AmbujaNeotia

THE NEOTIA UNIVERSITY

ज्ञानम् आत्म प्रदीपाय

UGC Enlisted & Recognised

Department of Optometry

School of Health Science

Bachelor of Optometry

(B.OPTOM)

OCULAR & VISUAL PHYSIOLOGY

Practical Manual

Course Code: BO 272

Created by: Supriyo Chatterjee

HoD - Optometry

CERTIFICATE

This is to certify that Mr. /Ms. ..... UID number ..... of the degree of Bachelor of Optometry Semester 2nd semester has satisfactorily completed the practical portion of the course Ocular & Visual Physiology, prescribed by The Neotia University for the year .....

....

Signature of Student Signature of Faculty

Date of Submission:

Practical Manual in Ocular & Visual Physiology,

B.OPTOM 2ndSemester

Course Code-272

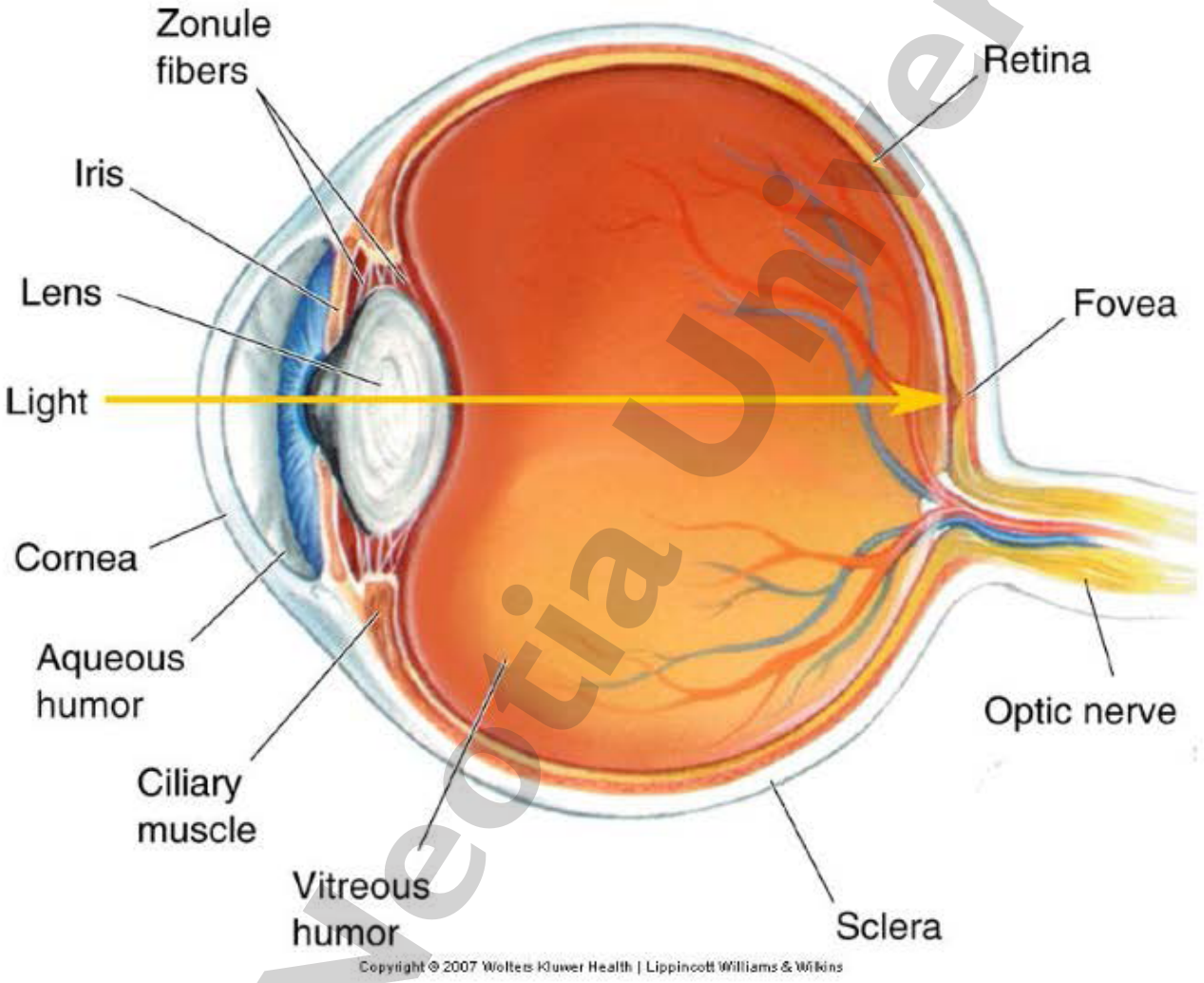
Sl no	Experiment no	Name of the Experiment	Procedure
1	1	Understanding of ocular structures with functions	Comprehensive understanding of the Model Eye ball in the Lab
2	2	Lids and their examination – measurements of PAH, Blink Rate, Reflex Blinking	Principle, Requirements, Procedure & observation
3	3	Corneal Sensitivity Tests – Central & Peripheral	Principle, Requirements, Procedure & observation
4	4	Assessment of Lacrimal Functions Schirmer's Test, TBUT, NITBUT, Jones Dye Test	Principle, Requirements, Procedure &clinical importance
5	5	Visual Acuity: Far and Near	Principle, Requirements, Procedure & observation
6	6	Ocular Motility, Versions, Vergence, Saccades and Pursuits.	Principle, Requirements, Procedure &observation
7	7	Basic Accommodation Evaluation	Principle, Procedure, clinical importance.
8	8	Basic Binocular Vision Examination:	Principle, Procedure, clinical importance.

