AmbujaNeotia

THE NEOTIA UNIVERSITY

ज्ञानम् आत्म प्रदीपाय

UGC Enlisted & Recognised

Department of Optometry

School of Health Science

Bachelor of Optometry

(B. OPTOM)

Clinical Refraction - I

Practical Manual

Course Code: BO 274

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2021

Certificate

This is to certify that Mr./Ms. …… with UID number …… of Bachelor of Optometry 2nd 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 - I

B.Optom 2nd Semester

Course Code-BO 274

Serial No.	Experiment No.	Name of the Experiment
1	1	Assessment of Visual Acuity. Normal and Subnormal Acuity
2	2	Pinhole assessment.
3	3	Stenopaic Slit and its application.
4	4	Visual Acuity & Refractive Error Simulations
5	5	Measurement of accommodation: near and far points and range.
6	6	Measurement of Vergence: near point and Adduction and abduction range
7	7	Fogging Techniques. Borish Delayed Refraction
8	8	Basic Subjective Method of Refraction including Binocular Balance.
9	9	JCC and Astigmatic Fan & Block Test.
10	10	Duochrome Test.
11	11	Practice of Retinoscopy – Spherical Errors of Refraction
12	12	Practice of Retinoscopy – Astigmatic Errors of Refraction
13	13	Dynamic Retinoscopy and its interpretations
14	14	Presbyopic Add Considerations and prescriptions.

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).

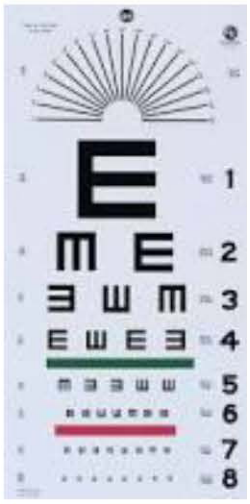
EXPERIMENT 1

ASSESSMENT OF VISUAL ACUITY

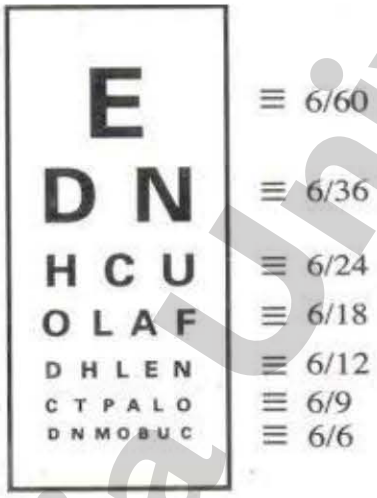
The **visual acuity test** is used to determine the smallest letters you can read on a standardized chart (Snellen chart) or a card held 20 feet (6 meters) away. Special charts are used when testing at distances shorter than 20 feet (6 meters). Some Snellen charts are actually video monitors showing letters or images.

Visual acuity is usually **measured** using a Snellen **eye** chart. **Eye** charts can **measure** how well one can see at a distance, and this is where the term "20/20 **vision**" originated from. During an **eye** exam, Optometrist will ask the patient to read a set of letters set in multiple lines, from biggest to smallest.

CHARTS FOR VISUAL ACUITY



Snellen with Fan Chart



Basic Snellen chart

Allen Picture Chart for Preschool Children

Hand Chart for non literate people

THE Log MAR Chart used in Low Vision cases

NORMAL AND SUBNORMAL ACUITY

The visual acuity test is used to determine the smallest letters you can read on a standardized chart (Snellen chart) or a card held 20 feet (6 meters) away. Special charts are used when testing at distances shorter than 20 feet (6 meters). Some Snellen charts are actually video monitors showing letters or images. Visual acuity refers to your ability to discern the shapes and details of the things you see. **It's just one factor in your overall vision.** Others include color vision, peripheral vision, and depth perception. There are several different types of visual acuity tests, most of which are very simple.

EVAUATION

- With PGP (present glass prescription)
- Unaided Visual Acuity (without any glass/contact lens)
- First take VA Binocularly (Habitual)
- Then One eye at a time.

Record VA with PGP first if the patient is having any existing spectacle. Else straight take Unaided VA without anything – first binocularly then monocularly.
OU (oculus uterque) or Both Eyes (BE) @ 6 mts and 40 cms
OD (RE) (oculus dexter) @ 6 mts and 40 cms
OS (LE) (oculus sinister) @ 6 mts and 40 cms
Remove the PGP and take Unaided VA in the same way and record it.
If the patient is not using any glass or contact lens, just record Unaided VA.
VA can be recorded by:

- **Snellen Chart (Standard Chart for literate children/adults)**
- **Tumbing E Chart (Standard Chart for illiterate adults/preschool children)**
- **Landolt C Chart (Standard Chart for illiterate adults/preschool children)**
- **Allen Picture Chart (Standard Chart for Preschool Children)**
- **ETDRS VA Chart (Mainly used in assessment of Low Vision)**
- **Log Mar Chart (Mainly used in assessment of Low Vision)**

We have discussed the procedures and the basic optics behind the construction of Letters in a VA Chart as well as shared a video. Your task is to write about the clinical procedures involved in using these charts.

VISUAL ACUITY RECORDING

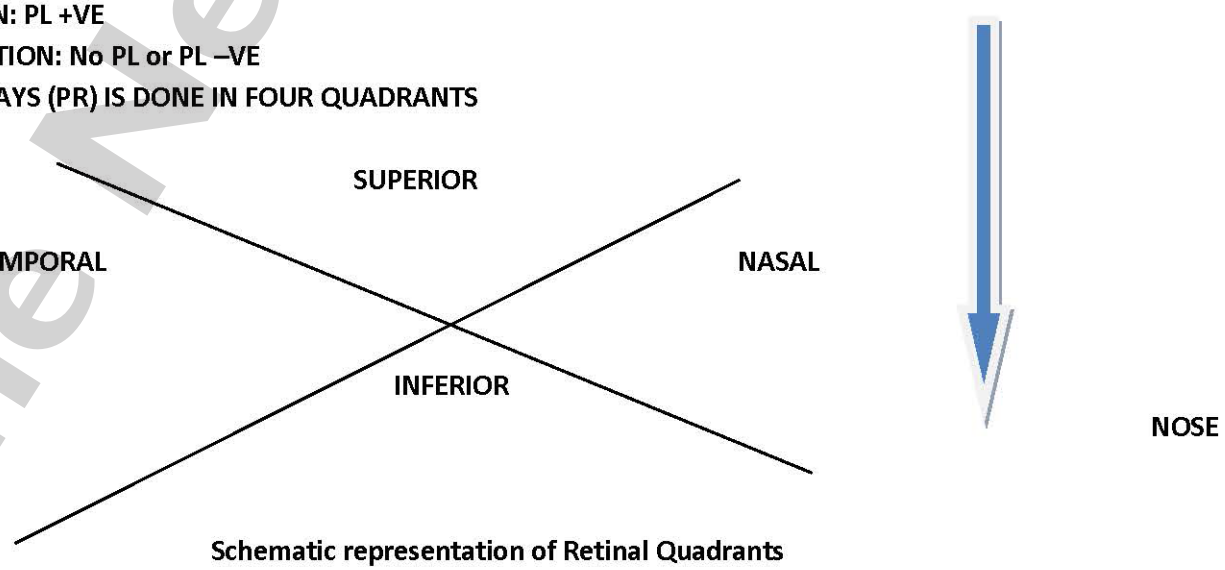
6/3
6/4
6/5 ↑ **HYPERACUITY**

6/6 **NORMAL VISUAL ACUITY**

6/9
6/12
6/18 **SUBNORMAL VISUAL ACUITY (USE PIN HOLE FOR DEFINITIVE DIAGNOSIS)**
6/24
6/36
6/60

5/60
4/60
3/60* **FURTHER SUBNORMAL VISUAL ACUITY (PIN HOLE IS OF NO USE HERE)**
2/60
1/60 ↓

IF A PATIENT IS UNABLE TO EVEN READ 1/60, THEN PROCEED IN THE FOLLOWING WAY:
FC @ 3MTS (FC = FINGER COUNT)
FC @ 2MTS
FC @ 1MT
FCCF (FINGER COUNT CLOSE TO FACE)
HM (HAND MOVEMENT)
LIGHT PERCEPTION: PL +VE
NO LIGHT PERCEPTION: No PL or PL –VE
PROJECTION OF RAYS (PR) IS DONE IN FOUR QUADRANTS



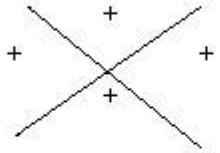
Schematic representation of Retinal Quadrants

PR is done to assess Retinal Quadrant Function where the Refractive Media (Cornea/Crystalline Lens/Vitreous) is not transparent and does not allow a detailed examination of the Fundus by Direct or Indirect Ophthalmoscope e.g., Matured Cataract.

