WITH JUST 1 TRIAL LENS
1) Dip +1.00 in front of the patient while they are reading. Did you see with or against?
If you saw with, then you know they have a higher than normal lag (at least +1.25 or higher)
If you saw against, then do a quick Retinoscopy sweep of the eye without any lens in place
If you saw with, then you know they are normal
If you saw no motion or against, you know they have a lead in accommodation

Exact quantification is not necessary on this test, bracketing is really your best friend to make MEM Retinoscopy both efficient and informative. Remember, when assessing accommodation with this method you are just trying to assess if the accommodation to the target is normal, and if it is abnormal, is it a lag or a lead? This information tells you if the visual system is compensating for another problem that you need to uncover and explore, and is not an end point to your investigation.

Learning Outcome:

The expected result for a normal accommodative response is +0.50 to +0.75 lag of accommodation at a 40 cm working distance. In presbyopic patients, you would expect the response to be whatever their near add is for that person. **It doesn't make much sense to do this for presbyopic patients.** If your results do not reveal this normal lag range, then there are a number of possibilities that could be on your differential:

High Lag (≥+1.00):

-Accommodative dysfunction
-Presbyopia or pre-presbyopia (if around 40)
-Uncorrected or under corrected Hyperopia
-Over minused patient
-Esophoria with insufficient vergence (patient under-accommodates to keep fusion)
-Patient wasn't paying attention during the test or the stimulus was too easy

Lead of accommodation (≤+0.25D or if you neutralized with no lens in place or a minus lens)

-Spasm of accommodation --the system is locked up creating "pseudo-myopia"
-Exophoria with insufficient compensating vergence (patient over-accommodates to keep fusion)
-Uncorrected or under corrected myopia

Unequal Results between the Eyes

-**Monocular Amblyopia** – this quite common in vision therapy practice where the amblyopic eye shows a much higher than normal lag response
-Anisometropia (unequal prescription) resulting in unequal accommodative demand
-Incorrect binocular balance during the distance Rx
-Adie's Tonic Pupil (1 eye has loss of accommodation due to pupil abnormality)

Fluctuation of Response

-Accommodative spasm
-Loss of attention
-Streff Syndrome – a condition where the patient has normal prescription but has difficulty seeing at all ranges and even tunnel vision due to stress

TASK –IN –LAB: PERFORM MEM ON YOUR CLASSMATES AT FIRST. RECORD AND ANALYSE THE FINDINGS. WHEN YOU GROW CONFIDENT THEN START DOING MEM ON OTHERS.

EXPERIMENT 3

CYCLOPLEGIC REFRACTION

Cycloplegic refraction is a procedure used to determine a person's complete **refractive** error by temporarily relaxing the muscles that aid in focusing the eye. **Cycloplegic** eye drops are used to temporarily relax the ciliary body, or focusing muscle, of the eyes.

TOP INDICATIONS FOR A CYCLOPLEGIC EXAMINATION

1. **Hyperopia**. Uncorrected hypermetropia can result in accommodative Esotropia, Strabismic amblyopia and Isometropic amblyopia. Children with >3.50ds of hypermetropia have a 13 times greater risk of developing strabismus or amblyopia.
2. **Esotropia**. New onset of/ previously well-controlled accommodative Esotropia is an indication for Cycloplegic refraction. This allows us to determine whether the eye turn has an accommodative component.
3. **Anisometropia** is a very powerful Amblyogenic risk factor. Over +1.00ds difference between two eyes can put a child at risk of developing Anisometropic amblyopia. It is not surprising to find a much larger difference in refractive error between the two eyes after cyclo-dilation. If you don't prescribe the full Anisometropic difference between the two eyes, the amblyopia/reduced acuity may not fully resolve despite occlusion therapy/patching. Treatment of Anisometropia should consist of symmetric reduction of hypermetropia of up to 2.00 D.
4. **Accommodative Spasm**. In older children and young adults, Cycloplegic refraction can confirm the diagnosis of accommodative spasm, which is a constant or intermittent, involuntary increase in ciliary contraction. Patients with low Hyperopia may present as myopic during examination; this so-called Pseudomyopia can be identified by Cycloplegic evaluation.
5. **Aesthenopia with near work**. This applies for children and young adults. A study of young adults 18-21 years old showed that they possessed +1 to +2 D of latent hypermetropia. Should they complain of headaches with near work and aesthenopia, Cycloplegic refraction is indicated.

