Reading Material for
Ophthalmic Technique-II

Compiled By:

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Preface

In the ever-evolving landscape of healthcare, the role of Allied Health Professionals (AHPs) has become increasingly pivotal, necessitating a dynamic response in education and training. The culmination of Dr. Nasir Ahmad Chaudhry's extensive experience and expertise, marked by the authorship of three prior books for MBBS students and postgraduate residents, is reflected in this curriculum for Ophthalmic Technician Training—a timely and crucial resource for the evolving needs of healthcare.

This revised curriculum addresses the shifting demands of the field, linking pre-service education with real-world tasks, modernizing training, and emphasizing integration of tasks and multi-skilling. The Core Course serves as a foundational knowledge base, fostering technical proficiency and facilitating advanced studies in Allied Health Sciences.

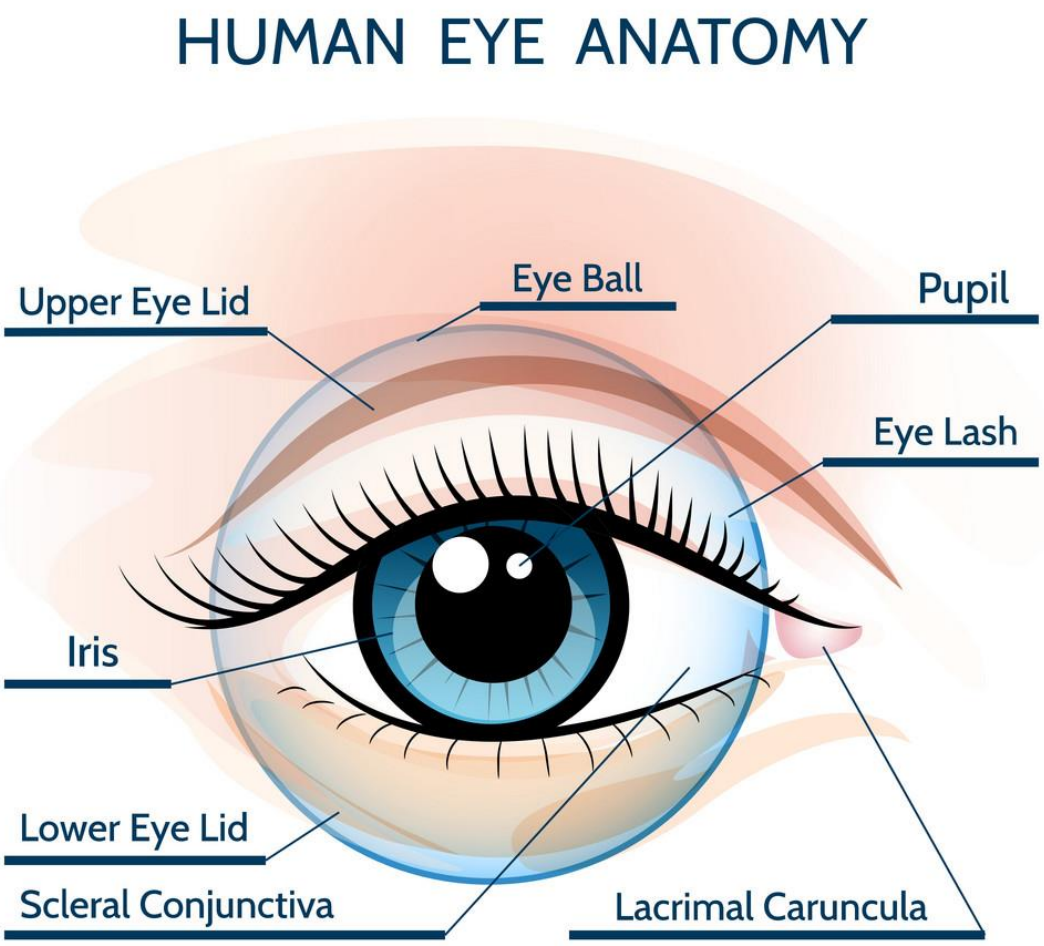
As the Associate Professor of Ophthalmology at King Edward Medical University, Lahore, Dr. Nasir Chaudhry brings a wealth of experience as a leading surgeon, educator, and academician. His commitment to excellence is evident in his numerous accolades, including prestigious awards for teaching and training services.

This resource is not merely a textbook but a comprehensive tool designed to nurture a generation of skilled Ophthalmic Technicians. Dr. Chaudhry's foresight in balancing practicality, exam orientation, and updated clinical knowledge ensures its relevance for postgraduate residents, aspiring professionals, and practitioners seeking to stay abreast of modern healthcare challenges.

In the spirit of progress and knowledge-sharing, this book stands as a guide, inspiring a deep interest in the pursuit of excellence in Allied Health Sciences.

Table of Contents

Unit 1: Ocular Anatomy

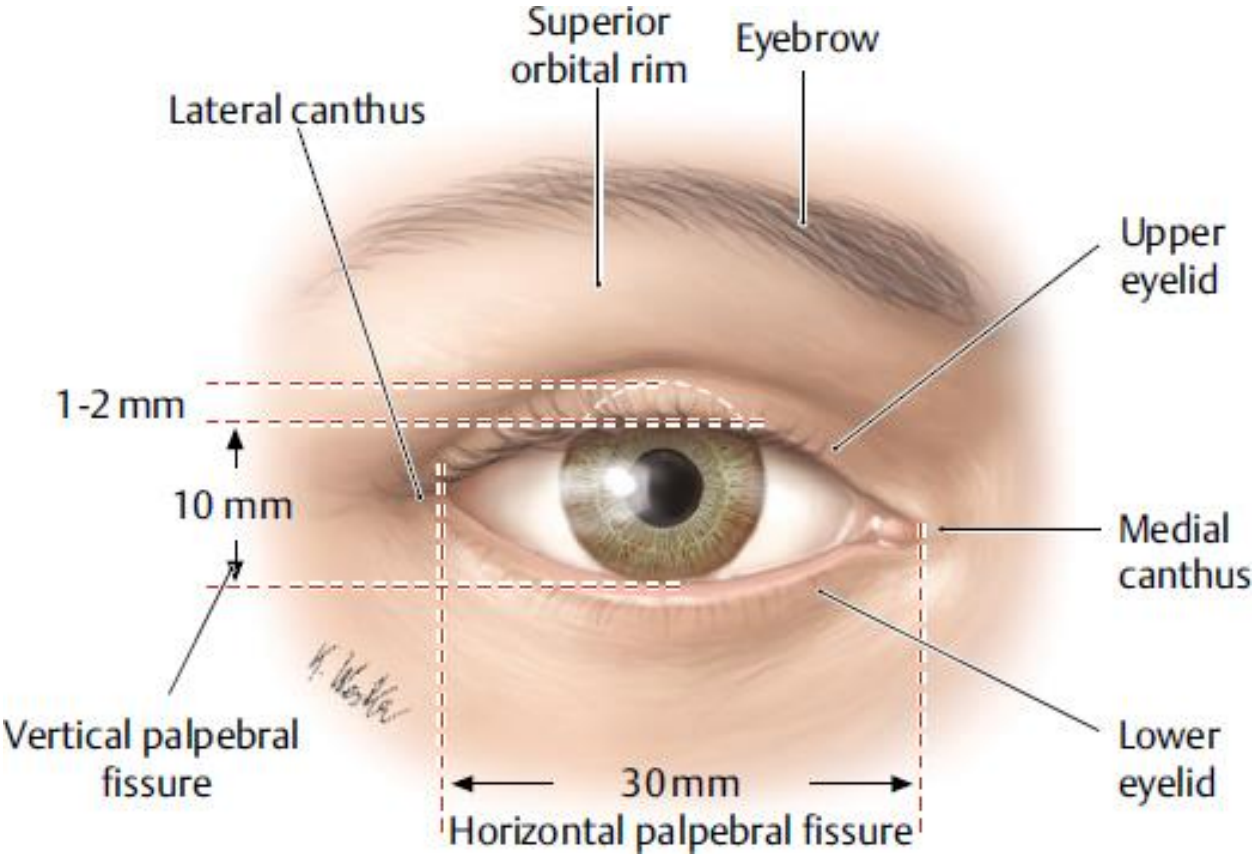


EYE- SURFACE ANATOMY

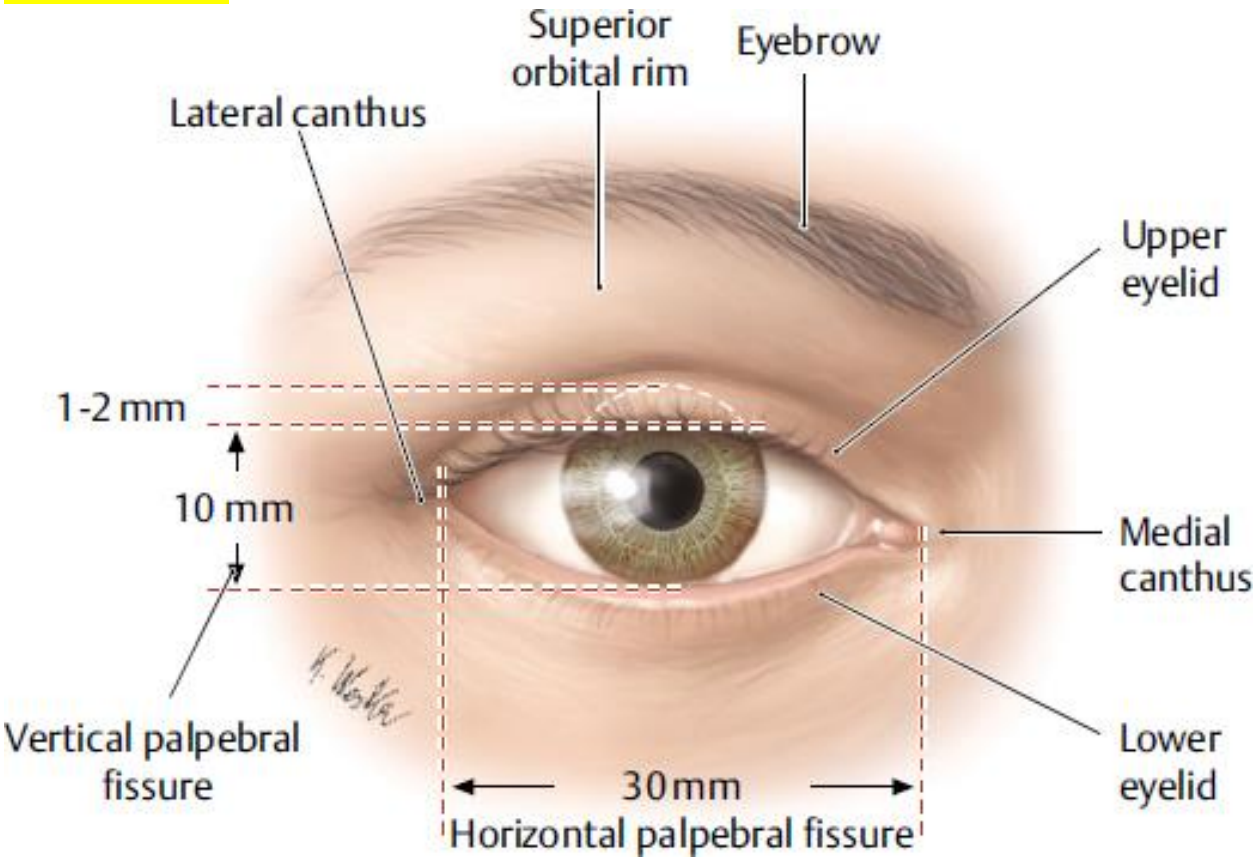
The eye is the organ of sight situated in the orbital cavity. It is almost spherical in shape and its diameter is 24 mm. Both eyes in human body function as a pair. Each eye is covered externally by moveable folds called eyelids(upper and lower). The triangular spaces, formed by the junction of the upper and lower lids, are called the **canthi.**