Both PL and PR tests can be done by a simple pen torch (not LED) or Ophthalmoscope light.

Recording NORMAL PR: PR + all quadrants or

PR



Recording ABNORMAL PR: (whichever of the following is found in clinical examination)

- **PR absent in Nasal Quadrant**
- **PR absent in Temporal Quadrant**
- **PR absent in Superior Quadrant**
- **PR absent in Inferior Quadrant**

EXPERIMENT 2

PIN HOLE VISION ASSESSMENT

This is a basic examination to check whether the subnormal VA is due to Refractive Anomalies or Ocular Pathological Conditions. If subnormal VA improves with PH then the underlying cause is Refractive and if the subnormal VA doesn't improve with PH – the cause is usually an ocular pathology/disease.

THE PINHOLE ACCESSORY IN REGULAR TRIAL BOX

The "pinhole effect" is an optical concept suggesting that the smaller the pupil size, the less defocus from spherical aberrations is present. When light passes through a small pinhole or pupil, all unfocused rays are blocked, leaving only focused light to land on the retina to form a clear image.

The obvious benefit of using this optical principle in clinical practice is to discriminate between reduced visual acuity secondary to refractive error and the presence of pathology. When a patient's visual acuity is not 20/20 despite the use of pinhole, further investigation to determine an underlying cause is warranted.

This is also a useful tool to check best-corrected visual acuity in patients for whom performing refraction is unnecessary or difficult. In a practical setting, pinhole visual acuity may be used to document vision of a patient returning for a medical follow-up; routine refraction is not indicated, but sometimes the patient does not bring their up-to-date spectacle or contact lens correction to the appointment.

Another worthy application is in the context of measuring potential visual acuity post cataract extraction. Potential acuity pinhole (PAP) is a monocular test using a pinhole Occluder to view a near target amidst bright illumination to predict visual status postoperatively.

EXPERIMENT 3

STENOPAIC SLIT & ITS APPLICATION

Stenopaic Slit is a standard accessory of a Trial Lens Box.

The Stenopaic slit is a black disk with a thin slit through it used by optometrists in detection of astigmatism. The disk is rotated so that the slit is oriented at different angles, changing the retinal blur size.

Principles & Clinical Uses

It is an instrument which is very useful for subjective refraction in certain circumstances. There is a rectangular aperture with 0.5 to 1.0 mm width and 15 mm in length. It is made up of a plastic body which consist slit in one portion and another portion is opaque. That's why it is assumed that opaque part is able to limit the admission of light to the eye. For this reason, it is able to reduce the blur circle in some particular area. Due to this, it is also responsible to create blur circle of its slit

Stenopaeic slit is also helpful in performing refraction because slit is able to find out the principal meridian. To start the refraction with slit, monocular fogging and de fogging should be done until the best correction is achieved. Then the slit is rotated slowly till the patient appreciates best vision in that meridian with the best correction. At this position, again eye is being fogged and then defogged at 0.50 diopters step interval until the patient reaches the best acuity. The power should be noted for that particular axis. Then the slit position should be rotated 90 degrees apart from its previous position and the procedure is repeated.

EXPERIMENT 4

REFRACTIVE ERROR SIMULATION & VISUAL ACUITY

Procedure:

VA in uncorrected Hyperopia remains normal but in Myopia and Astigmatism VA becomes subnormal. Simulation of Refractive Error can be done with appropriate Plus Lens – which will induce Artificial Myopia and appropriate Minus Lens which will induce Artificial Myopia in an otherwise emmetropic person. Similarly, introduction of Plus Cylinder will induce Artificial Myopic Astigmatism and a Minus Cylinder will induce Artificial Hyperopic Astigmatism. Once these

experiments are performed in the Lab you will learn the co-relation of each Refractive Error with Unaided VA. You can correlate the VA after simulation of different Refractive Errors by appropriate lenses from the Trial Lens Box to form a concrete idea regarding the Relationship of Unaided VA and Uncorrected Refractive Errors. Any discrepancy will warrant a Cycloplegic Refraction – either Optical (induced by lenses) or Pharmacological (induced by eye drops).

- **CHART DEPICTING THE CORRELATION OF UNAIDED VA WITH REFRACTIVE STATUS**

Degree of Absolute Hyperopia OR Hyperopia under Cycloplegic	Unaided VA	Degree of Myopia	Unaided VA	Degree of Astigmatism (expressed in minus cyl form) after Best Sphere correction	Unaided VA
+0.50D	6/9	-0.50D	6/9 – 6/12	0.25Dcyl	6/6
+0.75D	6/12	-1.00D	6/18	0.50 – 1.0Dcyl	6/9
+1.00D	6/12P – 6/18	-1.50D	6/24	1.0 – 1.50 Dcyl	6/12
+1.50D	6/24	-2.00D	6/36	2.00Dcyl	6/18
+2.00D	6/24 – 6/36	-3.00D	6/60	3.00Dcyl	6/24
+2.50D	6/36P – 6/60	-4.00D	3/60	4.00Dcyl	6/36
+3.50D	4/60	-5.00D	2/60	>4.00Dcyl	6/60
+4.50D	3/60	-6.00D	2/60 – 1/60		

Keep in mind the role of Accommodation in Uncorrected Hyperopia – especially in children and patients under the age of 40 years (Pre-Presbyopic Patients).

EXPERIMENT 5

MEASUREMENT OF ACCOMMODATION

You have already studied the Mechanism and preliminary measurements of Accommodation in Ocular & Visual Physiology – in theory and lab. Here we are going to only discuss the Clinical Measurements and the Normal (Expected) Values of each Accommodative Test.

- Tests probing Accommodative stimulation
- Tests probing Accommodative relaxation
- Tests probing Accommodative flexibility
- Tests probing Accommodative response

ACCOMMODATIVE AMPLITUDE

- **Push Up (PU) Test**

  Conventional push-up method The Royal Air Force near point ruler also known as the RAF rule or the RAF binocular gauge is designed to perform near point testing. It consists of a light-weight bar 500 mm in length, on which is mounted a sliding four-sided drum with different test targets on each panel. The RAF rule was used to carry out the conventional push-up method of measuring the amplitude of accommodation.

TARGET

The target used for the conventional pushup method was the N5 letter line. Times New Roman is the standard letter type of the RAF rule.

PROCEDURE

('From clear to first blur') An N5 target was placed at 40 cm from the subject. The examiner slowly and progressively moved the target closer to the subject until the letters appeared blurred. The end point was the first blur that could not be cleared. One or two trial settings were carried out to ensure that the subject understood the test and could establish a consistent judgment of blur. One eye was covered during the measurement. Three readings were taken for each eye. Either the right or the left eye was randomly selected to be tested first. All measurements were made with the gaze depressed slightly (between five and 10 degrees). The same procedure was repeated for the second eye and finally binocular amplitude was measured. The spectacle amplitude of accommodation in diopters could be read directly from the scale. The average value was recorded.

- **Minus Lens (ML) Test**

  This Test is done by keeping the target stationary while adding minus lens power over the refractive correction or without any correction if the patient was not having any prior prescription. Most commonly recommended that the ML procedure be performed at a viewing distance of 40 cm, corresponding to an initial accommodative stimulus of 2.50 diopters (D). Given that the goal is to measure maximum accommodation, it is important to know whether changing the target distance will result in a significant difference in the ML finding. Previously, in a study that compared the ML procedure performed at 6 m and 40 cm, the latter test distance was found to result in a higher AA.

SUMMARY

Amplitude of accommodation: may be monocular or binocular

Monocular Accommodative Amplitudes: the dioptric limit to which the patient can maintain clarity of a small target (20/20)

1. Donder's Push Up method: the accommodative demand of the small (at acuity threshold) Nearpoint target is changed in a ramp fashion as the target is moved toward the patient, who views the target monocularly - closer target: increased accommodation

2. Minus lens method: the accommodative demand of the small Nearpoint target is changed in a stepwise fashion as minus lenses are introduced to the patient monocularly - minus lenses: increased accommodation

Binocular Accommodative Amplitudes: the dioptric limit to which the patient can maintain clarity AND FUSION of small print as the accommodative demand is changed in a stepwise fashion.

1. Donder's Push Up method: the accommodative demand of the small Nearpoint target is changed as the target is moved toward the patient. The net vergence demand also changes as the target is moved.