Pre-Cycloplegic tests

As mentioned, the use of Cycloplegic agents will only be indicated on a patient who presents with symptoms requiring a need for further detailed assessment. Once a non-Cycloplegic examination has been conducted and it is determined that a Cycloplegic assessment is required, various pre-Cycloplegic tests should be performed in order to assess suitability and minimise the risk of any drug-related adverse reactions.

History and symptoms

- Determine whether the patient has had any previous adverse reactions to the drug
- Determine if the patient reports
- any symptoms suggestive of angle closure
- Determine if the patient has any systemic condition or ocular disease that may be aggravated by the use of the drug
- Determine if the patient is taking any systemic medication that could interact with the drug

Advice to the patient

- Fully explain to the patient/guardian the importance of Cycloplegic examination and why it is being performed. Obtain informed consent from the patient/guardian

- Explain the potential side-effects, for example, stinging on instillation, near- vision blur for several hours, pupil dilation and sensitivity to light/glare
- Explain the potential duration of the Cycloplegic drug (dependent on the drug and dose being used)
- Advise the patient not to operate any heavy machinery or drive at this time, as their visual acuity will be reduced
- Inform the patient of the possible risks of dilation, e.g., inducing acute angle-closure glaucoma
- Advise the parent/guardian to attend with the patient for the Cycloplegic examination on a day when important visual tasks are not going to be performed

Pre-tests

- Check the manifest refraction with vision and visual acuity at distance
- and near
- Determine the binocular status with tests appropriate to the patient's age (cover test, fixation disparity, ocular motility and accommodative function)
- Carry out an external eye examination including, slit-lamp examination, pupil function and note iris colour
- Carry out an internal eye examination including, ophthalmoscopy and intraocular pressures
- Check the amplitude of accommodation pre-Cycloplegia

Performing Cycloplegic refraction

Select a drug that will provide adequate Cycloplegia with minimal side-effects (see Table for drug choice available in optometric practice). Instilling drops can be daunting, especially in young children, and it is best to explain the process of instilling drops without using words or terminology that might scare the child and/or parent. Instil one drop in to each eye and ask the patient to either take a seat in the waiting room or return in 30 minutes, as this is the approximate time it will take for the commonly used drops to achieve maximum effect. Recheck the amplitude of accommodation to ensure there has been sufficient reduction. If this is not the case, instil another drop and recheck the results in 10 to 15 minutes.

Ideal Dosage for Cycloplegic Drugs:

- Atropine Sulphate 1% eye ointment – 3 times a day for 3 days – refraction on day 4.
- Homatropine eye drop – instil for 6 times at 15 minutes interval – refraction after 2 hours.
- Cyclopentolate eye drop – instil for 3 times at 10 minutes interval – refraction after 1 hour.

To enhance the effect of Cyclopentolate drops, one drop of local anaesthetic can be added. The patient must be instructed to keep the eyes closed for the drug availability and better action. In open eye condition, the drug may drain out through the nasolacrimal passage as well as the ambient light on the eyes will delay the onset of Cycloplegia.

It is advisable to recheck the patient when the Cycloplegic effect wears off – this is the POST MYDRIATIC TEST OR PMT – which is usually performed to see the accommodative response post Cycloplegic test.