Reference books and Resources:

1. RD Ravindran: Physiology of the eye, Arvind Eye Hospitals, Pondicherry, 2001
2. Different PDF as shared by the relevant Faculty
3. Video-Assisted Skill Transfer

EXPERIMENT 1.

CROSS SECTIONAL ANATOMY OF THE EYE

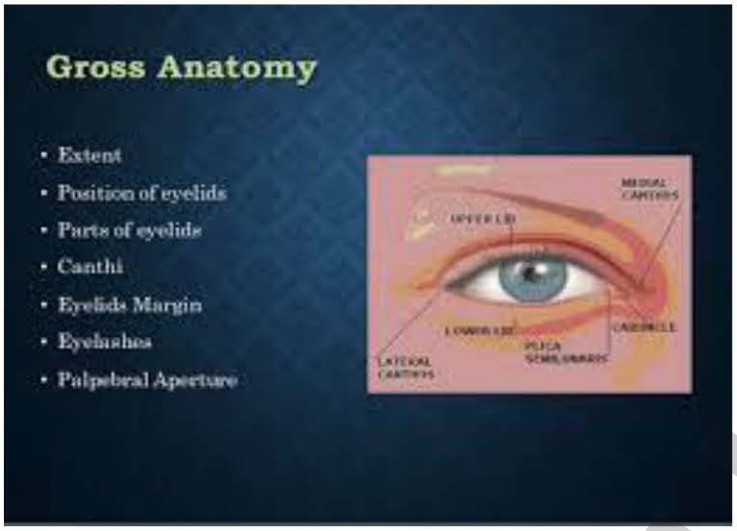


Procedure:

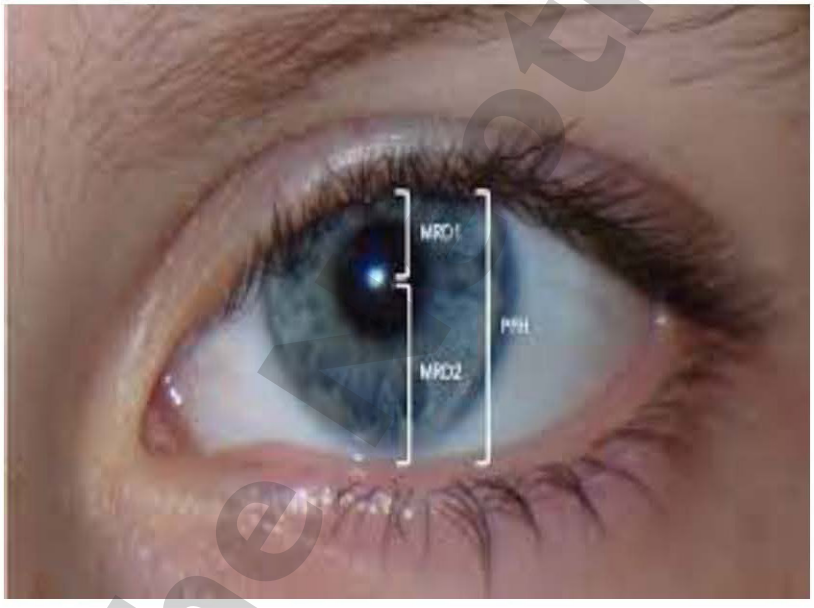
- Inspect the Model Eyeball to understand the structures and related functions that are discussed in theory.
- Study the dimensions of each structure and functional clinical importance in Optometry practice
- Write the details in Laboratory/Practical Note Book

EXPERIMENT 2

EYELIDS & THEIR EXAMINATION



Look at the extent/position/parts/canthus/eyelid margin/eyelashes/ palpebral aperture height



Palpebral Aperture Height – from the lower eyelid margin to the upper eyelid margin in mm

Visible Corneal Diameter – from 12 o'clock to 6 o'clock and 3 o'clock to 9 o'clock positions in mm