AS THE TARGET IS MOVED IN:

- Increased accommodation binocularly WITHOUT SUPPRESSION -increased accommodative convergence

- Increased proximal vergence

- Increased Fusional vergence (to maintain fusion)

2. Minus lens method: the accommodative demand of the small Nearpoint target is changed as minus lenses are introduced to the patient binocularly. The total vergence response, however, must remain at a steady state (to maintain fusion of the stationary target).

AS MINUS LENSES ARE APPLIED:

-increased accommodation binocularly without suppression

-increased accommodative convergence

-increased Fusional divergence to maintain fusion of the stationary target

TESTS PROBING ACCOMMODATIVE RELAXATION & STIMULATION

POSITIVE RELATIVE ACCOMMODATION (PRA) Test to stimulate Accommodation

PRA test is done by minus spherical lens: stepwise increase accommodation demand binocularly without suppression

- increased accommodative convergence

-increased Fusional divergence to maintain fusion of the stationary target

NEGATIVE RELATIVE ACCOMMODATION (NRA) Test to inhibit/relax Accommodation

NRA test is done by plus spherical lens: stepwise decrease accommodation demand binocularly without suppression

- decreased accommodative convergence

-increased Fusional convergence to maintain fusion of the stationary target

TESTS PROBING ACCOMMODATIVE FLEXIBILITY

Accommodative Facility: the ability to repeatedly shift accommodative response rapidly and in a jump-step.

This test is done by +/-2.00D Accommodative Flipper

Monocular Accommodative Facility:

Plus/minus lens method: plus and minus lenses (usually +/- 2.00D Flipper) are introduced to the patient monocularly, the other eye being covered, as they attempt to read a sequence of small (20/20-20/25) letters at 40 cm. This test is usually completed in a minute time interval

- Under MONOCULAR testing conditions; accommodative skills isolated. The lenses force a jump change in accommodative response

-plus lenses: decreased accommodation in a jump step

-minus lenses: increased accommodation in a jump step

Binocular Accommodative Facility: under BINOCULAR testing conditions; both the accommodation and vergence mechanisms are at play.

TESTS PROBING ACCOMMODATIVE RESPONSE

These tests are done by various methods of Dynamic Retinoscopy – where both Accommodation and Convergence come into action.

These Retinoscopy Methods are:

1. Monocular Estimate Method Retinoscopy (MEM)

2. Nott Retinoscopy

3. Book Retinoscopy

4. Stresspoint Retinoscopy

5. Bell Retinoscopy

The MEM is most commonly used and will be described here under the Section on Retinoscopy.

SUMMARY OF ACCOMMODATIVE TESTS:

- RAF RULER
- MINUS LENS PUSH UP
- PRA
- NRA
- MAF
- BAF
- MEM

While testing for Accommodation do the Relaxation Tests first before the Stimulation Tests to avoid Accommodative Spasm

EXPERIMENT 6

MEASUREMENT OF FUSIONAL VERGENCE

The Fusional reserves are the maximum amount the eyes can converge (Positive Fusional reserves, measured with base out prism) or diverge (Negative Fusional reserves, measured with base in prism) while still maintaining BSV. As the image doubles, the break point is reached.

EQUIPMENT NEEDED:

PRISM BAR SET (JUMP VERGENCE TESTING)

There are 2 sets of Prism Bars – Horizontal and Vertical Prisms.
Horizontal Bar is used for measuring PFV (Positive Fusional Vergence – ability to stimulate convergence while maintaining BSV) and NFV (Negative Fusional Vergence – ability to relax convergence while maintaining BSV)

For measuring PFV = Base Out Prisms are introduced before one eye until the patient reports blur and break. When Break is reported, the prisms are reduced until the patient reports Single image – Recovery.

So it is recorded as = **BLUR/BREAK/RECOVERY** and the Test is done both at 6mts and 40cms.

For measuring NFV = Base In Prisms are introduced before one eye until the patient reports blur and break. When Break is reported, the prisms are reduced until the patient reports Single image – Recovery.

Same way it is recorded as = BLUR/BREAK/RECOVERY and this Test is done both at 6mts and 40cms.

Normal Values for Vergences[5]		
Step vergence		**B/B/R**
Distance: @ 6mts	PFV Base-out	x/11/7
	NFV Base-in	x/7/4
Near: @ 40cms	PFV Base-out	x/23/16
	NFV Base-in	x/12/7

EXPERIMENT 7

FOGGING METHOD & BORISH DELAYED REFRACTION

With regard to optometry, **fogging** refers to the technique of adding plus sphere power during **refraction** and/or Retinoscopy in an attempt to control accommodation. If the vision is blurred too much, accommodation may actually be stimulated in a effort to see better. **SO AVOID OVER FOGGING!!**

Chiefly done to relax accommodation while the patient is fixing at a distance target and to detect Astigmatism by Astigmatic Fan & Block chart.

Distance Fogging

Here Accommodation is already at a resting phase as the patient is fixating on a distance target. After you reach BCVA with MPMM rule (Maximum Plus Minimum Minus) you have to add plus +1.00Dsph lens to fog the VA by 3 Snellen Lines. Then it is slowly reduced by 0.25Ds steps BCVA. If you suspect Astigmatism, then in this Fogged condition you can use Stenopaeic Slit or Astigmatic Fan & Block Chart Test to detect the Astigmatism.

Borish Delayed Refraction

Borish delayed refraction test (modified fogging technique) provides alternative method of measuring refractive error, where accommodation is controlled by adding positive lenses in front of the eyes to relax accommodation. **Borish** reported a fogging **technique** (**delayed** subjective test) with which higher plus power (up to +1.00D) than what was obtained earlier in the subjective **refraction** can be prescribed.

Procedure: The patient is asked to look at a near target at 40cms – whereby, the accommodation and convergence is in full action. Plus lenses are added in increasing diopters binocularly until the patient reports first sustained blur of the near target. Then the patient is asked to look at the distant Snellen chart and Plus lenses are reduced binocularly until the patient can see the 6/6 line. Reliability of this test is comparable with that of pharmacological Cycloplegic test.

EXPERIMENT 8

BASIC SUBJECTIVE METHOD INCLUDING BINOCULAR BALANCING

Subjective Method of Refraction involves a refractive compensation based on purely subjective response – where no objective measurement (Retinoscopy/Autorefractometry) is done.

Before commencing a Subjective Refraction, ensure that:

The patient is seated at a 6-metre distance from the Snellen chart.

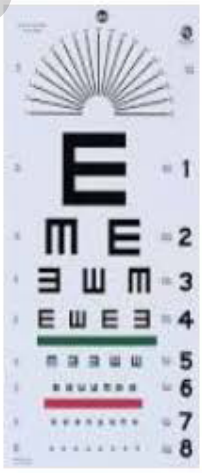
The illumination in the testing room is at a comfortable level of brightness for an indoor setting

Comfortably fit the trial frames onto the patient, by adjusting the nose piece, Inter-Pupillary Distance (IPD) and vertex distance to ensure that they are properly centered

1. The examination begins by testing the patient's BCVA in both eyes separately, without correction. Conventionally, the right eye is tested first. An Occluder is placed over the eye that is not being tested (e.g.: over the left eye, to test the right eye's vision).
2. **A pinhole** is then placed before the patient's eye, and their vision is then tested again (each eye separately) to determine if the patient's poor visual acuity is a result of optical irregularities, or pathological issues. If the patient is able to read more lines on the Snellen chart with the use of the pinhole, this indicates the presence of refractive error. This is based on the principle that the pinhole blocks out any peripheral rays of light, so that only the principal ray falls on the **fovea**, decreasing the size of blur circles.
3. In the presence of refractive error in most patients, visual acuity will improve with the use of the pinhole. The examiner aims to achieve this level of visual acuity, or better, by the end of the Subjective Refraction.

SUBJECTIVE REFRACTION PROTOCOL

- Assessment of Refractive status without the use of any objective tools – like Retinoscope or Autorefractometer.
- **Where to do this:** Preferably in eye camps where Retinoscopy and Autorefractometry is not feasible or in patients where objective procedures are not yielding the desired findings or results. Non cooperative patients. Refraction in Special Cases – where Cycloplegia is contraindicated.
- **Equipments needed:** Trial Box, Trial Frame, Occluder, Pin Hole and Acuity Chart, Astigmatic Fan and Block Chart or Jackson Cross Cylinder, Duochrome Test.