TABLE 3

Use of cycloplegic agents in young children and young adults

Cycloplegic agent	Dosage	Onset/duration
Atropine	• Not recommended in children under three months • Children > three months, for cycloplegic refraction: eye drops, use one drop (1%) twice per day for one to three days before refraction For ointment, use a thin strip three times a day for one-three days before refraction (do not use on the day of the refraction) • Adults, for cycloplegic refraction: eye drops, use one drop (1%) twice per day for one-three days before refraction For ointment, use a thin strip three times a day for one-three days before refraction (do not use on the day of the refraction)	Onset: 10-15 minutes, maximal in 30-40 minutes. Duration: Three to seven days
Cyclopentolate	• Not recommended in children under three months • Infants > 12 years, for cycloplegic refraction: one drop of 1%. • Children > 12 years and adults, for cycloplegic refraction: one drop of 0.5% solution (which may be repeated after five minutes) is usually sufficient Dark irides: one drop of 1% may be required, due to the pigment binding of the drug	Onset: 20-30 minutes, maximal after 60 minutes Duration: Eight hours
Tropicamide	Minimally effective cycloplegic agent, therefore 1% recommended for mydriasis, followed by a second drop after an interval of five minutes	Onset: 15-20 minutes Duration: Two to four hours
Homatropine	• Not recommended in children under three months • Infants >three months and adults, for cycloplegic refraction: one drop twice a day for one-three days before refraction	Onset: 15 minutes, maximal 30-40 miniutes Duration: 24-48 hours

(Courtesy- The Optician – UK)

EXPERIMENT 4

BORISH DELAYED METHOD OR BORISH DELAYED REFRACTION

STEPS

- Perform the regular subjective monocular refraction to BCVA
- Remember MPMVA (Maximum Plus to Maximum VA) and MMMVA (Minimum Minus to Maximum VA) Rule.
- Ask the patient to look at a target at 40cms
- Perform the NRA Test (by adding + spherical lens)
- Keep adding + sphere until the patient reports "First Sustained Blur".
- Direct the patients gaze to the Distance Snellen Chart
- Defog Binocularly by 0.25DS until the BCVA is reached at Distance
- Review Duochrome Binocularly.

Borish Delayed Test is a reliable alternative to Pharmacological Cycloplegia. There is only a 8% difference in comparing both the Tests. Where Cycloplegia is contraindicated, this Test can be performed. The indications for this Test are the same as that of Cycloplegic Examination.

Caution: Final BDR findings can be prescribed only after the Tests of Heterophoria, AC/A, PFV & NFV.

EXPERIMENT 5

HETEROPHORIA AND GRADIENT AC/A

Heterophoria or latent squint is defined as a condition in which eyes in the primary position or in their movement are maintained on the fixation point under stress only, with the aid of corrective fusion reflexes. When the influence of fusion is removed, the visual axis of one eye deviates.

Orthophoria is characterised by perfect alignment of two eyes in all positions of gaze and at all fixation distances so that the visual axes are parallel for distance and have proper convergence for near. Orthophoria as such is a rarity. A small amount of Heterophoria is usually present.

George T Stevens (1886) introduced the term Heterophoria and defined it as an abnormal adjustment of the eye muscles, or a tending of the visual lines in some other direction than parallelism, which applies to strabismus as well. In Heterophoria binocular vision is habitually maintained, but by the expenditure of a greater amount of force than is demanded in the perfect equilibrium of the ocular

muscles. Thus, deviation is kept latent by the fusion mechanism. In strabismus, Diplopia is present and to overcome this, there is long suppression of one image. Therefore, the dividing line between Heterophoria and strabismus rests on the ability or failure to maintain binocular vision.