When the eyes are open, the average **palpebra**l **fissures** measure about 27 to 30mm in width and 8 to 11mm in height.

The portions of the eye that are normally visible in the palpebral fissures are the cornea and sclera.



TERMS



1.1TERMS AND DEFINITIONS

Anatomy

It is branch of biology that studies the structure of living organisms.

Anterior

It means any front or forward part of body.

Posterior

It means any back or rear part of body.

Superior

It means one structure of body is present above the other structure.

Inferior

It means one structure is present below the other structure.

Eyeball

It is spherical structure that is responsible too see objects around living organisms.

Palpebral fissure

It is an area between upper and lower and eyelids where cornea and sclera are visible.

Optic nerve

It is bundle of neurons that connects eye with brain and send visual information to brain.

Pupillary reflex

It is change of shape of pupils in response to light source.

Convex lens

It is transparent optical structure that is thicker in center and thinner at margins. It converges the parallel light rays to a focal point.

Concave lens

It is thinner in center and thicker at margins. It diverges the light rays.

Color Vision

It is ability of eye to perceive different wavelengths of light as different colors.

Color blindness

In this disease one can not see explain different colors at a time.

Night blindness

It is disease in which one cant not see objects in dim light or at night. Its most common cause is vitamin A deficiency.

Myopia

It is also called nearsightedness ,in which one can see only near objects clearly.

Hyperopia

It is farsightedness in which one can see far objects clearly.

Exotropia

It is disease of eye in which one or both eye balls are turned horizontally outward from its normal position.

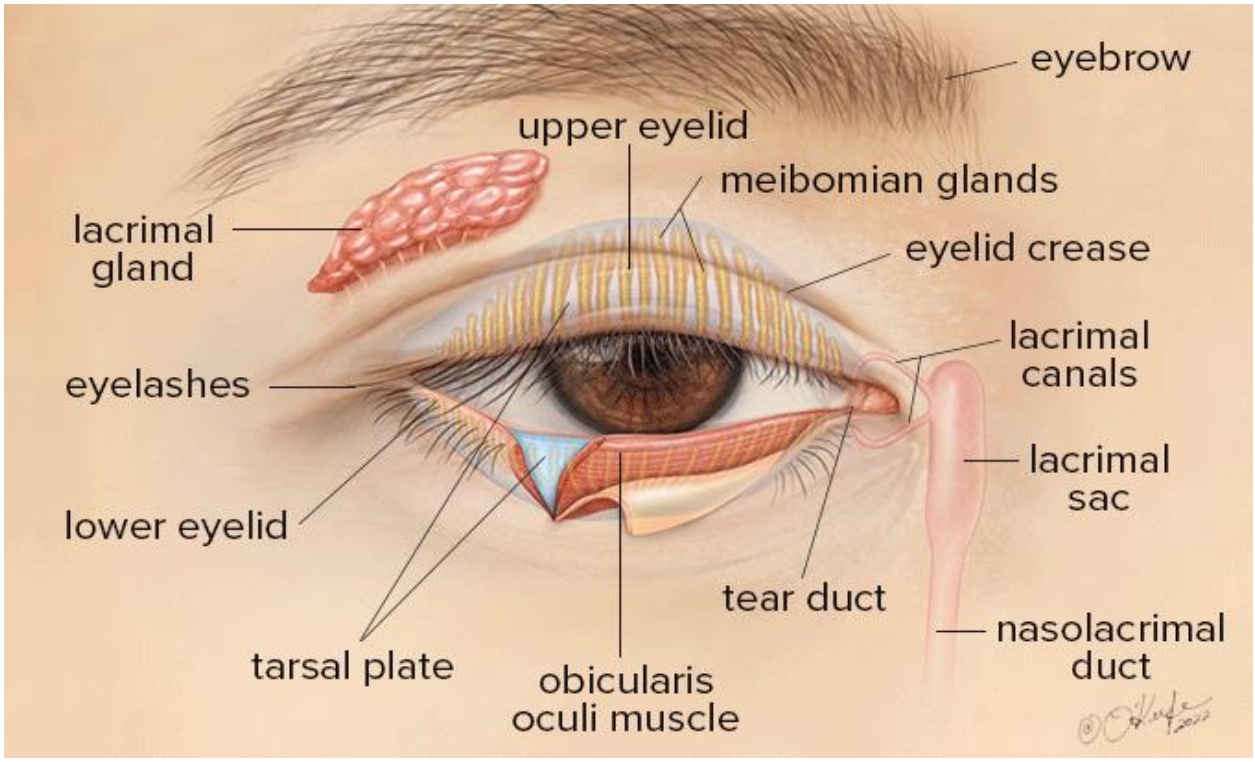
Esotropia

In this disease eyeball is turned horizontally inward from its normal position.

1.2 EYELID

Applied Anatomy

Eye lid is a complex structure comprised of different layers from epidermal surface inward. Skin of eyelid consists of epidermis, dermis and related structures and it is the thinnest skin in the human body.



A. EPIDERMIS

It consists of four layers

1. Keratin layer
2. Granular cell layer
3. Prickle cell layer
4. Basal cell layer

B. DERMIS

Composed of connective tissue , blood vessels, lymphatics and nerves.

C. SUBCUTANEOUS CONNECTIVE TISSUE

The connective tissue is loose over here and there is no fat in it.

D. ORBICULARIS OCULI MUSCLE

It is the muscle of protraction for eyes. It is divided into

a. Orbital Part

Its function is to close the lid voluntarily.

b. Palpebral part

It helps in the closure of the eyelids both voluntarily and involuntarily.

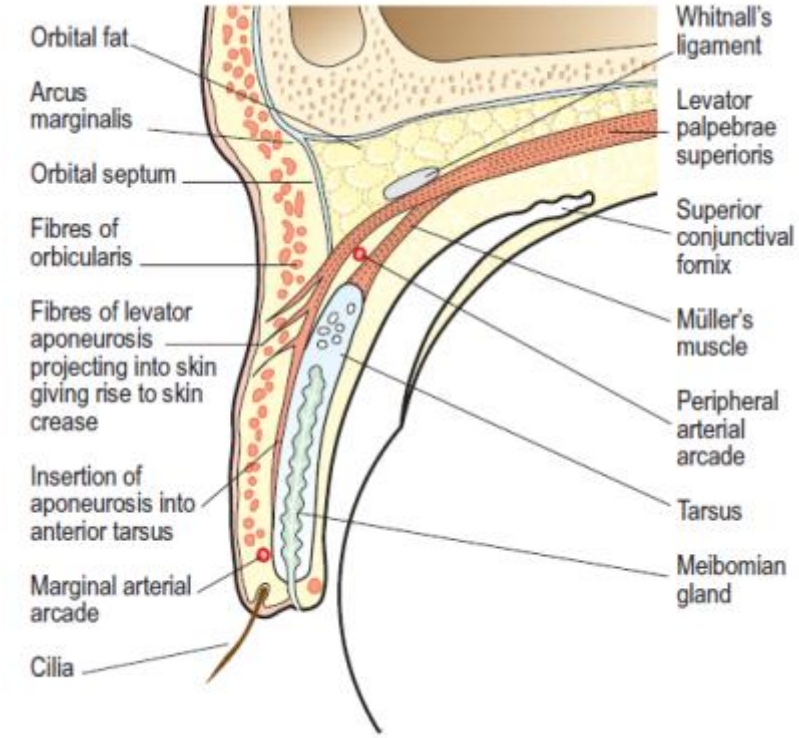
It is supplied by 7th cranial nerve or facial.

E. ORBITAL SEPTUM

It is a thin sheet of connective tissue that limits the spread of infections or fluids anteriorly or posteriorly.

F. TARSAL PLATE OR TARSUS

It is dense connective tissues plate present behind orbital septum. It has meibomian glands at its distal margin.



G. ORBITAL FAT

It lies behind the orbital septum arranged as two fat pads in the superior septum and three posterior to the inferior septum.

H. MUSCLES OF RETRACTION

a. Levator palpabrae superioris(LPS)

It lifts the eyelid about 15mm and supplied by 3rd cranial nerve or oculomotor nerve.

b. Muller Muscle

It originates from the inferior surface of LPS . It is supplied by sympathetic nerve and retracts the eyelid about 1-2mm.

c. Lower Lid retractor

It comes from inferior rectus muscle and supplied by 3rd cranial nerve or oculomotor nerve.

LID MARGIN

It has following structures

A. Two to three rows of Eyelashes arranged along anterior edge of eyelid margins

B. Grey line

C. Orifices of meibomian glands

D. Glands of zeis and moll

E. Mucocutaneou junction.

FUNCTIONS OF EYELID

There are following functions of eyelids

.Protraction (close eyes)

.Retraction (open eyes)

.Lubrication by blinking

.Removal of debris by blinking.