EQUIPMENT NEEDED FOR SUBJECTIVE REFRACTION

- ***This procedure is purely based on patient's subjective response.***
- STEPS INVOLVED

PART A

1. Entering Vision or Unaided Vision or Vision with PGP
2. Pin Hole Acuity – if the unaided VA or VA with PGP is subnormal
3. Deciding the starting point with 1st Stepping Lens
4. Estimation of Refractive status from VA at starting point
5. Finding the Best Vision with Sphere (Spherical Endpoint)

PART B

6. Astigmatic Analysis
   Astigmatic Fan Chart under Fogging

PART C

7. Monocular Endpoint for both RE & LE (Duochrome Test)
8. Binocular Balancing (Vertical Prism Dissociation Test)
9. Binocular Endpoint (Duochrome Test)

PART D

10. Determining the Presbyopic Addition and Writing the Final Rx

- So – the first issue is UNAIDED VISION, MONOCULAR/BINOCULAR/DISTANCE/NEAR
  Check whether the patient is having a normal unaided VA or subnormal unaided VA.
  If the patient is having a subnormal VA – you need to assess VA with Pin Hole and see if the VA improves or not. If the VA is improved, the conclusion you have is that the patient is having a Refractive Problem. If the VA doesn't improve, you conclude that the patient might have some pathological problems which cannot be improved by glasses and contact lenses.
- Once you have done this, the next issue is the determination of the Nature of Refractive Problem – Hyperopia/Myopia/Astigmatism/Anisometropia/Amblyopia
- This primary detection is done by a lens which we call "The First Stepping Lens or the First Diagnostic Lens". This is either a +0.50Dsph or a +1.00Dsph depending upon the amount of subnormal VA. From the unaided VA 6/6 to 6/18, the +0.50Dsph is used and in unaided VA less than 6/18, we use a +1.00Dsph.

- **Consider a few cases: (White eyes with subnormal vision)**
  1. Unaided VA 6/12, with PH 6/6? Therefore the Case is Refractive in Nature (H/M/A)
  2. Unaided VA 6/60, with PH 6/9+? Therefore the case is Refractive in Nature (H/M/A)
  3. Unaided VA is 6/24, with PH 6/12? Therefore the case is Partially Refractive in Nature
  4. Unaided VA 6/18, with PH 6/18 NFI? Not Refractive in Nature/Pathological
  5. Unaided VA 6/6 in EE? (Emmetropic or Hyperopic) (Never Myopia or Astigmatism)

  The role of First Stepping Lens (+0.50D or +1.00D)

  In EMMETROPIA: VA 6/5 in EE = Artificially Myopic & VA would become subnormal
  In MYOPIA: VA 6/36 in EE = It would lead to increased Myopia and VA would fall
  In HYPEROPIA: VA 6/6 in EE = VA would either improve or remain the same
  In ASTIGMATISM: VA 6/18 EE = VA would remain same or go worse
  In ANISOMETROPIA: VA 6/6 IN OD & 6/18 IN OS = VA in the worse eye would improve if there is Hyperopia and would fall if there is Myopia.
  In AMBLYOPIA: VA 6/6 IN OD AND 6/24 IN OS = VA in the better eye would decrease and VA in the worse eye will improve (if the eye is Hyperopic)

EXPERIMENT 9

THE JACKSON CROSS CYLINDER (JCC) TEST FOR ASTIGMATISM

Cross cylinder examination (otherwise known as **Jackson's cross cylinder**) is an examination used for the final fine-tuning of the axis and strength of astigmatism after its determination through Retinoscopy or Autorefractometry. It's naming derives from the fact that each of those cylinders can be considered as the combination of two equal yet opposite astigmatic lenses, placed vertically between them.

The sphere in the cross-cylinder is double and of opposite power to the cylinder. The two most commonly used in everyday practice are: +0.25/ -0.50 (or -0.25/ +0.50) +0.50/ -1.0 (or -0.50/ +1.0)

As the spherical equivalent of the cylinder is zero placing it in front of the patient doesn't change the position of the Sturm cone, it can however reduce or increase the astigmatic error.

We start by correcting the axis of the astigmatic error and continue by fine tuning the power.

Correcting the astigmatic axis

We start the standard examination of visual acuity by placing the patient in front of a Snellen's chart.

We place the sphere and the cylinder as determined by another method on the test frame. We have the patient looking at smallest line he can see reasonably comfortably. The examiner holds the instrument, with its handle being the projection of the astigmatic axis. In this way there is a positive and a negative correction on equal distance.

By turning the cylinder we alter the angle of the astigmatism. This can help the patient lead us to the position where he sees a clearer image. When he does, we turn the cylinder towards the respective angle. If the patient wears positive cylinder, we turn the axis 5 degrees towards it and the opposite if the patient wears a negative one instead. We repeat the process until the patient doesn't refer any difference in his vision. This is the correct axis.

Correcting the power of astigmatism

With the axis in place, we can accurately tune the power of the cylinder. We do that by turning the axis of the cylinder parallel to that of the trial spectacles. By repeating the same process as previously we can increase or decrease the astigmatic lens in jumps equal to the power of the cylinder. When the patient perceives no difference the trial lens is correct.

If the difference of the astigmatism found by the cross-cylinder method is more than 1.0D, we need to numerically subtract from the sphere half of the alteration found, in order to keep the spherical equivalent unaltered.

ASTIGMATIC FAN & BLOCK TEST FOR ASTIGMATISM

The **fan and block** test is used to determine the axis and magnitude of **astigmatism**. It determines the presence of any **astigmatism** and its principal axes. The **fan block** test consists of series of radiating lines spaced at 10°,15° or 30° interval and arranged after the manner of rays of rising sun.

Direct the patient to the fan-and-block chart. Ask the patient if any of the lines of the fan appear clearer or more distinct

While looking at the fan, add a fogging lens of spherical power (approximately equal to half of the cylinder power), until the patient reports that all the lines of the fan are now blurred/not clear. Now reduce the spherical fogging lens power by -0.25DS

To determine the principal meridians, rotate the arrow situated under the fan to the point (or the centre of a group of points) at which the patient reports the lines of the fan appear clearest. Continue fine adjustments of the arrow until both of its limbs are equally clear. This point indicates the negative cylinder axis

Insert half of the negative cylinder that you found on Retinoscopy at the axis found in the previous step and direct the patient to now look at the blocks situated under the arrow

Ask the patient, which of the blocks appear clearer/blacker. If the block with the lines going in the same direction as the cyl axis appear clearer, increase the cylinder power by -0.25; if, however, the block with the

lines going in the opposite direction is the clearest, reduce the cylinder power by +0.25. Continue adding negative or positive cylinders until both blocks are reported to be equally clear. For every 0.50DC change in cylinder power adjust the sphere power by 0.25DS.

Recheck the cyl axis by asking the patient if all the lines on the fan and both limbs of the arrow are equally clear. If not, it means that the cylinder axis is incorrect and the cylinder axis in the trial frame needs to be adjusted.

The final sphere check may now be carried out.

Final sphere check

Once the astigmatic correction has been checked, the best vision sphere (BVS) should be rechecked to ascertain if any refinement in the spherical component is required following cross-cyl.

Procedure for rechecking the BVS following cross-cyl

Direct the patient to view the best line of acuity they can read. Add +0.25DS and ask the patient if the letters are clearer, more blurred or the same

If the patient reports that the letters are better or the same, add +0.25DS. Continue to add +0.25DS until the patient sees no improvement in the acuity.

– Offer maximum positive sphere or minimum negative sphere.

If the visual acuity blurs with the +0.25DS in the first instance, add -0.25DS. Only add negative spheres if an improvement in the line of acuity is seen, i.e. the patient reads more letters than previously recorded.

+1 blur check

> This test is carried out to verify whether the spherical component of the spectacle prescription is correct and the patient has not been over-minused or under-plussed. It is also a precursor to binocular balancing of accommodation following a monocular refraction described later in this article.

Traditionally a +0.75DS or +1.00DS lens is used, as it helps to relax accommodation and suppresses the central vision while maintaining peripheral vision. The visual acuity with the +1.00DS blur should reduce to 6/12-6/18, if this does not occur; it suggests that the best vision sphere is not at its end point and needs to be rechecked.

Procedure for checking +1 blur

Following BVS, cross-cyl and acuity check, inform the patient that you will be placing a lens in front of their right eye that will/may blur the letters on the chart

While the left eye is still occluded, place a +1.00DS lens in front of the right eye

Ask the patient what the lowest or clearest line of letters is that they can now read

The visual acuity should blur back to about 6/12-6/18 (or around three lines worse acuity) and this is the correct end point

If it does not, remove the +1.00DS lens and recheck the best vision sphere pushing maximum plus and minimum minus

Replace the +1.00DS blur lens in front of the right eye and ensure appropriate blur as with other eye

Occlude the right eye and repeat the procedure for the left eye

Record the visual acuity for both eyes.