CLASSIFIACTION:

Heterophoria can be classified into:

- Horizontal Phoria (Exophoria and Esophoria)
- Vertical Phoria (Hyperphoria/Hypophoria)
- Torsional Phoria or Cyclophoria (In-Cyclophoria & Ex-Cyclophoria)

DETECTION & DIAGNOSIS

This can be done by:

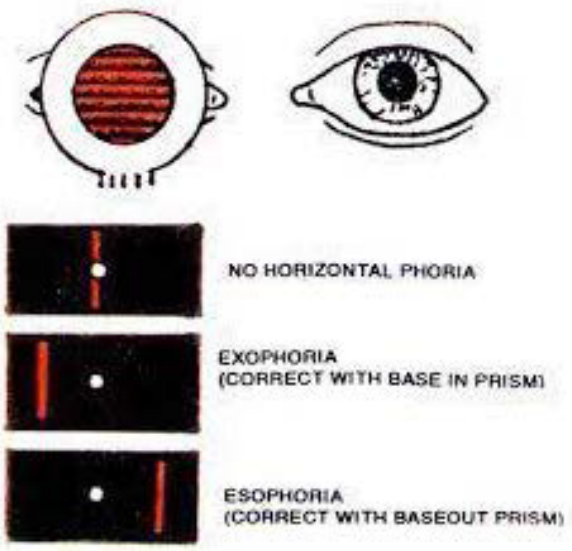
- Maddox Rod (available in the Trial Lens Box) for measuring Heterophoria at 6 meters
- Maddox Wing – for measuring Heterophoria at 40cms
- Howell Phoria Card – for measuring Heterophoria at 40cms (Free Space Evaluation)

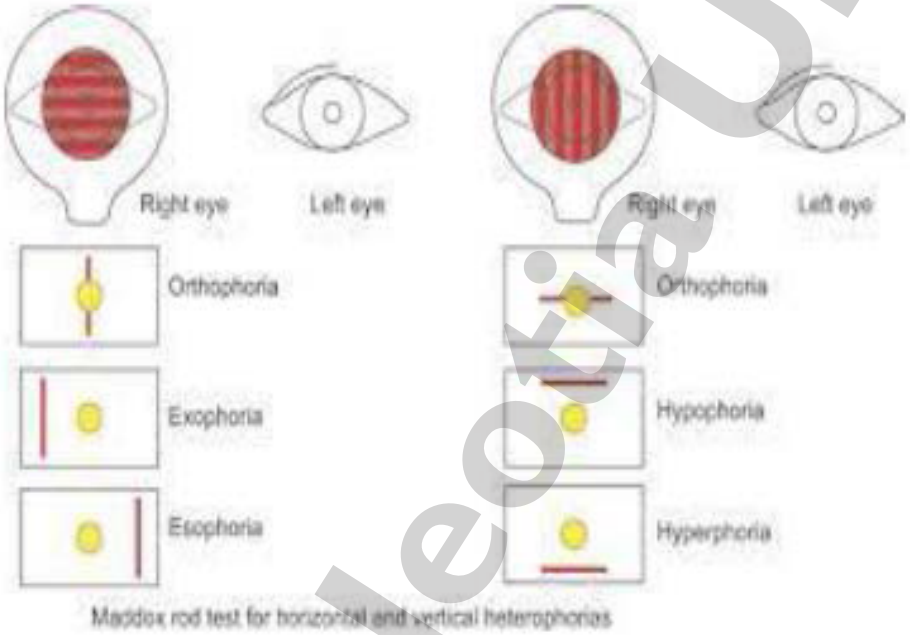
THE MADDOX ROD TEST

- To measure Horizontal Phoria, the MR is placed horizontally over the right eye – producing a vertical streak of red light and the left eye is fixed at the muscle light in the Test Cabinet. So the Right eye sees the RED STREAK and the Left eye sees the WHITE MUSCLE LIGHT.
- To measure Vertical Phoria, the MR is placed vertically over the right eye – producing a horizontal streak of red light and the left eye is fixed at the muscle light in the Test Cabinet. So the Right eye sees the RED STREAK and the LEFT eye sees the WHITE MUSCLE LIGHT.
- Questions are asked now to the patient that if the RED Streak is passing through the White Light or not.
- IF yes – Orthophoria or no muscular deviation is diagnosed (ORTHO or NMD)
- IF the RED STREAK is to the right of the Muscle Light – this is Uncrossed Diplopia of Esophoria and that should be neutralised by adding Base OUT prisms before the Left eye.