.Prevent dryness and maintain eye health.

BLOOD SUPPLY

Ophthalmic artery and lacrimal artery supply the lids.

LYMPHATIC DRAINAGE

Submandibular and preauricular nodes drain the lymphatics.

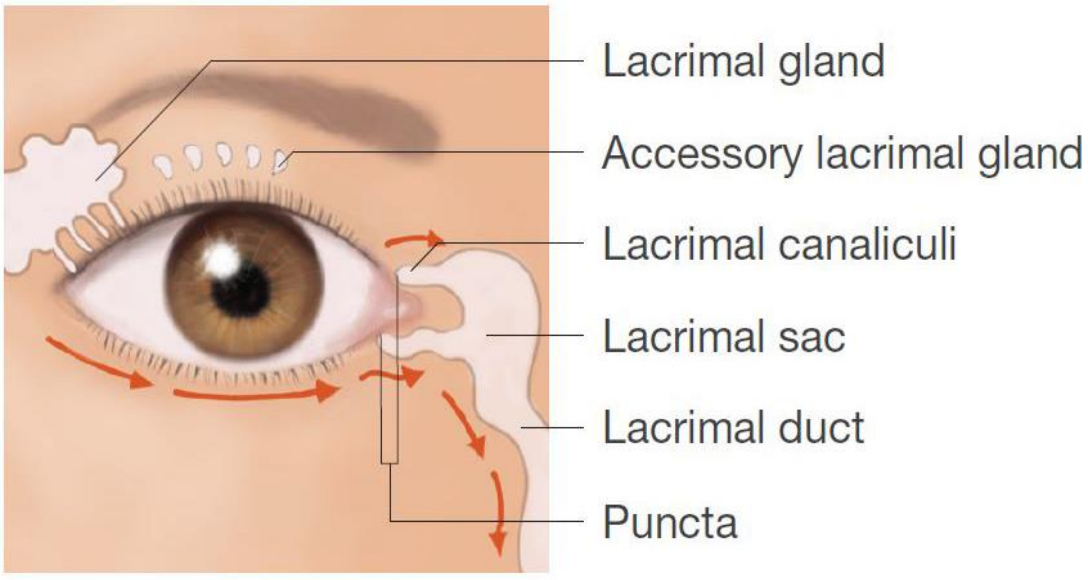
NERVE SUPPLY

Sensory supply is through ophthalmic and maxillary branch of 5th cranial nerve or trigeminal nerve. Motor supply to levator muscles is from oculomotor nerve and to orbicularis oculi muscle is from facial nerve and muller muscle is supplied by sympathetic nerve.

1.3 LACRIMAL SYSTEM

LACRIMAL GLANDS

Lacrimal gland is situated in the lacrimal fossa formed by frontal bone.
Its ductules open into the upper lid.

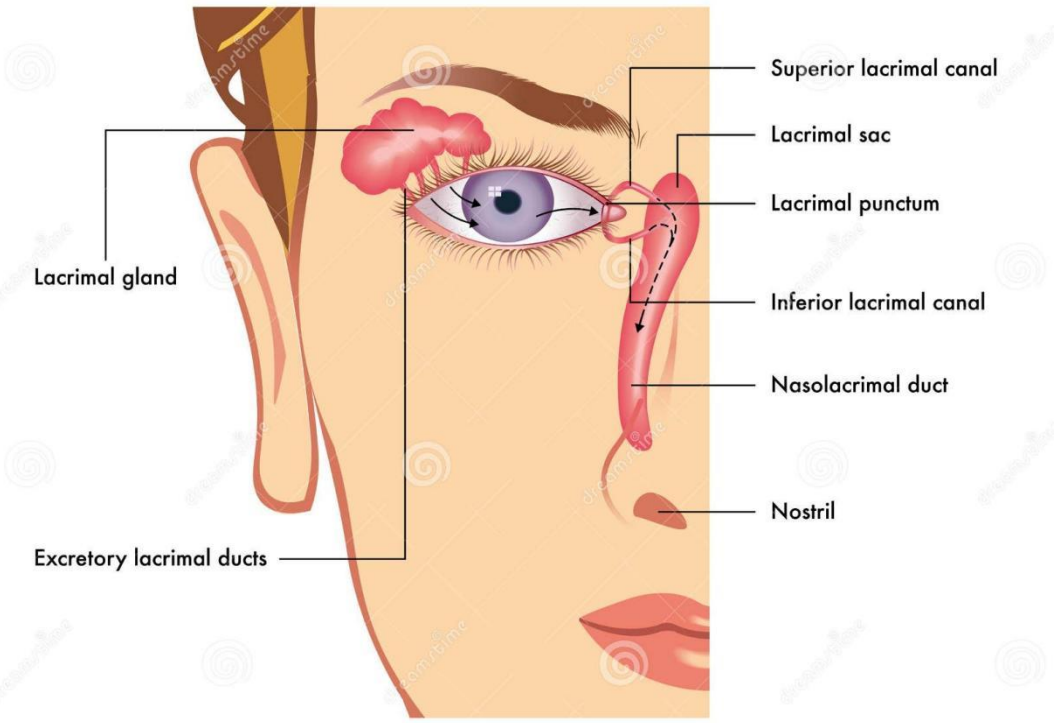


It is supplied by lacrimal artery and venous drainage into superior ophthalmic vein.
Its nervous supply is via pterygopalatine ganglion (parasympathetic) and by superior cervical ganglion (sympathetic).

The glands of Krause and Wolfring are **accessory lacrimal glands.**

LACRIMAL PASSAGES

Passage consists of puncta, canaliculi, lacrimal sac and nasolacrimal duct.



PUNCTA

a pair of puncta for each eye , located at posterior margins of the upper and lower eye lids near medial canthus and open into lacrimal canaliculi. These canaliculi connect puncta to lacrimal sac and are about 8-10mm in length. In 90 % of the cases upper and lower canaliculi join to form common canaliculi which opens into lacrimal sac.

LACRIMAL SAC

Located in the lacrimal fossa located in the medial orbital wall.

NASOLACRIMAL DUCT

It connects the sac to the inferior meatus of the nose. It is about 15-18mm long and lies in the bony canal.

1.4 TEAR FILM

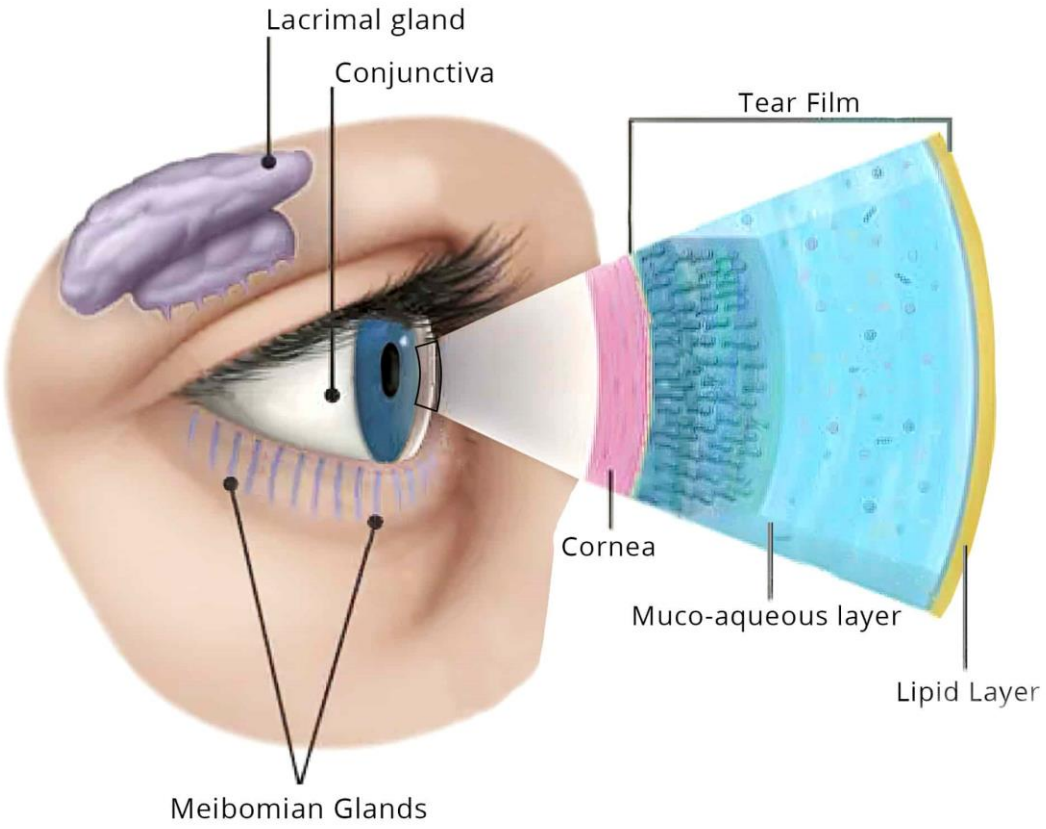
These are secretions from the lacrimal, accessory glands and meibomian gland.

Composition

Tear composed of water mainly with minute quantity of salts and other compounds.

Layers of Tear Film

1. Most superficially is Lipid layer consists of cholestrol esters and lipids. It is secreted by meibomian glands.
2. Mucoaqueous layer is inner layer composed of water, electrolytes, inorganic salts, urea, protein, glucose and mucin which is secreted from conjunctival goblet cells.