Blink Rate: Normal – 12 to 14 blinks per minute

RECORD YOUR CLASSMATE'S PAH, VCD, AND BLINK RATE IN THE LAB NOTE BOOK

EXPERIMENT 3

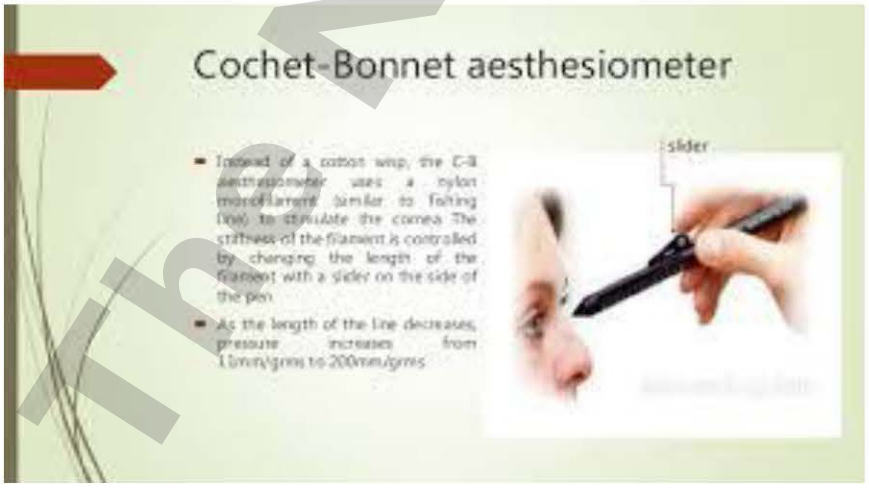
CORNEAL SENSITIVITY TESTS

- This test may be required by the patient's history or by the results of the external examination or slit-lamp examination.
- The examiner merely touches the central portion of the cornea with a sterile wisp of cotton to determined whether or not the patient has a normal corneal sensation.

Cotton Wisp Test – Normal response is a BLINK as the Wisp is touched on the Cornea

- **Central Cornea = more sensitive**
- **Peripheral Cornea = less sensitive**
- **Age and Diabetes reduces Corneal Sensitivity**

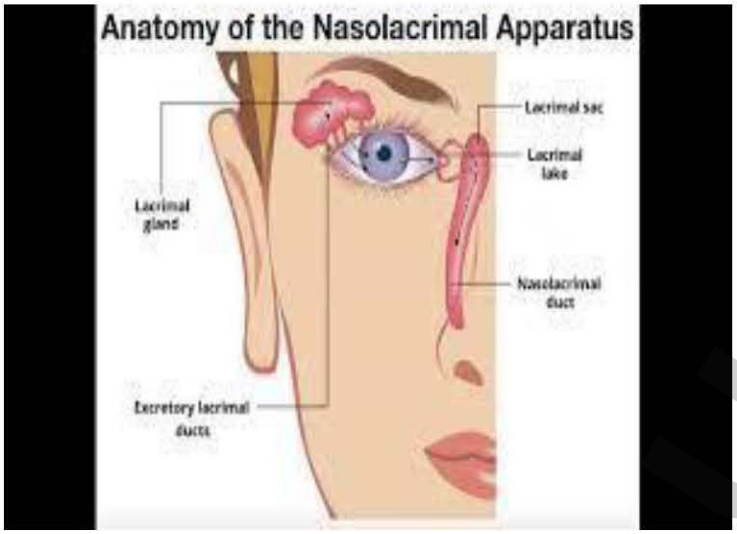
Cochet – Bonnet Aesthesiometer (a more sophisticated test)

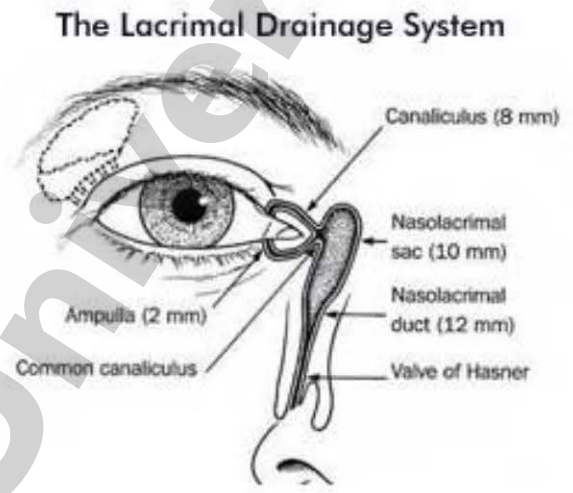


- **Read about this tests in Textbook**
- **Perform the Cotton – Wisp Test on your classmates and record their responses**