- IF the RED STREAK is to the left of the Muscle Light – this is Crossed Diplopia of Exophoria and that should be neutralised by adding BASE IN prisms before the Left eye.

SUMMARY OF MADDOX ROD APPEARANCE & INTERPRETATIONS





Maddox rod test for horizontal and vertical heterophorias

Cyclophoria is measured by Double Maddox Rod – which will be covered in BV-I.

POINTS TO BE NOTED:

- Horizontal Phoria is the most common form of Heterophoria and is associated with Refractive Status, Accommodation and Fusional Vergence problems. This is commonly placed under the umbrella term of Non Strabismic Binocular Dysfunction (NSBD).
- Cover Test can do a QUALITATIVE ANALYSIS of Heterophoria while Maddox Rod does a QUANTITATIVE ANALYSIS.
- While examining Horizontal Phoria it is mandatory to test that both at 6 metres and 40cms – to diagnose Vergence Disorders and associated Accommodative Disorders.

MADDOX WING (Heterophoria at 40cms)

Instructions to the patient & Inferences:

- Look through the eye-pieces of the instrument with both eyes open.
- Look at the White Arrow and tell on which number the Arrow is pointing to.
- The Right Side ODD NUMBERS denote ESOPHORIA and the Left Side EVEN NUMBERS denote EXOPHORIA.
- The Vertical Red Line is meant to assess any Vertical Phoria at 40cms

Both Horizontal and Vertical Phoria at near are readily QUANTIFIED by Maddox Wing and do not require any prism incorporation to neutralise the deviations.

https://youtu.be/iHw9Yf_Gbe0 Link to see and understand Maddox Rod Procedure

https://youtu.be/CuiacyWbDYQ Link to see and understand Maddox Wing Procedure

HOWELL PHORIA CARD & AC/A RATIO BY GRADIENT METHOD

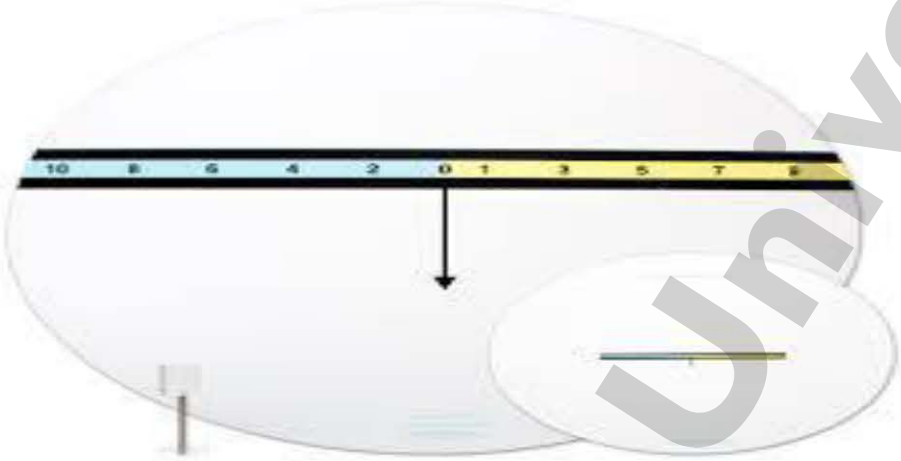
HOWELL PHORIA CARD EXAMINATION & ANALYSIS

HOWELL PHORIA CARD at 33 cms = Evaluation of Heterophoria in a Free Space

The Test consists of 2 cards – one for distance and the other for near. Distance Card is placed at a distance of 3 meters and the Near Card is placed at 33 – 40cms from the patient. We will deal with the Near Card only.