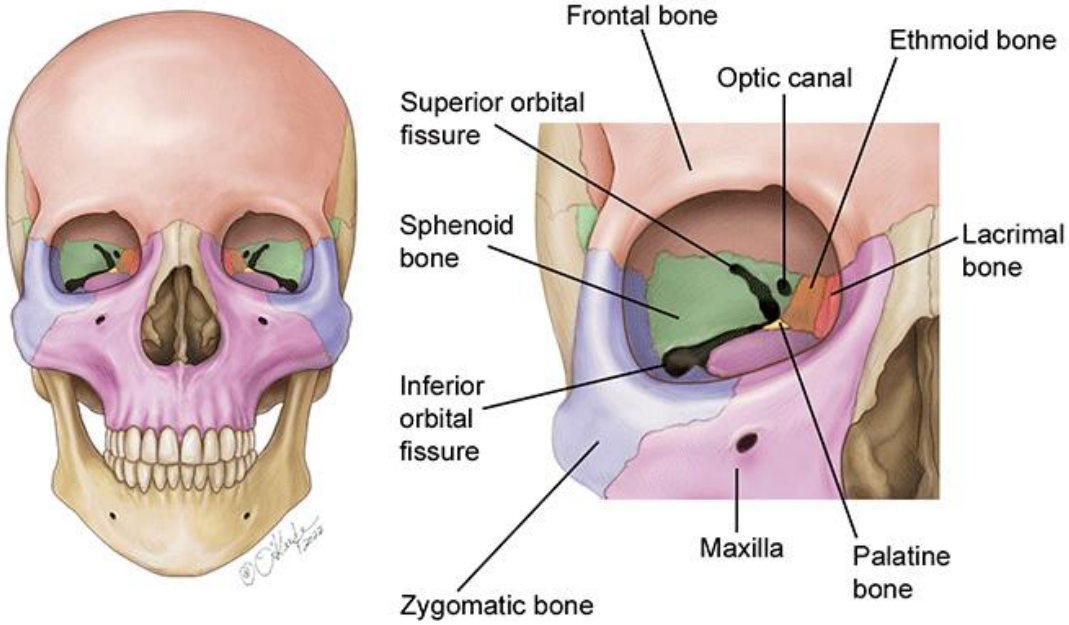
Functions of Tear Film

1. It coats the superficial surface of cornea and provides nutrition.
2. It lubricates corena and conjunctiva to maintain its smooth refracting surface.
3. Prevents from microorganisms as it contains bactericidal lysozymes.
4. Facilitates the movements of eyelids.

1.5 ORBIT

The orbit is a pyramidal structure, with the apex pointing posteriorly to the optic canal and the base anteriorly.

The boundaries of the orbit are formed by seven bones.



ROOF

Superior wall is formed by the frontal bone and lesser wing of sphenoid bone.

FLOOR

Inferior wall is formed by maxilla, palatine and zygomatic bones.

MEDIAL WALL

Formed by ethmoid, maxilla, lacrimal and sphenoid bones.

LATERAL WALL

Formed by the zygomatic bone and greater wing of the sphenoid.

APEX

Located at the opening to the optic canal, the optic foramen.

BASE

Opens out into the face, and is bounded by the eyelids. It is also known as the orbital rim.

1.6 CONTENTS OF ORBIT

The bony orbit contains eyeballs and related structures

EXTRAOCULAR MUSCLES-there are 7 muscles responsible for movement of eyeball and superior eyelid.

They move the globe in all directions.

The **medial rectus muscle** moves the eye toward the nose. It is supplied by 3rd cranial nerve.

The **lateral rectus muscle** moves the eye horizontally to the outer side. It is supplied by 6th cranial nerve.

The **superior rectus** muscle elevates the eye primarily.It is supplied by 3rd cranial nerve.

The **inferior rectus** muscle depresses the eye. It is supplied by 3rd cranial nerve.

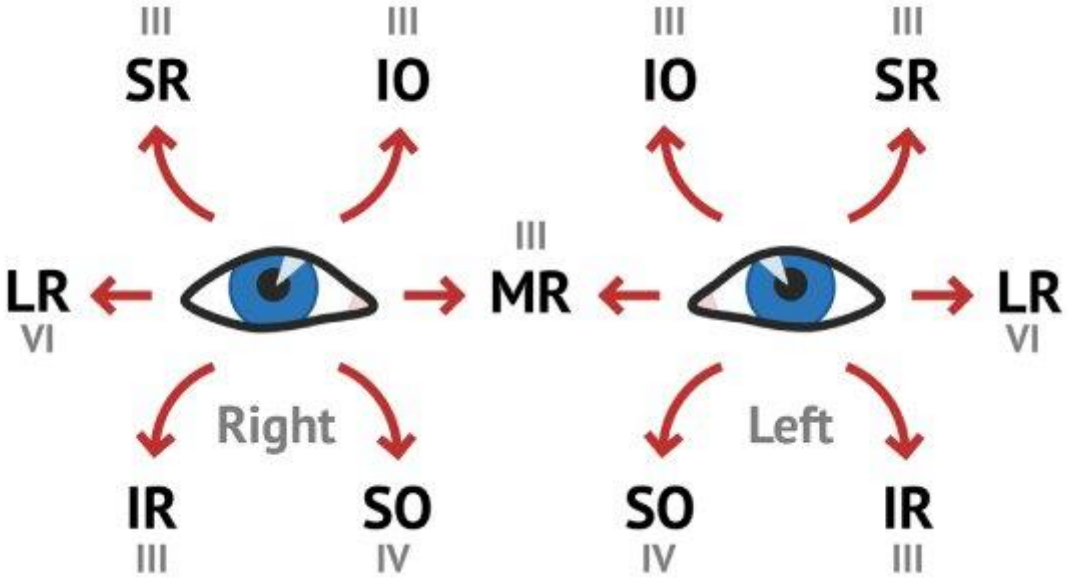
The rectus muscles are inserted very close to the limbus, the medial rectus lying approximately 5.5mm and the lateral rectus approximately 7mm from the limbus.

The **superior oblique muscle** rotates eyeball towards the nose; it also functions to depress the eye. It is supplied by 4th cranial nerve.

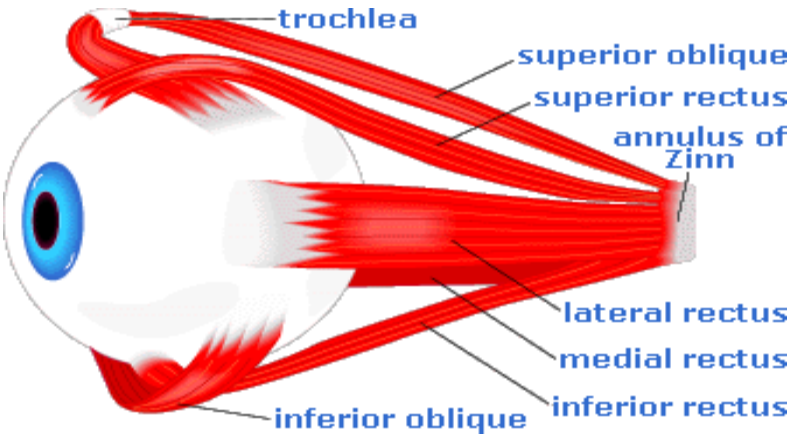
The **inferior oblique muscle** moves eyeball outwards and also elevates the eye. It is supplied by 3rd cranial nerve.

The oblique muscles are inserted behind the equator of the globe.

Functions and nerve supplies of muscles are drawn below for easy learning:



In the lid, the **levator palpebrae superioris** muscle serves to elevate the lid, whereas the **orbicularis oculi** muscle closes the eye during winking, blinking, or forced lid closure. If the levator muscle is weak or absent, the lid droops and ptosis results.



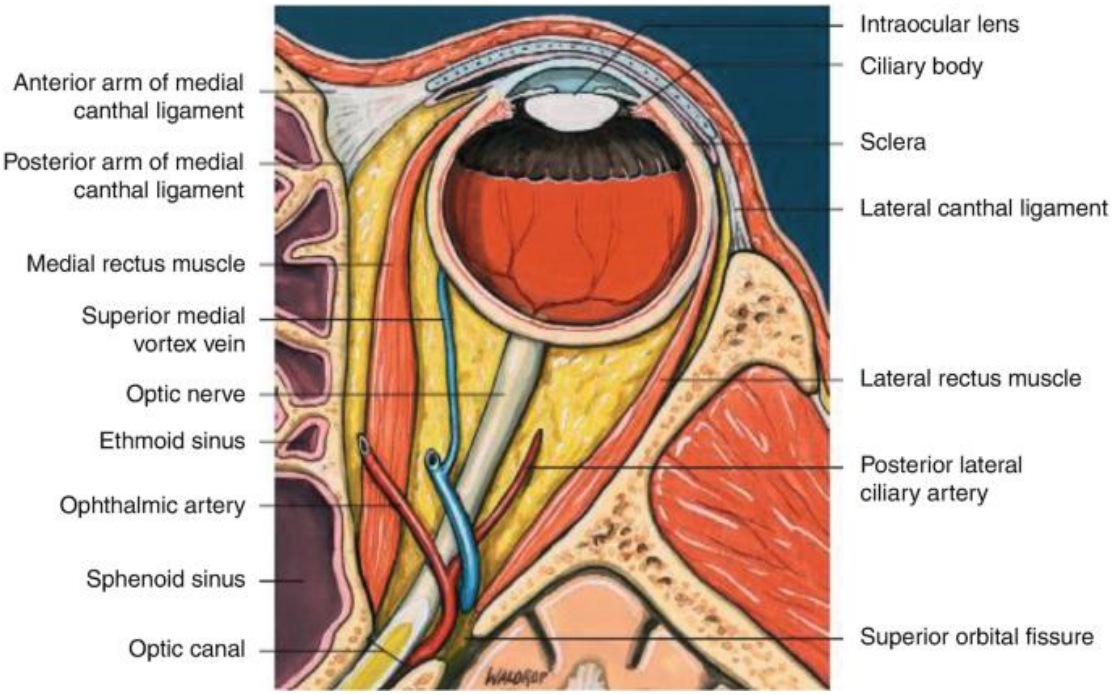
NERVOUS SUPPLY

Except superior oblique and lateral rectus muscle , all muscles are supplied by 3rd cranial nerve or oculomotor nerve.

Superior oblique is supplied by 4th cranial nerve or trochlear nerve.

Lateral rectus is supplied by 6th cranial nerve or abducent nerve.

V<u>ESSELS</u>- ophthalmic artery and ophthalmic veins.



PATHWAYS IN THE ORBIT

There are three main pathways by which structures can enter and leave the orbit

A. Optic canal

It transmits the optic nerve and ophthalmic artery.

B. Superior orbital fissure

It transmits the lacrimal, frontal, trochlear, oculomotor, nasociliary and abducent nerves. It also carries superior ophthalmic vein.

C. Inferior orbital fissure

It transmits the zygomatic branch of the maxillary nerve, the inferior ophthalmic vein, and sympathetic nerves.