EXPERIMENT 4

ASSESSMENT OF LACRIMAL FUNCTIONS

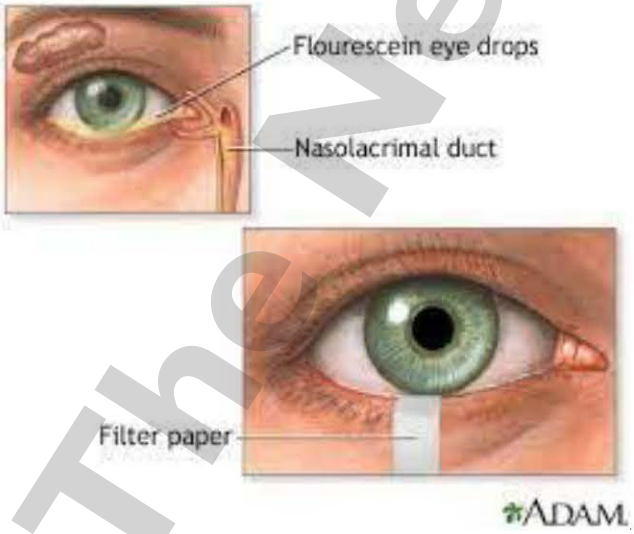




Assessment includes:

- **Production of Tears (Schirmer's Test)**
- **Stability of Tears (Tear Break Up Time or TBUT)**
- **Drainage of Tears (Jones Dye Test or Nasolacrimal Syringing)**

SCHIRMER'S TEST



- **CAN BE DONE IN 2 WAYS:**

A. **REFLEX SECRETION (WITHOUT LOCAL ANAESTHETIC DROPS)**

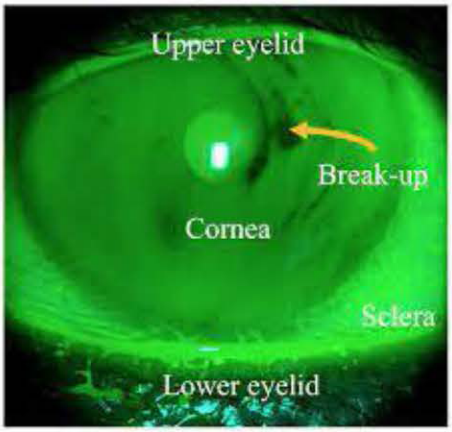
B. **BASAL SECRETION (WITH LOCAL ANAESTHETIC DROPS)**

- **NORMAL VALUES**

  Without anesthesia, wetting of less than 15 mm of a **Schirmer's** strip indicates dry eyes. With anesthesia, the **interpretation** is as follows: 0 to 5 mm of wetting, severe dry eyes; 5 to 10 mm of wetting, moderately dry eyes; 10 to 15 mm of wetting, mildly dry eyes; and greater than 15 mm of wetting, normal tear function.

TEAR BREAK UP TIME (TBUT)

Tear breakup time (TBUT) is determined by measuring the interval between instillation of topical Fluoroscein 0.5% and appearance of the first dry spots on the cornea. Measure it prior to instillation of any anesthetic eye drops. A Fluoroscein strip is moistened with saline and applied to the inferior cul-de-sac. Observed with Slit Lamp Cobalt Blue Filter setting



Normal Values:

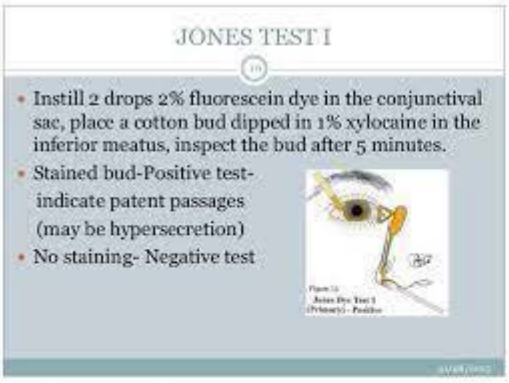
- **10 – 30 seconds**
- **Less than 10 seconds is indicative of ocular surface pathology**

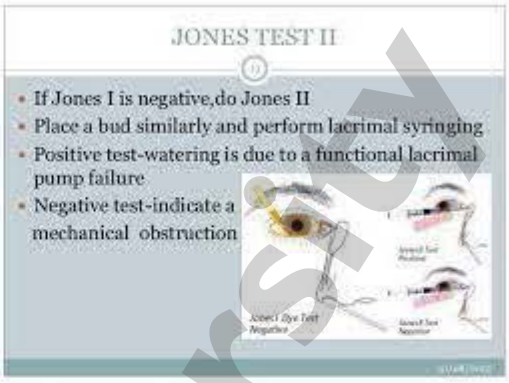
DRAINAGE OF TEARS

JONES DYE TEST (NON INVASIVE)

The **Jones** dye **test** is used to assess patency of the lacrimal drainage system. In the first part of the **test**, a drop of Fluoroscein is placed in the conjunctival cul-de-sac. After 5 minutes, the nose is examined for the presence of dye. Jones Dye Disappearance Test (JDDT) is of two types:

- Jones Test I
- Jones Test II





Nasolacrimal Syringing (NLD Syringing – INVASIVE)

Lacrimal syringing can be used to probe the **lacrimal** duct. Sterile saline is gently pushed through the **syringe**, where it may in some cases dislodge debris out through the nose thus removing the blockage causing the watery eyes.