What we can assess clinically:

- Near Horizontal Heterophoria Assessment
- Gradient AC/A Ratio (ACCOMODATIVE- COVERGENCE/ACCOMMODATION RATIO)



- Yellow side consists of ODD numbers and is the Esophoric side
- Blue side consists of EVEN numbers and is the Exophoric Side
- Vertical & Cyclophoria cannot be detected in this Test
- A 6 or 8 prism base down is placed before the Right eye and the patient is asked how many lines they see and where the upper arrow is pointing to? That is on which number and which side? Is the arrow steady or the position is varying or fluctuating?
- If the arrow is steady – then we can conclude a Non Decompensated Heterophoria.
- If the arrow is unsteady and varies in position – then we can conclude that the case is Decompensated Heterophoria – where the Fusional Reserves (NFV & PFV by BI & BO Prisms) and Accommodative Facility is not rigid.
- If the patient says that the arrow is in between two numbers i.e., 4 & 6 then we conclude 5 Exo

FIRST THE HABITUAL NEAR HORIZONTAL PHORIA IS NOTED

EXAMPLE:

1. Patient says that the arrow is in between 3 and 5 of the yellow side. Diagnosis = 4 Eso
2. Patient says that the arrow is exactly over the lower arrow. Diagnosis = Orthophoria
3. Patient says that the arrow is right on top the number 8 in blue side. Diagnosis = 8 Exo

FURTHER CLASSIFICATION OF HORIZONTAL PHORIA (VERGENCE DYSFUNCTION ANALYSIS)

ESOPHORIA

BASIC ESO: DIST ESO = NEAR ESO > NORMAL AC/A

CONVERGENCE EXCESS: NEAR ESO> DIST ESO > HIGH AC/A

DIVERGENCE INSUFFICIENCY: DIST ESO>NEAR ESO> LOW AC/A

EXOPHORIA

BASIC EXO: DIST EXO = NEAR EXO NORMAL AC/A

CONVERGENCE INSUFFICIENCY: NEAR EXO>DIST. EXO LOW AC/A

DIVERGENCE EXCESS: DIST.EXO> NEAR EXO HIGH AC/A

The AC/A RATIO BY GRADIENT METHOD:

BASIC CLINICAL PHILOSOPHY – THIS IS THE CHANGE IN NEAR HETEROPHORIA UPON STIMULATION OF 1.00D ACCOMMODATION. Normal AC/A is 4/1.