There are other minor openings into the orbital cavity.

The **nasolacrimal canal**, which drains tears from the eye to the nasal cavity. Other small openings include the supra orbital **foramen** and **infraorbital canal**.

FUNCTIONS

The main function of the bony orbit is to protect the eyeball and the related structures like vessels and nerves.

1.7 CONJUCTIVA

It is thin, semi- transparent mucous membrane of the eye covering the inner surface of eyelids. It lubricates the eye by producing mucus and tears in small quantity.

It has two parts

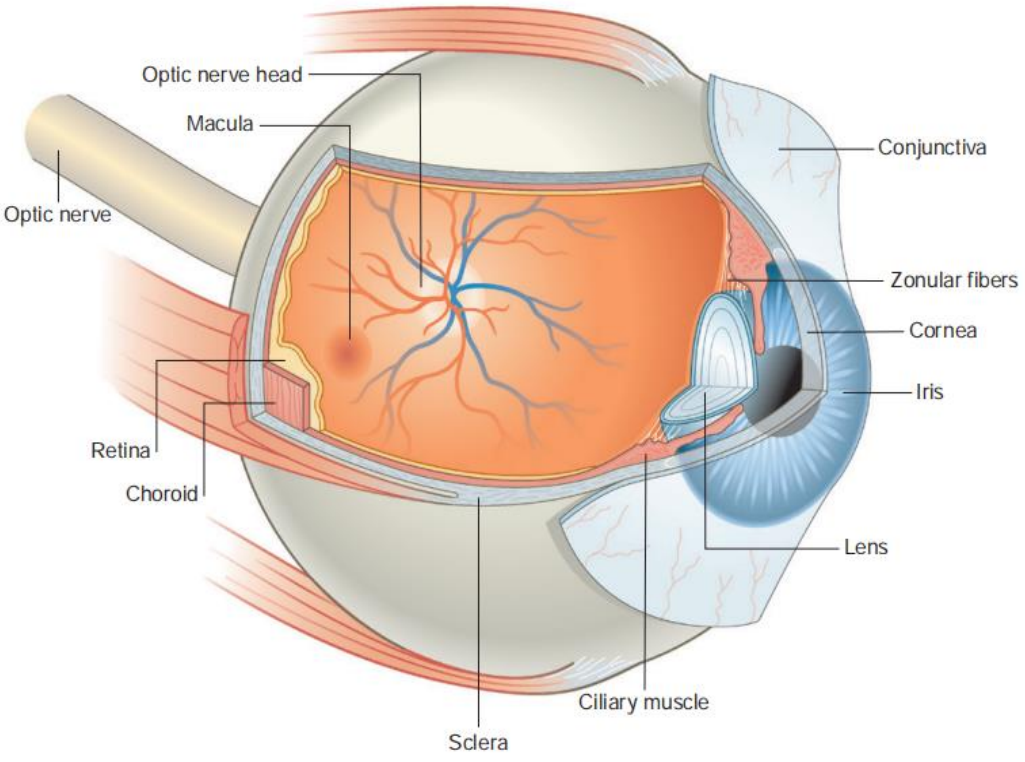
A. Palpebral conjunctiva which covers inner surface of eyelids.

B. Bulbar conjunctiva covers the visible part of sclera.

Conjunctiva has two layers I.e. epithelial and stromal. It also helps to protect the eye by preventing the entry of microbes into the eye.

1.8 EYEBALL

The eyeball is a bilateral and spherical organ lying in the bony orbit with the facial skeleton housing the structures responsible for vision.



Its structures are arranged in three layers as follows:

1- Outer Fibrous Layer (Corneo-scleral layer)

2- Middle uveal layer

3- Inner retintal layer

And interior of eyeball having anterior segment, crystalline lens and posterior segment(vitreous cavity)

Outer Fibrous Layer (Corneo-scleral layer)

This layer is divided into cornea and sclera providing shape and protection to the inner structures of eyeball.

1.8a CORNEA

The transparent layer comprising anterior one sixth of the outer layer. It covers Iris, Pupil and anterior chamber. It plays important role in the vision I.e accounts for two-thirds of the eye's optical power.

The average refractive power of cornea is +43 Diopters.

Cornea has five layers

1. Corneal Epithelium

It is non keratinized Stratified squamous layer

2. Bowman membrane

It is acellular superficial layer of the stroma formed by collagen fibers.

3. Corneal stroma

It accounts for 90 % of corneal thickness. It comprises 78 % water along with collagen fibrils.

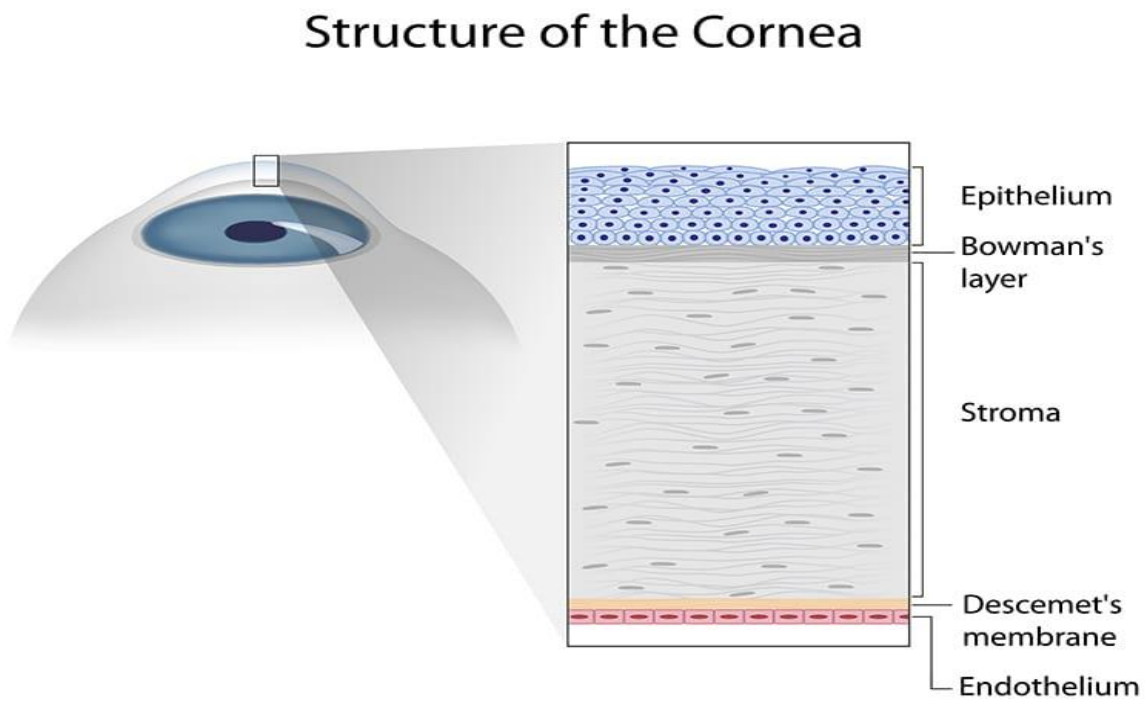
4. Descemet's membrane

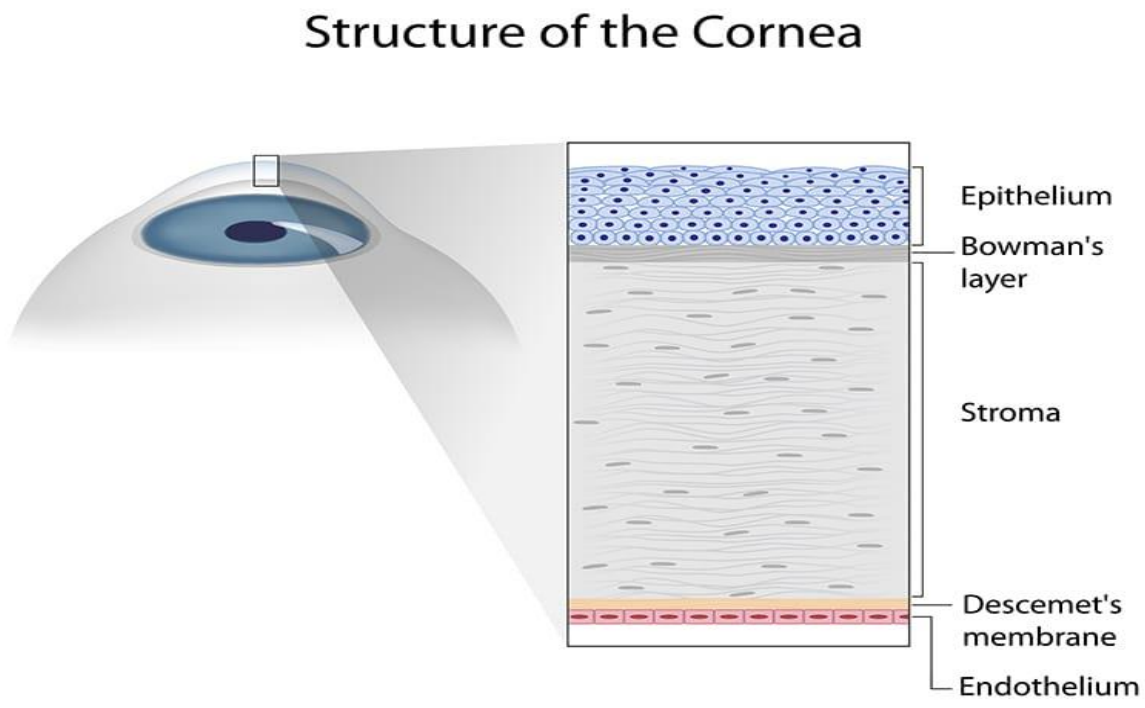
This is elastic layer consisting of collagen fibrils which are different from stromal fibrils. It forms basement membrane of the endothelial cells.

5. Corneal Endothelium

It is responsible for maintaining translucency of cornea.