Binocular balancing is essentially the name given to describe the method of balancing the accommodative status of the two eyes while viewing a distance target binocularly.

Performing binocular balancing is not necessary on patients who are monocular, have little or no accommodation or if a binocular refraction has been performed.

Procedure for binocular balancing

Perform the +1.00DS blur check in both eyes consecutively as described earlier and ensure that equal blur back has been achieved in both eyes

Leave the +1.00DS lens in the left eye, ensuring the Occluder is removed from both eyes. Inform the patient that you have 'blurred' or 'fogged' the left eye intentionally but they should keep both eyes open during this test. Where equal blur back has not/is not possible eg due to unequal visual acuities, the +1.00DS lens should be placed in front of the 'worst eye' first

Starting with the right eye, ask the patient to read the lowest line of letters they can see clearly. Add +0.25DS and ask them if the letters appear clearer, more blurred or the same. If the patient reports that the letters are better or the same, add +0.25DS. Continue to present and add +0.25DS until the patient sees no improvement in the acuity or it just blurs

If the visual acuity blurs with the +0.25DS in the first instance, offer -0.25DS. Only give negative spheres if an improvement in the line of acuity is seen, ie the patient reads more letters than previously recorded

Remove the +1.00DS lens and now place it in front of the right eye. Repeat the procedure as described above from 3-4 for the left eye.

Binocular addition

Binocular addition is the process of checking the maximum plus sphere that can be given to the patient binocularly.

Binocular VA

Where applicable, the binocular acuity should always be recorded; it can be particularly indicated in specific situations such as nystagmus where the binocular acuity will be better than the monocular measurement and for occupational and driving standards where recording binocular visual acuity is necessitated.

Procedure for checking binocular vision/visual acuity

Following monocular acuity testing, ask the patient to read the lowest line of letters they can see clearly on the chart with both eyes open/unoccluded.

Recording results

The end results following subjective refraction should be recorded detailing, at a minimum, the final spherical and cylindrical lens power/axis, the monocular visual acuity and the binocular visual acuity. More detailed record cards may also note the +1blur result, binocular addition and binocular balancing results.

Example of recording final refraction results:

RE: -2.00/-0.50 x180 VA 6/5 +1B 6/12 (Binocular Bal +0.25DS)

LE: -2.50/-0.50 x10 VA 6/5 +1B 6/12 Binocular Add?

Binocular VA 6/4

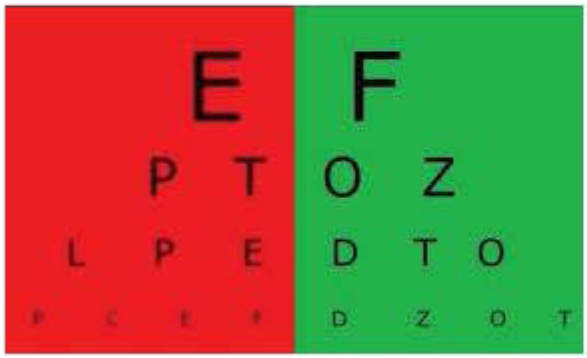
Final prescription issued:

RE: -1.75/-0.50 x 180

LE: -2.25/-0.50 x 10

EXPERIMENT 10

DUOCHROME TEST



The Duochrome or Bichromatic test is commonly used as a check on the best vision sphere during monocular refraction. It can be used at two points:

- After the initial determination of the best vision sphere and prior to the use of the Jackson cross-cylinder (JCC) - to ensure the circle of least confusion is on the retina prior to the use of the JCC.
- After the JCC test and prior to finalising the refractive correction.

Procedure:

1. Occlude one eye. Turn off the room lights to dilate the pupil, which increases the chromatic aberration of the eye.

2. Ask the patient: "Are the rings/letters/dots clearer and backer on the red or on the green, or are they the same?" If they are the same, this suggests the vest vision sphere has been obtained and the circle of least confusion is on the retina.

3. If the rings on the **green** are clearer, **add plus** +0.25 DS until you obtain balance. Note the additional spherical power needed to obtain balance.

4. If the rings on the **red** look clearer, **add minus** -0.25 DS until you obtain balance, noting the additional power required.

5. If more than +/- 0.50 DS is required to balance, this usually indicated the Duochrome test is not reliable for this patient and should be ignored.

6. Prior to the use of the JCC: if the clarity of the rings changes from green to red with +0.25 DS or from red to green with -0.25 DS, then leave a young patient on the green as they will be able to accommodate to bring the circle of least confusion onto the retina.

7. After the use of the JCC and before finalising the refraction: if the clarity of the rings changes from green to red with +0.25DS or red to green with -0.25 DS, note the additional spherical power required t leave a young patient 'on the red.'

8. Use the additional lens power suggested by the Duochrome test and cross-check whether this additional power is preferred by the patient using the plus-minus technique of best vision sphere assessment.

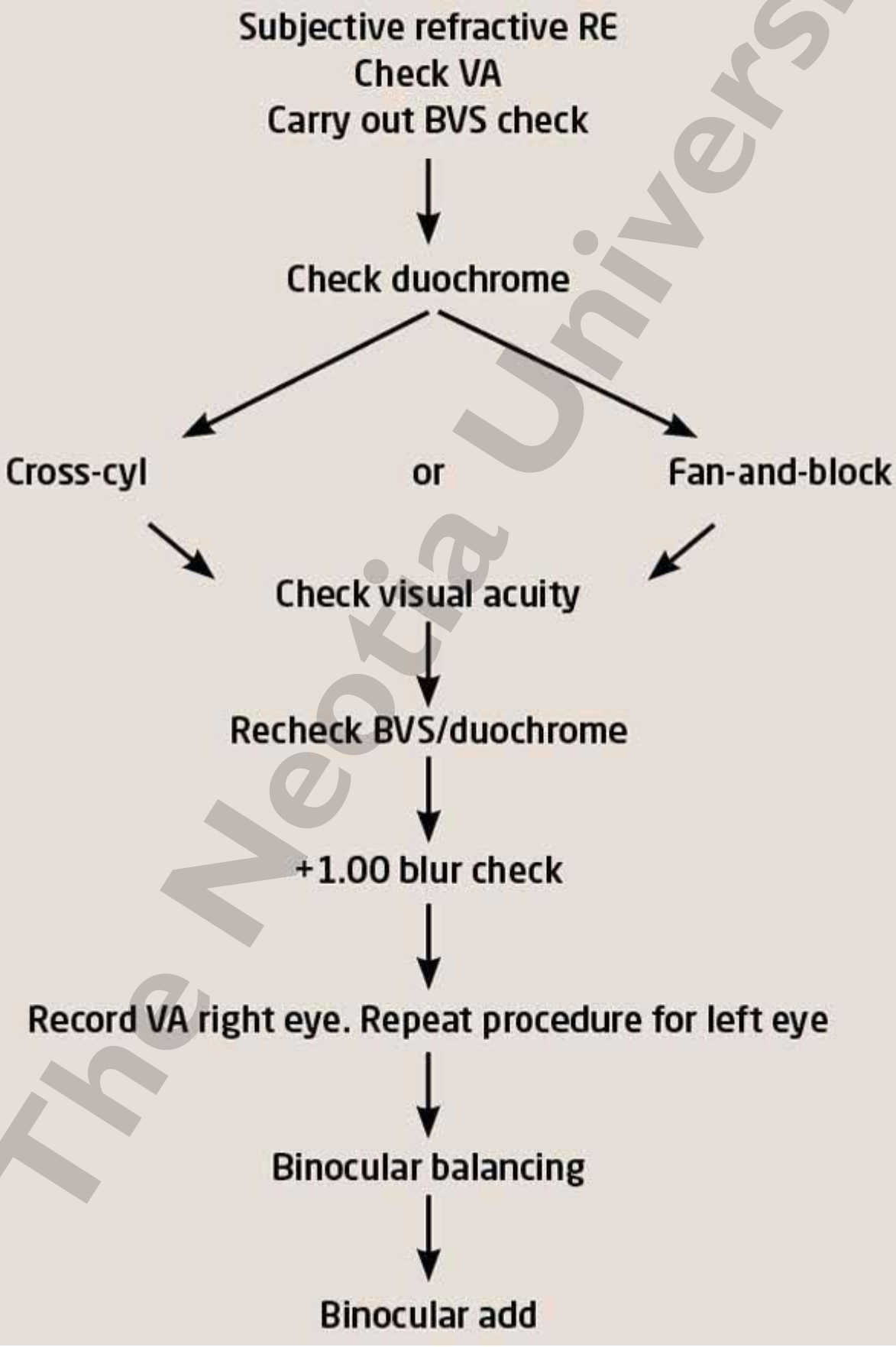
SUMMARY OF DUOCHROME (PATIENT RESPONSE)

Refractive State	Colour seen
Emmetrope	Red = Green
Corrected Myope	Red (only slightly clearer)
Under-corrected myope	Red
Over-corrected myope	Green
Corrected Hypermetrope	Red = green
Under-corrected Hypermetrope	Green
Over-corrected Hypermetrope	Red

PRACTICE THE ABOVE PROCEDURES AND NOTE YOUR FINDINGS HERE:

MONOCULAR SUBJECTIVE REFRACTION

(LIGHTS ON!)