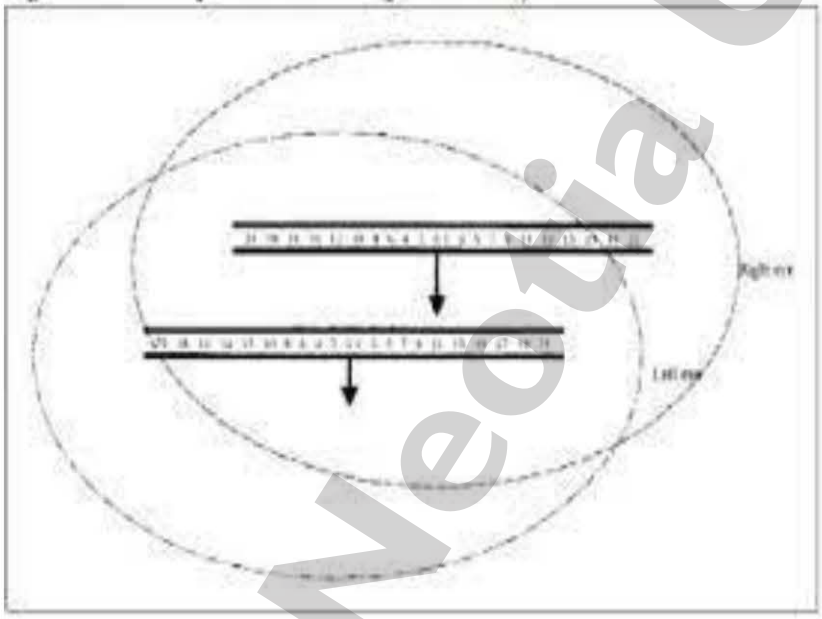
IF +1.00DS IS ADDED BINOCULARLY IT WILL RELAX ACCOMMODATION AND CONVERGENCE

IF -1.00DS IS ADDED BINOCULARLY IT WILL STIMULATE ACCOMMODATION AND CONVERGENCE

Procedure:

- Check the Near Habitual Heterophoria
- Add -1.00Ds binocularly (Accommodation is STIMULATED so ACCOMMODATIVE CONVERGENCE IS ALSO STIMULATED)
- Record the CHANGE in near Heterophoria

Figure 1: Free-Space Phoria Card (patient's view)



Patient's view of Howell Card after Prism Dissociation.

Howell Phoria Card procedure would be demonestrated in the Optometry Lab along with Gradient AC/A Ratio procedure.

EXPERIMENT 7
AUTOREFRACTOMETRY PRACTICE

You are all familiar with the Optical Principles of Autorefractometry. Here, we will be more clinical oriented to that instrument, its operation, advantage and disadvantage.

Desktop Regular Autorefractometer with Keratometer

Using an Autorefractor

Below is a generic 'guide to using an Autorefractor - although instrument's icons, LED screens etc may vary, most Autorefractor employ similar methods of assessment, requiring accurate positioning of the patient, instrument and focusing of the target.

- The patient is positioned comfortably on the instrument – i.e. place their chin on the chin rest and forehead against the headrest; this helps reduce errors caused by poor positioning. The outer canthus of the examined eye must align with the mark on the situated at the side of the headrest.
- Each eye in measured in turn, beginning with the right eye. A vertical alignment joystick/knob on the instrument is adjusted and moved until the patient can view the fixation target with their right eye
- The joystick is adjusted until the pupil is vertically centred on an LCD screen
- The joystick is moved in, out, left or right until the alignment targets are in focus and centred on the pupil
- If the instrument is set up in the auto mode, the measurements will automatically be acquired when alignment is achieved
- If the instrument is set up in the manual mode, the fire button is depressed to acquire a measurement when alignment is achieved
- Multiple readings are taken automatically/manually to allow for minor fluctuations in accommodation
- The same procedure is repeated for the left eye
- Once readings are obtained, the instrument may automatically print out the results or the print button is pressed for a print-out of the results.

Limitations for accuracy

Common sources of error that lead to inaccurate results include: poor fixation; accommodative fluctuations causing an 'over minus' of readings; and corneal, lens and media opacities. A lack of portability and cost are also a concern.

Accuracy in Autorefractor

The latest instruments have improved the accuracy of results by ensuring precise fixation and interpretation of an adequate incident and reflected light beam. Accommodative influences have been improved using auto-fogging distant targets and open view Autorefractor. New models incorporate features to improve measurements in the presence of media opacities and corneal irregularities, utilising topographic and wavefront designs to determine the refraction. Several portable designs now exist and have found a niche in child screening to detect high degrees of ametropia.

a) Alignment problem
b) Problem of Irregular Astigmatism
c) Problem of unwanted Accommodation

a) ALIGNMENT PROBLEM - As per Schiener principle both pinhole apertures must fit within patient's pupil. -If the pt. fixation wanders or he/she moves the head, the reading is invalid. - Thus, considerable cooperation is required.

b) IRREGULAR ASTIGMATISM - In irregular astigmatism, the best refraction over the whole pupil maybe different in contrast to the two small pinhole areas of the pupil.

c) ACCOMODATION - on looking into the instrument patients tend to accommodate causing Instrument myopia which alters the actual refractive status of the patients.