The junction of cornea and sclera is gray semi-transparent area referred as **limbus.**





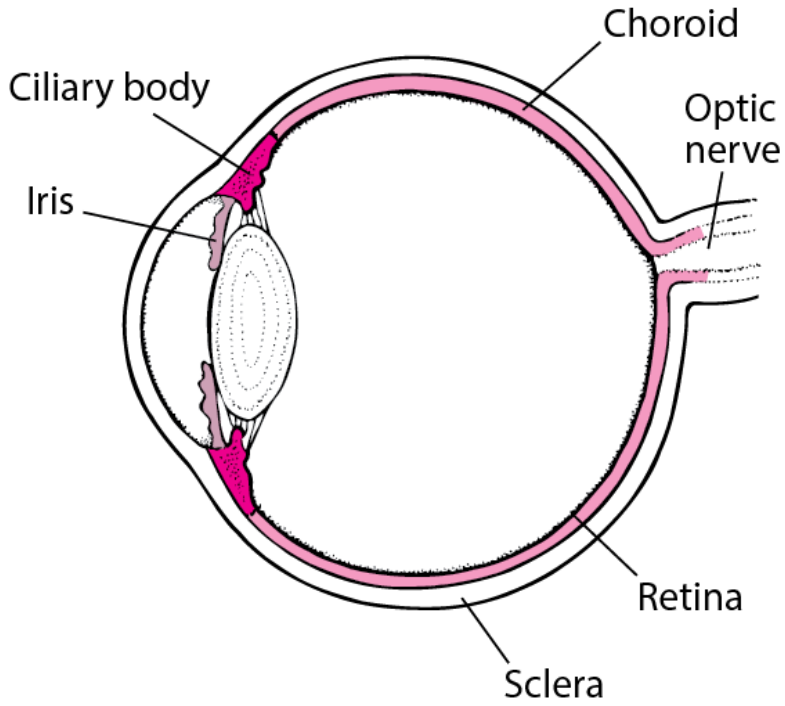
1.8b SCLERA

It is the non- transparent structure made of collagen, forming the 5/6th part of outer layer. It is the 1 mm thick white part of eye visible externally. It is relatively avascular section of the eyeball.

It provides site for muscle attachments and also helps in keeping the choroid and retina in correct shape.

1.8c Middle vascular layer (Uveal Layer)

Uveal layer also called uvea is highly vascular structure present under sclera.



Its main function is to provide nutrition to eye.

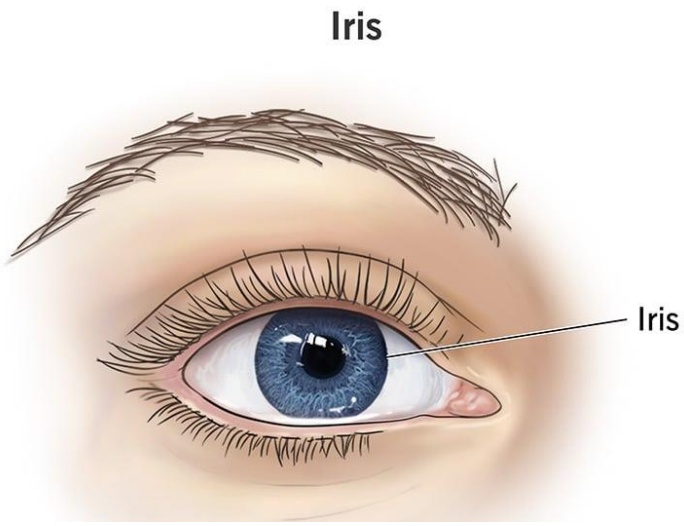
It has 3 parts

1. **Iris.**

It is pigmented structure which is similar to diaphragm of camera. Its functions are to give color to eye and control light entry by its central aperture called **Pupil.**

Pupil

The pupil is the circular opening in the center of the iris that regulates the amount of light entering the eye. In bright light, the pupil constricts (becomes smaller) to reduce the amount of light, and in dim light, it dilates (enlarges) to allow more light in. Changes in pupil size are controlled by the muscles of the iris.



2. **Ciliary body**

It is triangular in shape and consists of two parts **pars plicata and pars plana.**

It has 2 functions

1.Aqueous humor production

2.Lens accommodation

3. Choroid

It is highly vascular structure, situated between sclera and retina.

It has three layers

Inner capillaries layer

Middle small vessel layer

Outer large vessel layer

Function: Food and oxygen supply to retina

1.8d Inner Retinal Layer

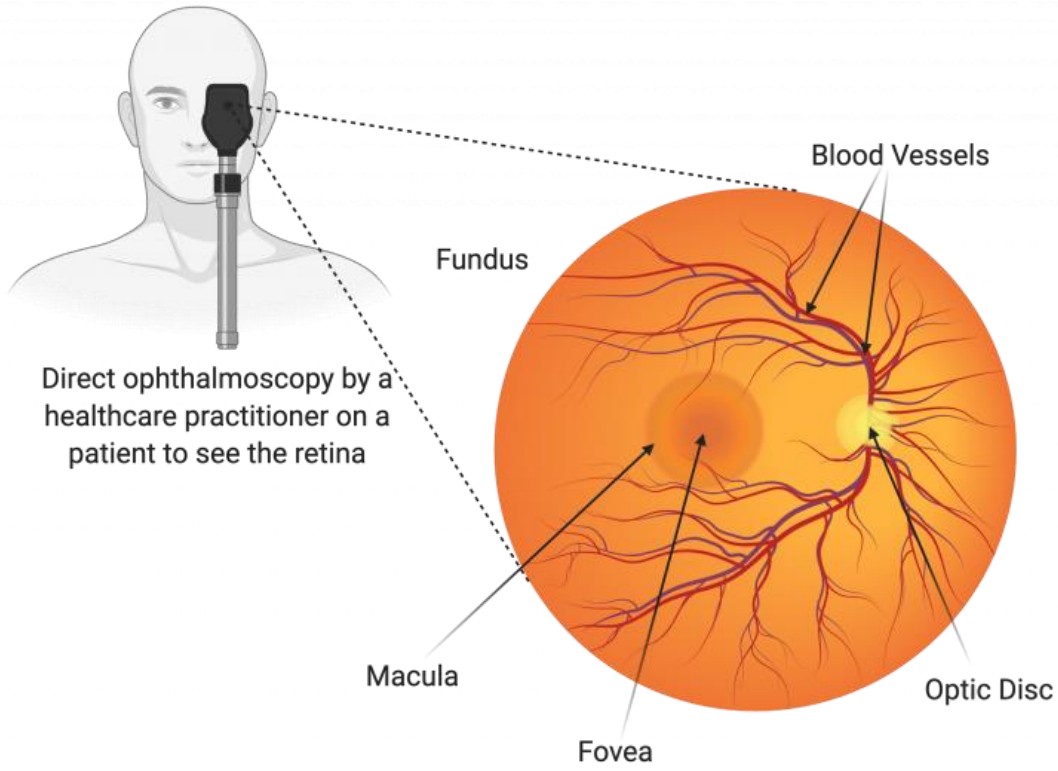
It is inner most layer which consists of 3 parts

1 Optic disc, which collects visual information from retina and send to brain.

2 Macula lutea

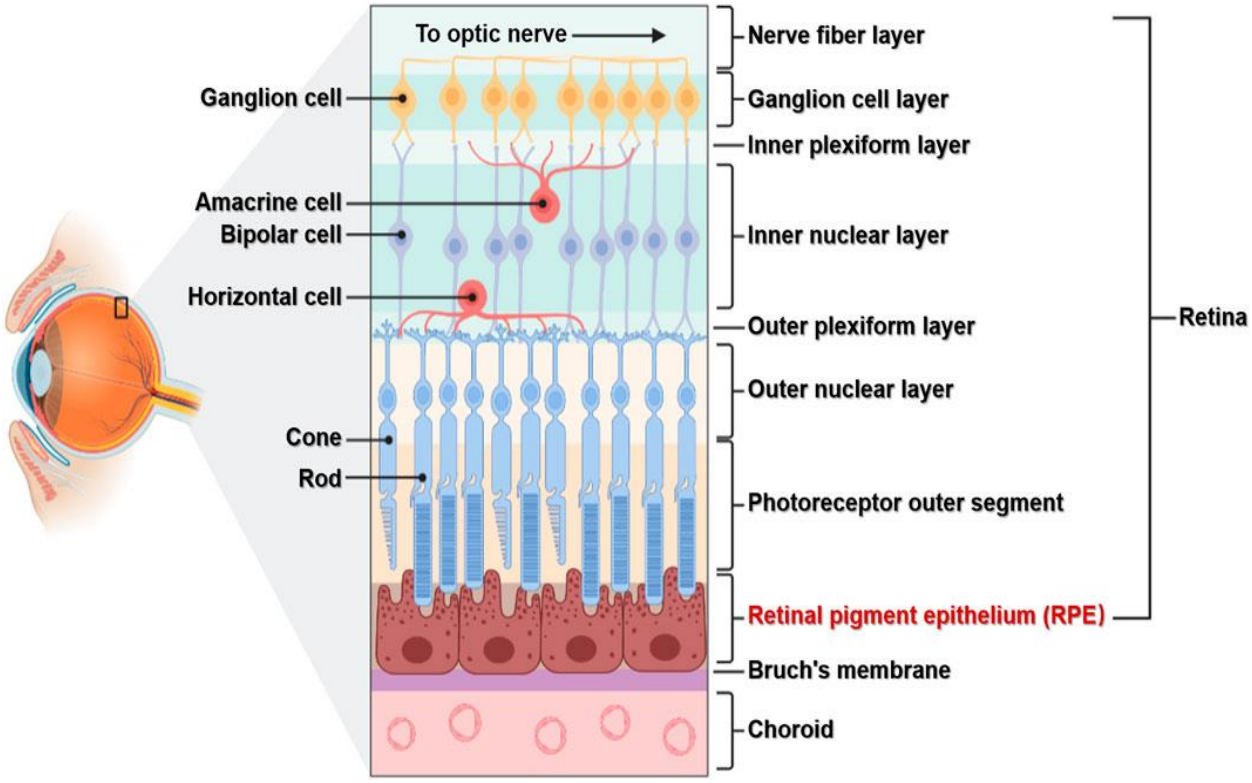
3 Peripheral retina,

The junction between retina and ciliary body is called ora serrata.