- Wash your hands (and afterwards too).
- Position the patient comfortably with head supported.
- Minimise distractions, both for yourself and the patient.
- Ensure good lighting.
- Always explain to the patient (and any companion, if appropriate) what you are going to do.

You will need

- a torch (held by an assistant) or preferably a well-powered lamp
- magnification (e.g., loupes)
- normal saline
- a sterile 2 ml syringe
- a sterile Nettleship dilator
- a sterile lacrimal cannula
- local anaesthetic eye drops
- clean cotton wool or gauze swabs
- a towel
- gloves

Method

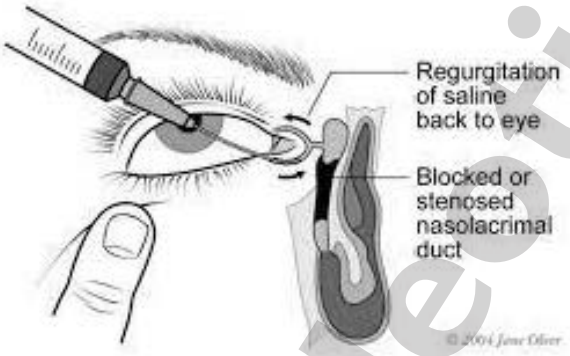
- Instil the local anaesthetic eye drops, allowing the drops to fall directly over the lower Punctum, and wait about 30 seconds.

- Ask the patient to look upwards and outwards (away from the nose) and to maintain this gaze until the procedure is over.
- With cotton wool or a gauze swab, gently pull down the lower eyelid to expose the lower Punctum.
- With the other hand, insert the Nettleship dilator into the lower Punctum, following the direction of the lower canaliculus. Gently rotate it a few times and then withdraw the dilator (this dilation will facilitate the insertion of the cannula).
- Inject the fluid slowly, and explain to the patient that they may have the sensation of a salty taste at the back of the mouth and the need to swallow fluid.
- If the patient is not aware of this sensation, it indicates a blockage somewhere in the lacrimal apparatus. The fluid may be seen coming through the upper Punctum.

The next part of the procedure requires two people:

- Instil the local anaesthetic drops directly over the upper Punctum and again over the lower Punctum; wait about thirty seconds.
- Gently raise the upper eyelid to expose the upper Punctum.
- Occlude the upper Punctum with the Nettleship dilator. The assistant will need to hold the dilator in the upper Punctum while the syringing is repeated through the lower Punctum as before.
- If the patient still does not experience the salty taste and swallow sensation, this will indicate that the site of the blockage is in the common canaliculus or the lacrimal sac.

Lacrimal Syringing

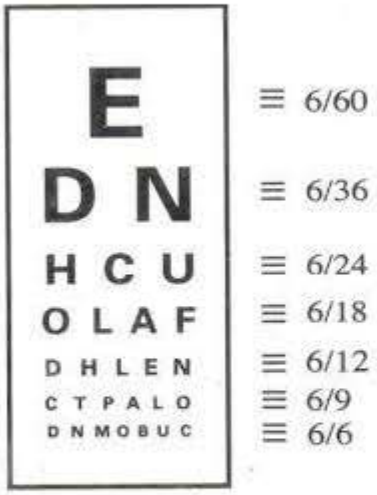


Syringing of NLD will be practiced in your higher semesters. Presently you are supposed to concentrate on the NON INVASIVE Procedures – Schirmer's Test, TBUT and Jones Dye Test I & II.

Practice these test on your classmates and record the findings in your Lab book

EXPERIMENT 5

VISUAL ACUITY FAR & NEAR



The Standard Snellen Chart for VA assessment at 6 meters

The Standard Jaegar's Chart for near VA to be held at 40 cms

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.

6/6 vision is a term used to express normal visual acuity (the clarity or sharpness of vision) measured at a distance of 6 meters. If you have 6/6 vision, you can see clearly at 6 meters what should normally be seen at that distance. If you have 6/60 vision, it means that you must be as close as 6 meters to see what a person with normal vision can see at 60 meters.

Having 6/6 vision does not necessarily mean you have perfect vision. 6/6 vision only indicates the sharpness or clarity of vision at a distance. Other important vision skills, including peripheral awareness or side vision, eye coordination, depth perception, focusing ability and colour vision, contribute to your overall visual ability.