The above Figure offers a flow chart summary of the monocular subjective procedure. The goal of a subjective refraction is to measure and improve a patient's visual function by means of patient and practitioner interaction. It relies heavily on good communication and a well-structured routine to maximise patient response and comfort. A subjective routine should flow effortlessly and have a logical progression. Always ensure you explain the test procedures to the patient and what they may expect to, where possible, experience. Be prepared to modify your routine for patients where communication is limited or responses are not reliable. In the next article I will take a look at binocular techniques and some adaptations to subjective procedure for patients with poor acuity. *(Courtesy – The Optician – England)*

EXPERIMENT 11

STATIC RETINSOCOPY (STREAK RETINOSCOPE)

Static Retinoscopy is a type of **Retinoscopy** used in determining a patient's refractive error. It relies on Foucault knife-edge test, which states that the examiner should simulate optical infinity to obtain the correct refractive power. To perform Retinoscopy, the light from the Retinoscope is oscillated across the whole eye and the movement of the light source or reflex within the pupil is observed. The aim of Retinoscopy is to neutralise the movement observed on Retinoscopy to achieve reversal (no movement), which occurs when the far point of the eye being examined coincides with the nodal point of the practitioner's eye. There are a number of advantages and disadvantages of Retinoscopy over Autorefractometry. Before commencing Retinoscopy a variety of factors need to be considered to ensure the results obtained are accurate and reliable. These include the working distance, the lighting conditions, the fixation target and position.

Working distance

The distance from the Retinoscope to the patient's eye is known as the working distance (Figure 2). Performing Retinoscopy at an infinite distance from the patient ie greater than 6m away, means no allowance needs to be taken for working distance; in other words, the results achieved represent the patient's refractive status. However, it is not practical to do this; the reflex will be dim, difficult to observe, and it will be impractical to change the correcting lenses. As a result, practitioners perform Retinoscopy at a distance less than infinity, but modify their final Retinoscopy result to take account of their 'working distance'. Most practitioners use a working distance of 66cm, which requires adding a working distance lens of -1.50DS to the final result. Alternatively, a working distance allowance lens of +1.50 can be placed in the trial fame prior to commencing Retinoscopy. This can help to avoid mathematical errors when deducting the working distance lens power from the final retinoscopic results (or even forgetting to deduct the working distance) and also aid as a fogging lens to control accommodation. However, the use of the working distance allowance lens can result in increased reflections and uses up space on the trial frame that may be required for the patient's prescription.

Lighting conditions

It is ideal to perform Retinoscopy in a darkened room. This will cause the pupil to dilate, making the reflex more visible; however, as a result of dilation aberrations and accommodation may be increased. The Retinoscope light levels should be kept on medium. If too bright, the pupil may constrict, so inhibiting visibility.

Fixation target

In static Retinoscopy, the patient fixates on a distance target. This target should ensure the patient's accommodation is relaxed, otherwise the final prescription will be incorrect. With the advent of computerised

test charts, practitioners have a plethora of targets to choose from, but the green section of the Duochrome is considered to be a good fixation target as it induces the least amount of accommodation.

Retinoscopy techniques

A number of techniques for using a Retinoscope have been developed. These techniques can aid in the derivation of the distance refractive error and can also be used to give clinically significant insights to the varying degrees of accommodative activity.

Static 'dry' Retinoscopy

Most practitioners will be very familiar with the traditional static (dry) Retinoscopy to determine the distance refractive state of the eye. In this method, the patient views a distance target generally at 6m, the technique of which is described below:

- Ensure the practitioner's refractive error is corrected
- Measure the PD and fit the trial frame. Place the working distance allowance lens in the the trial frame
- Ensure you are sitting at the same height and eye level as the patient. Ensure your working distance is correct
- Ensure the focus slide or collar of the Retinoscope is down to produce the most divergent beam of light. Pushing the slide up produces a convergent beam and the reflex movements reverse
- Direct the patient to look at a distance target with both eyes open, ideally, as previously mentioned, at the green section of the Duochrome to ensure accommodation is relaxed
- Position yourself on the right-hand side of the patient. Before commencing Retinoscopy on the right eye, use the Retinoscope to quickly eliminate any 'with' movement seen in the left eye by adding positive spheres. This acts as a fogging lens and helps to prevent accommodation. A fogging lens is not required if an against movement is seen first
- Use your right eye to refract your patient's right eye. This will help to reduce errors in parallax. Rotate the streak Retinoscope through 360° to identify the band reflex. Once you have identified the band, only oscillate the Retinoscope along that band and the band 90° to it
- If there is no obvious band or the reflex is very slow, use high positive spheres (with movement) or high negative sphere (against movement) to reveal a more apparent band
- Neutralise the slowest with, the fastest against or if you are faced with a with and an against movement neutralise the with movement first with spheres
- Having neutralised one meridian with a ±ve sphere you should be left with band reflex parallel to the direction you have moved the Retinoscope to neutralise the sphere. The reflex should move against the direction of the Retinoscope
- Place a negative cylinder with its axis parallel to the band reflex, and then oscillate your Retinoscope at 90° to this, adding negative cylinders until the against movement is neutralised. At reversal, coloured fringes may be seen (chromatic aberration) or the reflex may split and scissor (spherical aberration)
- If you are moving the Retinoscope along the cylinder axis but the reflex moves obliquely, you have placed the cylinder at the incorrect axis. To correct this, rotate the cylinder axis within the trial frame towards the direction of the reflex within the pupil. When the correct axis has been identified and you drive the light along the cylinder axis, the reflex within the pupil will move in the same direction

- Keeping the results of the first eye in place, move to the patient's left hand side. Remove the fogging lens and repeat the process for the left eye

- Remove the working distance allowance lens or add -1.50DS to the sphere only of both eyes. Measure the visual acuity of each eye monocularly.

Static Retinoscopy relies heavily on ensuring the patient's accommodation is as relaxed as possible. Listed below are tips to control accommodation during examination.

- Ensure the patient is focusing on a distance target like the green rings on the Duochrome. Using this target has been shown to have the least accommodative effect on the patient's eye

- Ensure the patient informs you if your head obscures the Duochrome/distance target, otherwise the patient may focus on your head and accommodate

- Add a fogging lens to eliminate any 'with' movement seen in the eye not being checked first. Often using a working distance allowance lens will eliminate any 'with' movement seen

- In the presence of high ametropia, use large dioptric intervals when changing lens powers. This will ensure neutralisation is reached quickly and reduces the accommodative effect of continually changing lenses in the trial frame
- **Neutralise the "with movement" reflex first**

NOTES FOR PERFORMING STATIC RETINOSCOPY

- For with movements add positive lenses
- For against movements add negative lenses
- For fast movement add low power lenses
- For slow movement add high power lenses.
- If the reflex is dim, slow moving and difficult to interpret, add high power positive and negative lenses in turn to improve visibility and get you started
- Pushing the retinoscope focus slide up to give a less divergent beam also helps to speed up the movement, but remember to push it down again

(Courtesy: The Optician – England)

EXPERIMENT 12

NEAR & DYNAMIC RETINOSCOPIES

Mohindra 'near' Retinoscopy

The Mohindra technique (also referred to as near Retinoscopy) is a very useful technique with children. Studies have shown a good correlation between this technique and 'wet' Retinoscopy in low/medium Hyperopia. However, a poor correlation is shown in children with Esophoria or Esotropia and the actual Hyperopia present.