Retina has 10 layers

1. Retinal pigment epithelium
2. Layers of rods and cones
3. External limiting membrane
4. Outer nuclear layer
5. Outer plexiform layer



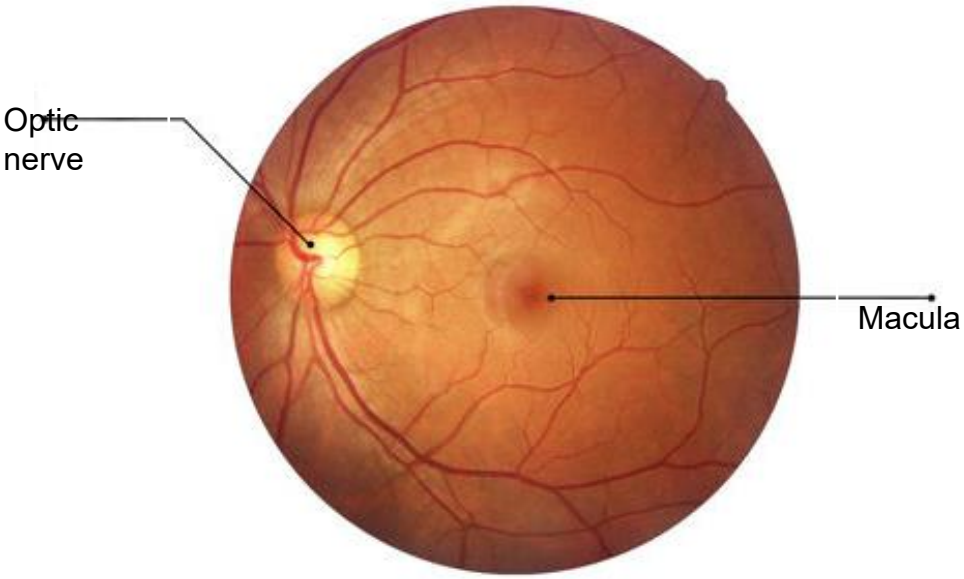
6. Inner nuclear layer
7. Inner plexiform layer
8. Ganglion cell layer
9. Nerve fiber layer
10. Internal limiting membrane

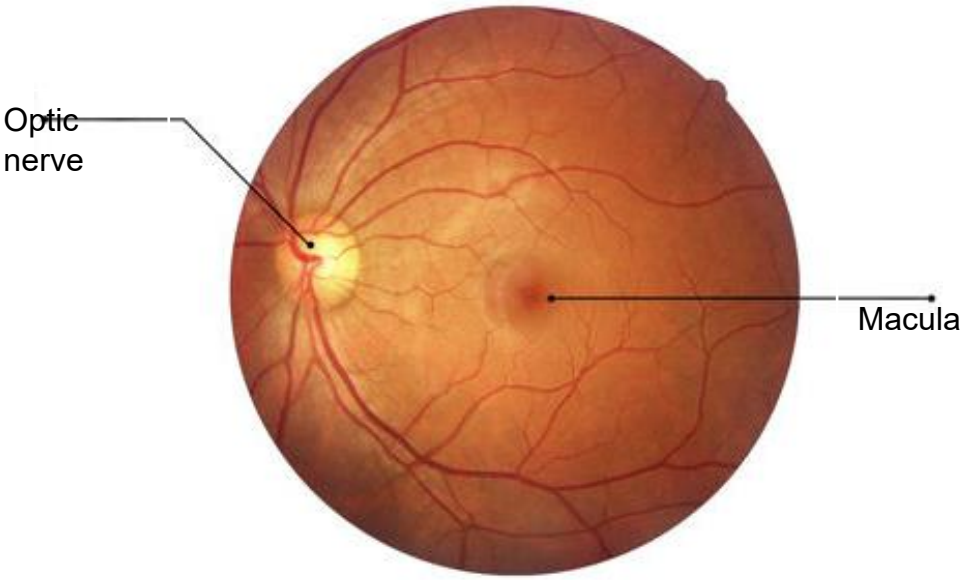
FUNTIONS OF RETINA:

Sends visual information to brain like;
Image formation
Color perception (It is function of cones)
Peripheral vision

1.9 MACULA

The macula is a small, highly sensitive area in the center of the retina at the back of the eye. It is responsible for central vision and allows us to see fine details clearly. Its diameter is 5-6mm.