Summary:

Autorefractor provide a reliable alternative to Retinoscopy in many 'standard' adult patients (Elliott & Wilkes 1989, McCaghrey & Matthews 1993) and can be particularly accurate at determining Astigmatism (Walline et al. 1999). When used with Cycloplegia in children, it is as accurate, if not more so, than Retinoscopy (Elliott & Wilkes 1989, Walline et al. 1999). Autorefractor can appeal to some patients.

However, Autorefractor should not be used with young children without Cycloplegia because of proximal accommodation errors producing significantly more minus results than subjective refraction (Elliott & Wilkes 1989, Zhao et al. 2004), particularly in young Hyperope.

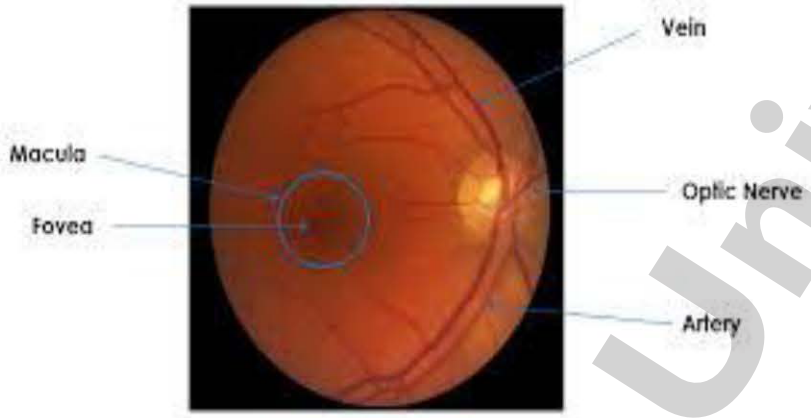
Results can also be unreliable or unobtainable in patients with poor fixation, high refractive errors, small pupils, cataracts, pseudophakia, nystagmus, and amblyopia and in some cases Senile Maculopathy (Elliott & Wilkes 1989).

In addition, Autorefraction lacks the assessment of the ocular media (e.g. early detection of cataracts, keratoconus) provided by Retinoscopy and Autorefractor is typically non-portable and more expensive than Retinoscopes. Finally, they are also more likely to break down than a Retinoscope (Steele et al. 2006).

Link to see and Learn the Procedure: https://youtu.be/r1tcP-xSglQ

EXPERIMENT 8
PRACTICE OF DIRECT OPHTHALMOSCOPY

This is the clinical procedure to assess the posterior segment of the eye as well as the ocular refractive media. This is also known as Fundoscopy as the posterior pole of the eye is called Fundus. This is the most common examination procedure in a Routine Eye & Vision Examination of any individual – be that a child or an adult. You have already studied about the optics and the instrument in Ophthalmic Instrumentation class. Here we will focus on the clinical procedure only.



THE FUNDUS AS SEEN BY AN OPHTHALMOSCOPE

The structures/conditions to be seen -

- Red Retinal Reflex from 1 meter distance(this ensures a clear refractive media)
- Slowly zoom in the back side of the eye through the pupil (Follow the rule R-R-R/ L-L-L)
- First see the Optic Nerve Head. Observe Margin/Colour/Cupping
- Then ask the patient to look at the light of the Ophthalmoscope – the Macula with the Foveal Reflex will automatically come into view
- Then look at the Blood Vessels – Arteries & Veins. Veins are thicker than the arteries and are dark in colour.

  Link to see the procedure: https://youtu.be/7IhvhKvK_iM and https://youtu.be/b-cFIDo68ng

Initially it will be difficult to see the Fundus in non dilated pupils. For this, you can dilate the pupils by using a Mydriatic Drug (Tropicamide or Tropicamide with Phenylepherine combination. You need to see some 100 pairs of normal Fundus – before you can pick up or detect pathological lesions of the posterior pole or the refractive media.