- Measure the PD and fit the trial frame (optional dependent on age)
- Darken the room lights as much as possible
- Position yourself 50cm away from the patient on the same height and visual axis
- Occlude the left eye (preferably by the person holding the child)
- Dim the retinoscopic light and ask the child to fixate on the dim light
- Neutralize the two principal meridians as described in Static Retinoscopy using spherical and cylindrical lenses
- Occlude the right eye and repeat for the left eye
- Apply the adjustment value (see fourth point in Dynamic Retinoscopy section).

NOTES FOR PERFORMING NEAR RETINOSCOPY

- Darkening the room light aids in patient fixation and concentration
- Dimming the retinoscopy light does not stimulate accommodation beyond that which represents the patient's dark state of accommodation
- Ensure the retinoscope light is kept on the pupil only for a short period of time to avoid stimulating accommodation
- An adjustment value is applied to the final result once neutralisation is seen. Originally a value of -1.25D was added to the final result. Other sources state that -0.75D is a better value to use for infants and -1.00D should be used for children over the age of two years

(Courtesy: The Optician - England)

Dynamic Retinoscopy

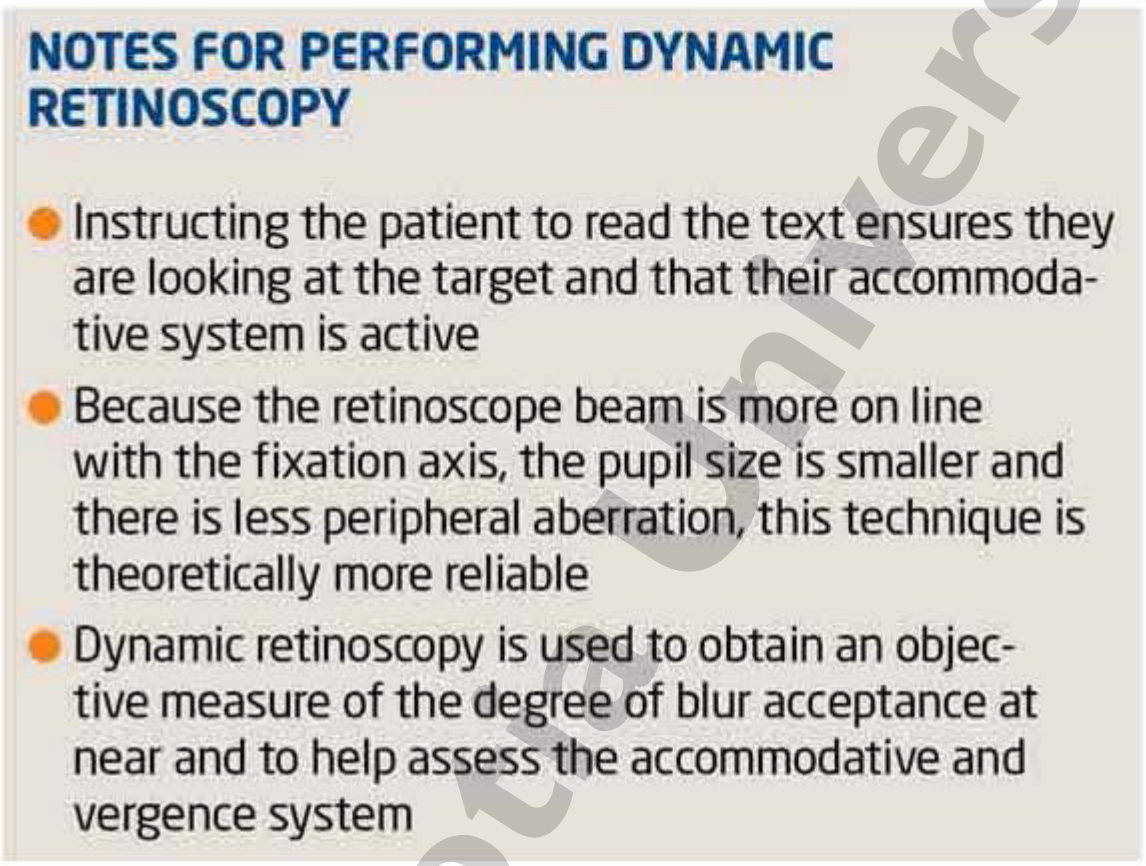
This technique measures the refractive status of the eye when it is accommodating at near and whether the patient is accommodating too much, too little, unequal or sluggishly. Dynamic Retinoscopy can be useful for providing near lenses for presbyopic patients who may or may not be aware of any near difficulty depending on whether they have sufficient near demand to elicit the problem.

Various techniques have been described to determine the accommodative status of the patient's eye, the main difference being the manner in which the positive lenses are added to obtain neutralisation.

Measure the PD and fit the trial frame

- The room lights can be kept on
- Start with the patient's distance prescription in place
- Hold your Retinoscope 40cm from the patient and use a target consisting of a block of reduced Snellen letters clipped to your Retinoscopy. Pictures can be used for small children
- Instruct the patient to start reading the text or to describe the pictures out loud

- With the distance correction in place, a 'with' reflex should be seen
- Add plus lenses binocularly until neutralization is seen
- An adjustment value of 0.50D is then made to the final prescription to allow for the accommodative lag.



(Courtesy – The Optician – England)

Monocular estimate method (MEM) Retinoscopy

The technique is performed monocularly. The aim is to determine the accommodative lag by estimating the reflex motion without disturbing the accommodative state. This technique is particularly useful for observing a patient's spontaneous accommodative response to a detailed target at their normal working distance.

- The patient is asked to wear their habitual near prescription
- The ambient illumination should be set so that there is enough illumination to allow the viewing of small print
- Position yourself slightly lower than the vertical midline but on axis, to emulate a typical reading posture at the patient's habitual near working distance
- Clip an appropriate MEM card to the Retinoscope and ensure the radioscopy beam is passing through the central aperture of the card

- Begin by shining the Retinoscope beam on the bridge of the patient's nose. Ask the patient to read the words on the card or to name the pictures
- Move the Retinoscope beam across the horizontal meridian of one eye and then the other. A slight 'with' movement should be seen, for which the speed of the reflex is observed
- Place a positive spherical lens in front of the eye for two seconds or less so as not to change accommodation
- Continue to change the lenses until neutralization is seen
- Repeat the procedure for the left eye.

NOTES FOR PERFORMING MEM RETINOSCOPY

- The procedure determines whether a patient's accommodative response is equal to the accommodative stimulus and what their natural accommodative state is without disrupting it
- The lenses should be presented in front of each eye for a short period (less than 2 seconds) so as not to stimulate accommodation
- Performing retinoscopy off axis will result in an 'against' movement being induced
- The target consists of a 12X12 cm white card in which there is a central hole and a series of printed words of varying difficulty or pictures depending on the level of literacy. These words or pictures are printed around the central hole to ensure that the retinoscope reflex is as close to the visual axis as possible. The card chosen will be dependent on the patient's literacy level
- A MEM value of +0.50 to +0.75 is considered normal. This lag of accommodation is an indication of the index of accommodative accuracy. If more than +1.00D of lag is observed, some form of correction should be considered for near work
- A negative value on MEM can indicate that the patient is over-accommodating. To check this, place a plus spherical lens binocularly in a trial frame, give the patient some time to adapt and do MEM again to assess what effect the plus lenses is having on their accommodative system. The lenses generally, will be enough to relax the accommodative system and a normal MEM value will then be observed. If this does not occur, do not prescribe plus lenses

(Courtesy – The Optician – England)

Cycloplegic 'wet' Retinoscopy

Cycloplegic refraction is indicated when patients present with symptoms of either decreased vision not corrected to a predicted level, variable and inconsistent end point of refraction, amblyopia, and suspect latent Hyperopia, suspect Pseudomyopia, uncooperative/non-communicative patients, accommodative Esotropia or uncompensated Esophoria. There are significant risk factors linked to previous family ocular history and suspected malingering.

Cycloplegia can be achieved using various drugs. Cycloplegic drugs inhibit the accommodative power of the eye by blocking the action of the ciliary muscle, allowing the total refractive error of the eye to be measured.

A variety of Cycloplegic agents are available, but in optometric practice, Cyclopentolate 0.5 per cent or 1 per cent is commonly the choice of drug used. With this, the onset is quick and recovery is shorter compared to other Cycloplegic agents.

Performing Cycloplegic refraction

- Explain to the patient and parent what you will be doing and why

– Ensure the parent is clear why you want to use a Cycloplegic drug and consent from the parent has been given

– Explain that using drops will temporarily cause the vision to blur, the pupils to dilate and have an increased sensitivity to light. It is helpful to inform the patient and parent how long dilation may last

– Advise the patient and the parent to attend for Cycloplegic refraction on a day when important visual tasks are not going to be performed.