Some people can see well at a distance but are unable to bring nearer objects into focus. This condition can be caused by **Hyperopia** (farsightedness) or **Presbyopia** (loss of focusing ability). Others can see items that are close but cannot see those far away. This condition may be caused by **Myopia** (nearsightedness).

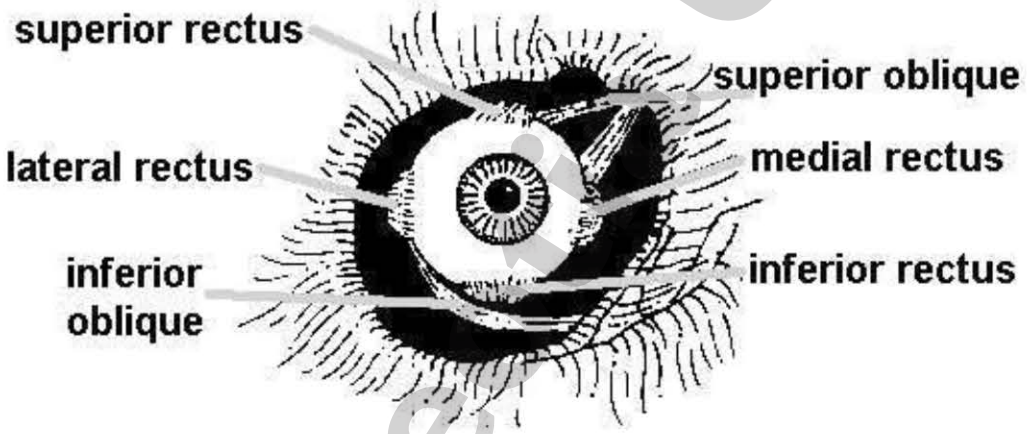
A **comprehensive eye examination** by a doctor of optometry can diagnose what is affecting your ability to see well. In most cases, your doctor of optometry can prescribe glasses, contact lenses or a vision therapy program that will help improve your vision. If the reduced vision is due to an eye disease, you may be prescribed ocular medication or another treatment.

EXPERIMENT 6

OCULAR MOTILITY AND ITS EVALUATION

The term **ocular motility** refers to the study of the twelve extraocular muscles and their impact on **eye** movement. Each **eye** has six muscles, four rectus and two oblique, which, when functioning properly, allow the eyes to work together in a wide range of gaze.

Patients are usually tested for eye position and movement during a routine eye examination. To observe the action of all twelve muscles, the patient is asked to look in the 9 diagnostic positions of gaze. The patient follows a target to various points of gaze while the physician closely monitors their eye movements. Any noted limitation or misalignment of the eyes could indicate muscle weakness or paralysis and warrant further investigation.



Nerves that supply these eye muscles:
REMEMBER: SO 4/ LR 6/ REST 3

Superior Oblique 4th CN

Lateral Rectus 6th CN

Medial Rectus 3rd CN

Superior Rectus 3rd CN

Inferior Rectus 3rd CN

Inferior Oblique 3rd CN

EYE MOVEMENTS

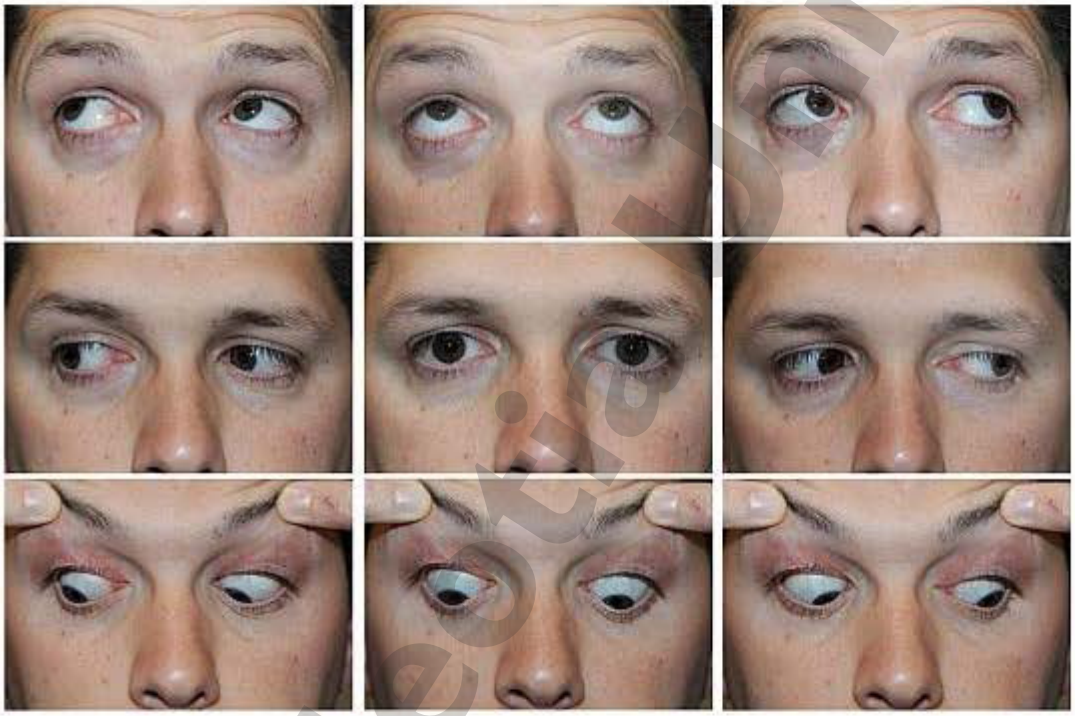
Basically 2 types of eye movement are found:

Version – where both visual axes of the eyes remain parallel to each other. Monocular Versions are called Ductions. This is also called as Conjugate Eye Movement.

Vergence – where both visual axes of the eyes do not remain parallel – as in Convergence and Divergence. This is also called Disjunctive Eye Movements

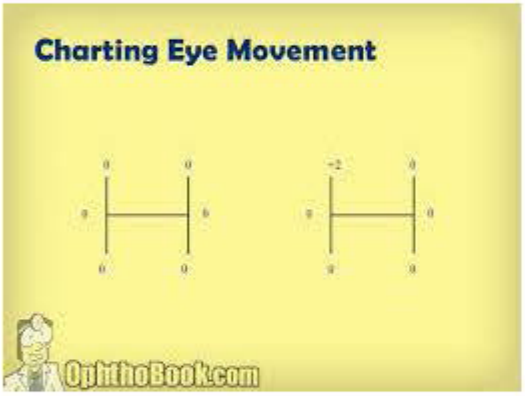
Besides these, there are 2 more classifications of Eye movements – which are micro movements of the eyes – Saccadic Eye Movement & Pursuit Eye Movement.

The Diagnostic Positions of Gaze (VERSIONS)



VERGENCE (CONVERGENCE)

CHARTING EYE MOVEMENT



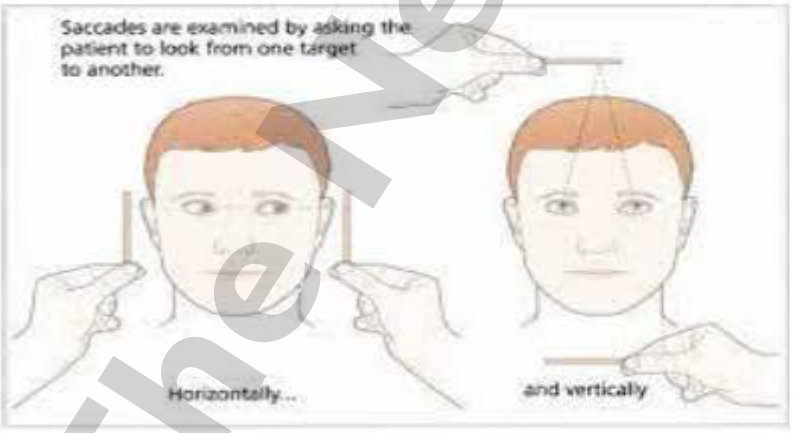
SACCADES & PURSUITS

Saccades are rapid eye jumps, bringing our focus from one object to another. This is observed during reading commonly but is not limited to the task of reading only. **Saccades** are eye movements used to rapidly refixate from one object to another. The examiner can **test saccades** by holding two widely spaced targets in front of the patient (such as the examiner's thumb on one hand and index finger on the other) and asking the patient to look back and forth between the targets. **Saccades are** rapid eye movements designed to shift the fovea to objects of visual interest. Abnormalities of **saccades** offer important clues in the diagnosis of a number of movement disorders.

Pursuits are smooth eye movements that involve following or tracking a moving target. This is especially important for people such as athletes who need to keep their eyes on a moving ball.

Both saccades and pursuits are initiated by a part of the brain called the Frontal Eye Fields. This part is responsible for recognizing and identifying our objects of focus. From there, signals will be sent through a complex network to different parts of the brain that will activate our eye muscles to do a saccade or a pursuit.