- Select a drug that will provide adequate Cycloplegia with minimal side-effects

– Instilling drops can be daunting especially in young children, and it is best to explain the process without using words or terminology that might scare the child and/or parent

– Check that the patient has not had any previous adverse reactions or know of any contraindications to using a topical diagnostic drug

– As with all topical agents, note the expiry date, dosage and drug type that is being used, along with the number of drops being instilled and the time at which the drops are being instilled.

- Prior to instillation, check and note the patient's amplitude of accommodation. Looking at the amount of Mydriasis alone is not a sufficient method for checking if adequate Cycloplegia has been achieved

- Instill one drop in 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 drops to gain maximum effect

- Recheck the amplitude of accommodation to ensure there has been sufficient reduction. If this is not the case, instill another drop and recheck the results in 10-15 minutes

- Cycloplegic refraction is carried out in a similar fashion to dry static Retinoscopy

– Direct the patient to look at a distance target (Duochrome) with both eyes open

– Due to pupil dilation and peripheral aberrations, the retinal reflexes may be distorted. Concentrate on the central 3-4mm reflex within the pupil

? If possible, attempt a subjective refraction; however, due to spherical and ocular aberrations the final visual acuity may be slightly reduced.

Prescribing after Cycloplegic refraction

Following Cycloplegic refraction, the final prescription given will depend on what the patient's needs are, what they will be able to adapt to and what will give them the best acuity and alignment.

- Binocular status – in patients with Esotropia <4 years of age, prescribe the full refractive correction. For patients with Esophoria, prescribe the full correction if binocular instability is noted

- Ciliary tonicity – reduce the prescription by 0.50 to 1.00D

- Age – prescribe closer to the manifest refraction to alleviate symptoms but do not blur the distance vision

- Prescription history – if glasses have not been worn previously, reduce the prescription for adaptation purposes.

Autorefractor have become a useful tool for providing a starting point for subjective refraction within the optometric practice. New and improved designs have made them easy to use, repeatable and fast. New models are also able to provide Keratometry measurements, displaying corneal mapping and detect corneal irregularities.

Poor fixation, accommodative fluctuations and media opacities are common sources of errors that lead to inaccuracy of results when using Autorefractor. Manufacturers have, however, made several improvements to instruments to improve their accuracy.

An accurate Retinoscopy result can drastically reduce the time spent on a subjective refraction. It is a particularly useful tool for determining the refractive state in young patients, patients with learning difficulties and those who do not speak English. It also provides a wealth of information about the visual system using various retinoscopic techniques. Retinoscopy relies on ensuring the patient's accommodation is as relaxed as possible, where dry Retinoscopy does not yield reliable results. 'Wet' Retinoscopy can be used to determine the 'true' refractive state of the eye and is particularly useful in children or patients presenting with symptoms that do not match the expected level of results.

EXPERIMENT 14

PRESBYOPIC ADD CONSIDERATION & PRESCRIPTION

Presbyopia is physiological insufficiency of accommodation associated with the aging of the eye that results in progressively worsening ability to focus clearly on close objects. Symptoms include difficulty reading small print, having to hold reading material farther away, headaches, and eyestrain.

Presbyopia is the irreversible loss of the accommodative ability of the eye that occurs due to aging. Accommodation refers to the ability of the eye to increase its refractive power of the crystalline lens in order to focus near objects on the retina. The most significant decrease in accommodative power occurs in between the ages of 20 and 50. In the first two decades of life accommodative amplitude has been shown to be relatively stable in the range of 7-10 diopters. By the age of 50, accommodative amplitude has typically decreased to about 0.50 diopters. This decline occurs as a natural result of aging and will ultimately affect any person reaching advanced enough age. Despite its ubiquity, the exact mechanism behind presbyopia remains unknown.

Before prescribing spectacles, make sure there is nothing else wrong with the persons eyes.

- **Measure distance vision.** If presenting vision is 6/18 (6/12 if they drive) or worse in either eye, do not prescribe spectacles without further tests. If vision does NOT improve to at least 6/9 with pinhole, the person needs an eye health check. If vision DOES improve to at least 6/9 with pinhole, the person needs an eye test for distance vision

- **Ask about health.** Several diseases pose related eye problems. Affected patients should always have an eye health check.

Clinical Procedure

The correct power of spectacles for presbyopia depends on the persons age, the distance at which they want to see for near work, and how well they can see.

1. **Take a detailed history.** Write down the persons age and medical history and symptoms. Find out if there is a general medical history of diabetes, hypertension, thyroid disease, rheumatoid arthritis, or other eye disease.
2. **Find out the persons working distance**, which is the distance at which they would like to do most of their near work. Find out what kind of near work the person does
3. Ask him or her to hold a near vision chart at the distance they do most near tasks. Around 40 cm is a comfortable distance for most people.
4. **Measure near vision**
    - The person holds the near chart at their working distance with both eyes open. Ask them to read the smallest line or show the smallest shapes they can see clearly. Write this down as their near visual acuity (e.g. N8 or J6)
    - If the person already has spectacles for presbyopia, measure their near vision with these being worn. Write this down as 'near visual acuity with spectacles'
    - If the person is able to see N8 or better without any spectacles, they might not need spectacles for presbyopia. If they can see N8 or better with their old spectacles, they might not need new spectacles.
5. **Identify the correct lens power**
    - Look up the person's age in the following table and select the power to try first.

Suggested lens power for different ages

Persons age	Lens power
35 to 45	+1.00
45 to 50	+1.50
50 to 55	+2.00
Over 55	+2.50 or higher

- **Measure near vision with the selected power** spectacles or trial lenses. Give the person the near chart to hold at the distance they would like to see clearly. Ask him or her to show the smallest line they can see. If the person cannot see at least the N8 line, try the next stronger power
- **Check the range of clear vision.** Many people will have good vision using the approximate power, but some may not. If you want to make sure that the lens power is suitable for that individual, check that the persons range of clear vision with the lens power is correct. The range of clear vision is the distance between the closest that a person can see clearly and the furthest that they can see clearly. The range is achieved by trying out the testing at various distances
- Ask the person to look at the smallest line they can see on the near chart and then bring the chart closer until the letters become blurred. Hold one hand to mark the closest distance then ask the person to move the chart further away until the letters become blurred. Mark the furthest distance

6. **Before prescribing spectacles, note:**
    - **Approximate lens powers, based on age, will not be suitable for all.** A weaker lens power than expected for a person's age, or no presbyopic lenses, might be needed if a person has myopia (short-sightedness). They should remove their distance spectacles if they want to see at a close distance. A lens power stronger than expected for the persons age may be needed if the person has Hyperopia (far-sightedness), low vision, wants to work at a distance closer than 40 cm, or to see very small objects, for example, a 48 year-old man may like to make jewellery at 25 cm, so might need +2.00
    - **Do not prescribe a power that is too high.** If there is no difference in the near vision when a person looks through a +0.50 stronger power, do not prescribe the stronger power. This is because if the power is stronger than needed, the person will have to hold things too close to their eyes. Also, most people would like to see at their near working distance as well as a little further away. For example, a woman may mainly want to see her sewing at 40 cm, but holds a book at 50 cm and chops vegetables at 60 cm
    - **A change in spectacles** is usually only necessary if the person needs at least 0.50 stronger than their old spectacles, has received spectacles for presbyopia about two years ago, or can see better with the new spectacles than their old spectacles.
7. **Select the type of lenses** that would be best for the person. The options.

Types of lenses

Types of lenses	Advantages	Disadvantages
Single vision (Ready-made, near or reading spectacles)	Less expensive	The person will see clearly at near but their distance vision will be blurred when they look up

Types of lenses	Advantages	Disadvantages
Bifocal lenses and Multifocal lenses (Varifocal)	Useful if a person has a distance refractive error and presbyopia, or if they need to see clearly at distance and near	Usually more expensive than single vision spectacles for presbyopia, and may take longer to acquire

8. **Adjust the spectacles and explain how to use them.** Before the person leaves with their new spectacles:
    - Adjust spectacles to fit properly and feel comfortable
    - Explain the use of spectacles for presbyopia and that it may take a little time to get used to them. Tell them to come back if they experience any problems
    - Explain how to look after the spectacles so that the lenses do not become scratched. Advise them to wash the spectacles daily with soap and water and wipe with a clean cloth.
9. **Remind them to return in about two years** to check if they need new spectacles to see more clearly at close distances.