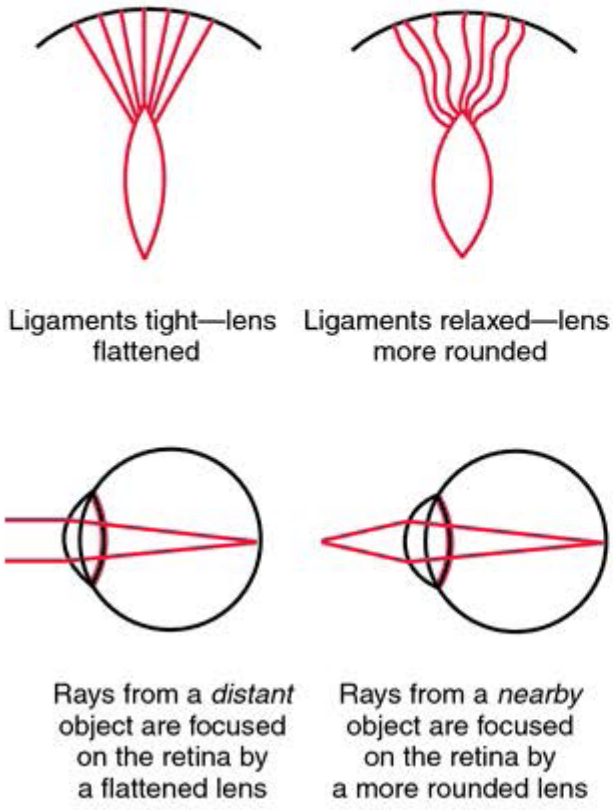
Examination of Saccadic Eye Movements



Can be done with 2 pencils.

EXPERIMENT 7

BASIC ACCOMMODATION ASSESSMENTS



THEORY:

The automatic adjustment of the lens curvature, resulting in a change in the focal length of the **eye**, which brings images of objects from various distances into focus on the retina; the ability of the **eye** to focus at various distances, by changing lens shape.

Ocular accommodation is not just a mechanism for altering curvature of the crystalline lens of the eye, it also enables aqueous humor outflow through the trabecular meshwork, influencing intraocular pressure (IOP). Long term stress on the ciliary muscle from sustained near focusing may initiate myopic eye growth in children and primary open angle glaucoma in presbyopic adults. Multi-factorial studies of ocular accommodation that include measures of IOP, ciliary muscle morphology, anterior chamber depth and assessment of nutritional intake and metabolic markers may elucidate etiology and novel strategies for management of both myopia and chronic glaucoma. Anatomy of the ciliary fibers from anterior insertion in the fluid drainage pathway to their posterior consanguinity with the vascular choroid alters ocular parameters such as micro-fluctuations of accommodation and pulsatile ocular blood flow that are driven by cardiac contractions conveyed by carotid arteries. Stretching of the choroid has consequences for thinning of the peripheral retina, sclera and Lamina Cribrosa with potential to induce retinal tears and optic nerve cupping. Early metabolic interventions may lead to prevention or reduced severity of myopia and glaucoma. Finally, it might improve quality of life of patients and decrease disability from visual impairment and blindness.

BASIC ASSESSMENT

Accommodative amplitude is **measured** in diopters by first calculating the inverse of the distance of the near point for the Emmetropic eye; this can then be compared to the age-adjusted normal amplitude of **accommodation** calculated with **Hofstetter's formula:**

Minimum monocular accommodative amplitude=15D–0.25×age)

The distance between the near point and the far point of the eye, the limits within which **accommodation** is able to adjust the crystalline lens so that an image is sharply focused on the retina is called the **range of accommodation**.

A **normal** eye is considered to have a **near point** at about 11 cm (4.3 inches) for a thirty year old. The **near point** is highly age dependent. A person with Hyperopia or Presbyopia would have a **near point** that is farther away than **normal**.

Clinical accommodation tests can theoretically be categorized into four different types:

1) Tests of accommodative amplitude (AA by Hofstetter's Formula or RAF Ruler)

2) Tests of relative accommodation (Positive & Negative Relative Accommodation PRA & NRA by loose lenses)

3) Tests of accommodative facility (Binocular Accommodative Flipper of +2.00/-2.00D)

4) Tests measuring lag of accommodation (By MEM Retinoscopy)

The RAF Ruler and the Procedure

Plus and Minus Sphere Lenses for PRA & NRA

NRA = use plus (normal value + 1.75DS)

PRA = use minus (normal value -2.25DS)

MEM Retinoscopy: for Evaluation of Accommodative Lag or Lead.

Accommodative Flipper to Evaluate Accommodative Facility

EXPERIMENT 8

ASSESSMENT OF BASIC BINOCULAR VISION:

A **Binocular Vision Assessment** is a type of **vision evaluation** best-performed by an optometrist with training in **binocular vision**. This **assessment** goes beyond the scope of primary eyecare and evaluates conditions of **eye teaming**, **eye focusing**, **eye tracking**, **visual perception** and **visual processing speed.**

Binocular single **vision** (BSV) is the ability to use both eyes together to achieve a single fused percept, even in the presence of disparity of the image seen by each eye. It is divided into five **grades**:

Simultaneous macular perception,

Superimposition,

Sensory fusion,

Motor fusion

Stereopsis.

THE STEREO FLY TEST – which can cover the basic sensory motor aspects of Binocular Single Vision (BSV)