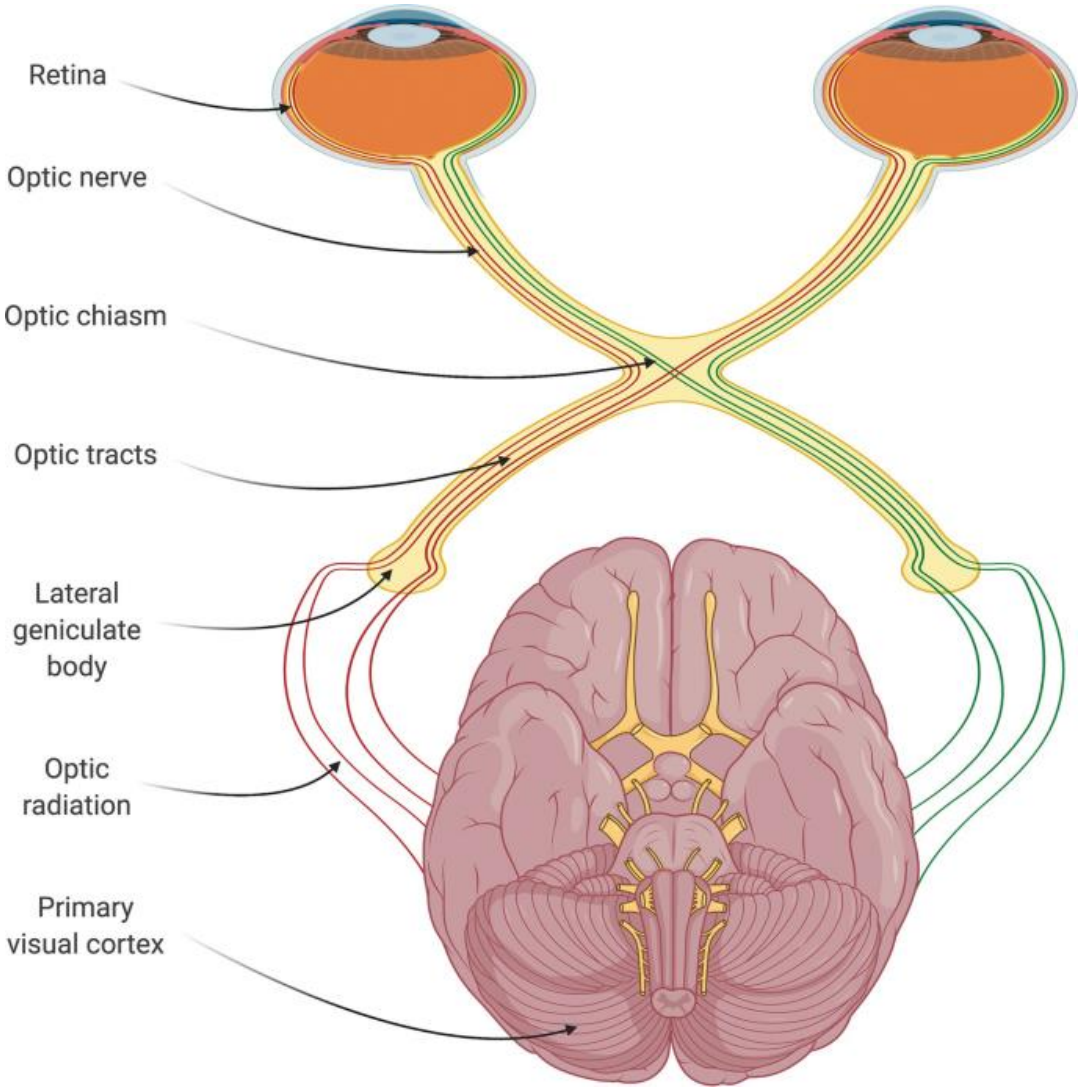


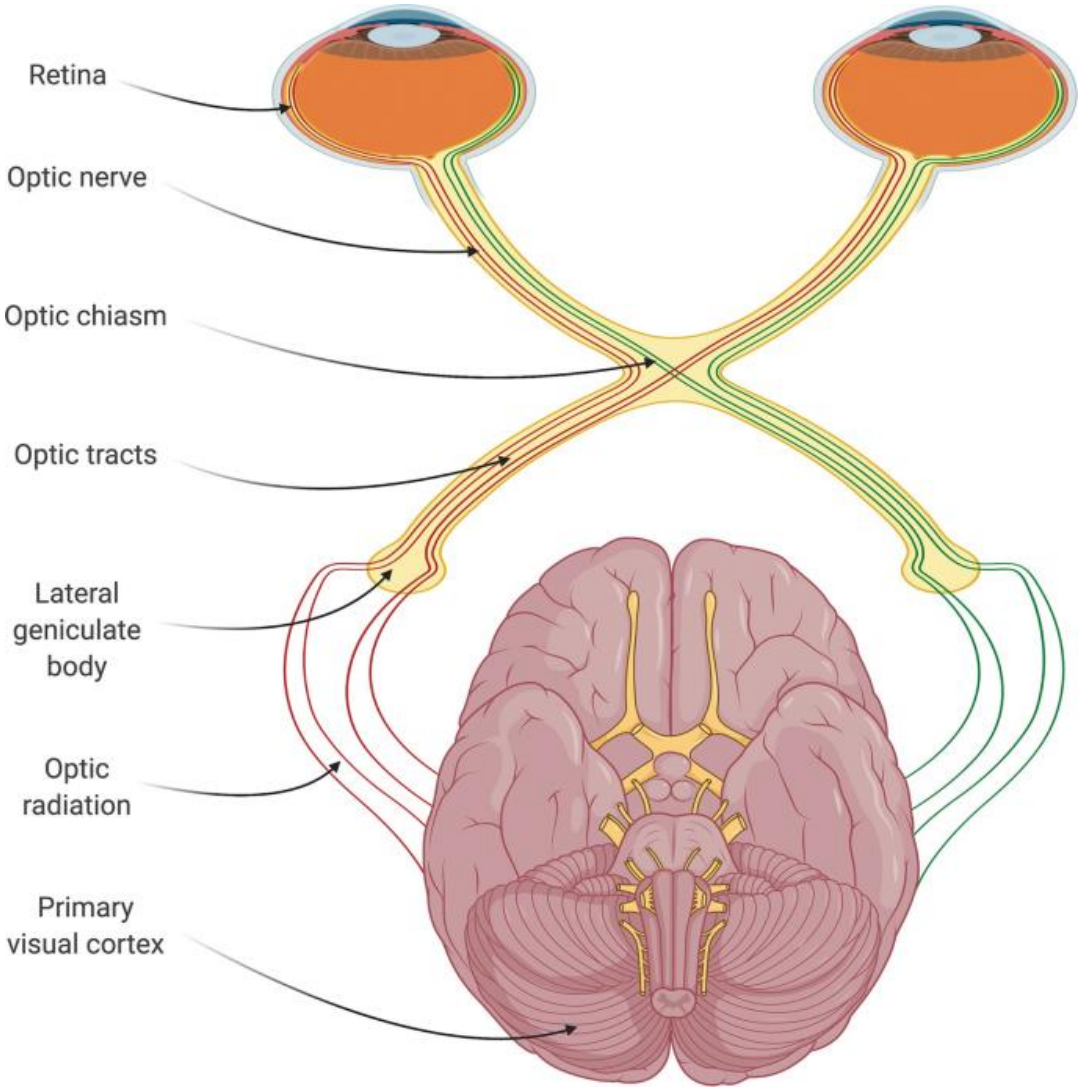
1.10 OPTIC NERVE

The optic nerve is the second cranial nerve and serves as the primary route for sending visual information from the eye to the brain via visual pathway. It consists of a bundle of nerve fibers that come from the retina, carrying visual signals in the form of electrical impulses. These impulses travel in the optic nerve and reach the brain, where they are processed to form the image of objects.

1.11 Visual Pathway

The visual pathway sends visual information from the eyes to the brain. Light enters the eyes and stimulates photoreceptor cells in the retina. Signals travel through the optic nerve and reaches the optic chiasm where some fibers cross to the opposite side. The optic tract continues to the lateral geniculate nucleus in the thalamus of brain. From there, optic radiation carry signals go to the visual cortex in the occipital(posterior) lobe of brain, where visual perception and images formed.





1.12 Interior of eye ball

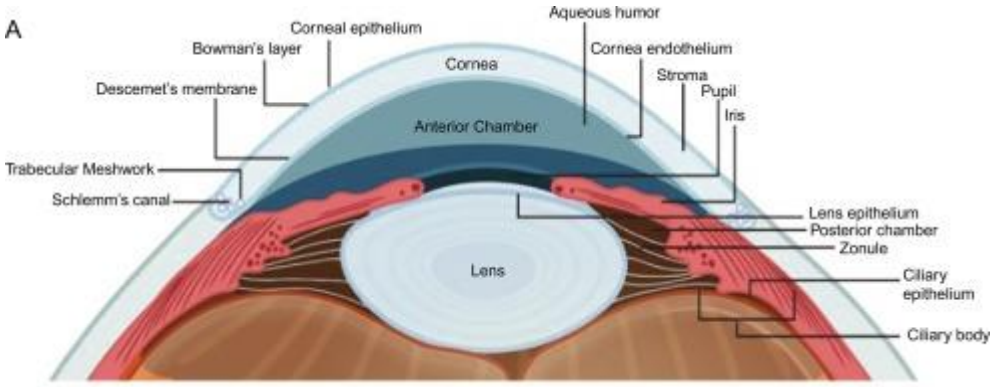
It consists of

1 Anterior segment

It has two parts

Anterior chamber

It is present between cornea (in front) and iris(behind) . It contains clear fluid aqueous humor.

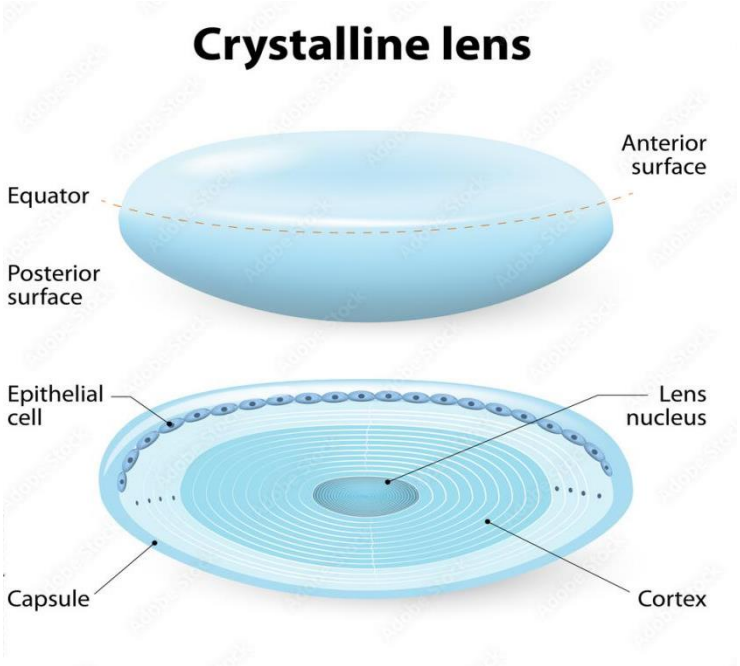


Posterior chamber

It is small space present between iris and lens

2 Crystalline lens

It is transparent biconvex structure which refract light and form image on retina.



It has no blood supply and nerve supply.

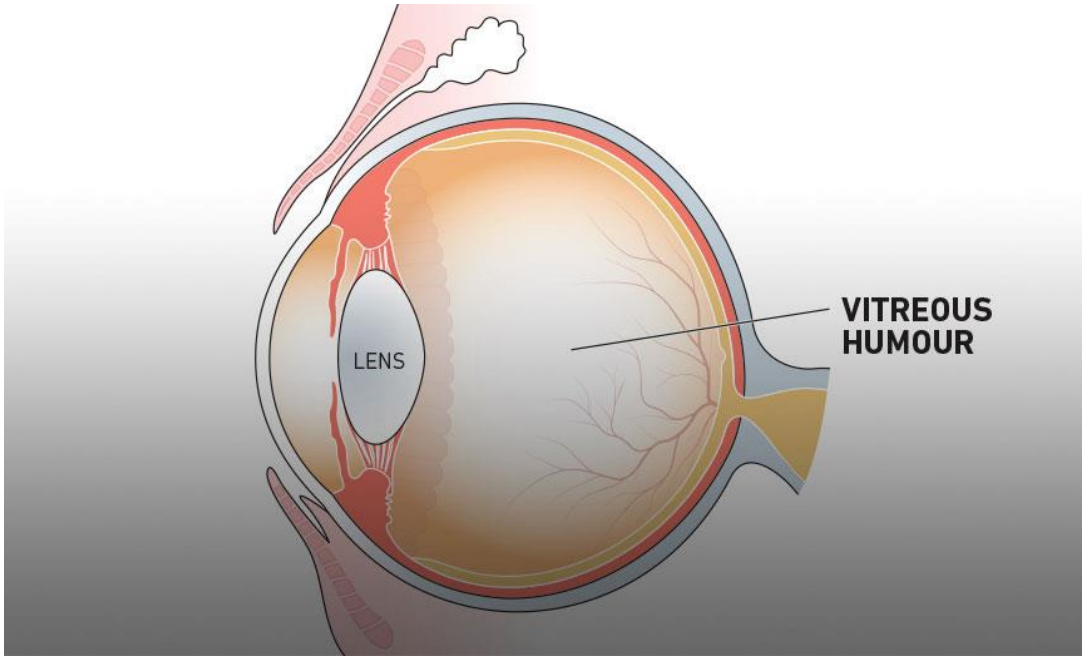
It consists of lens capsule, lens epithelium, lens fibers, cortex ,and central nucleus.

It takes its nutrition from aqueous humor and vitreous humor.

3 Posterior segment

It is also known as vitreous cavity which contains vitreous humor.

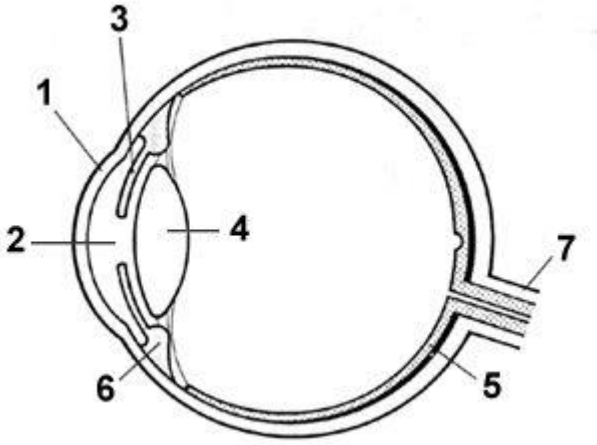
Vitreous humor is a gel like structure. It is present behind lens. On its behind aspect retina is present.



Function of vitreous is to
maintain the tone of eyeball and gives structural support to it.

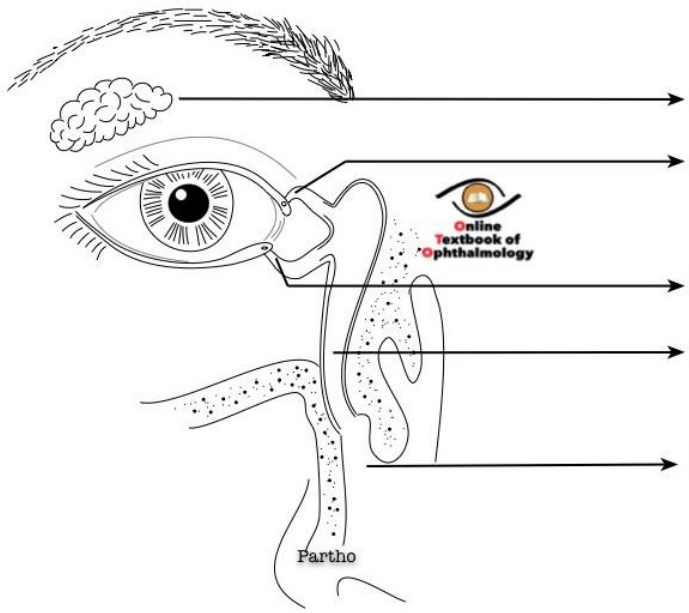
1.13 Assessment

Question 1. Identify and label the main parts of the eye on a diagram.

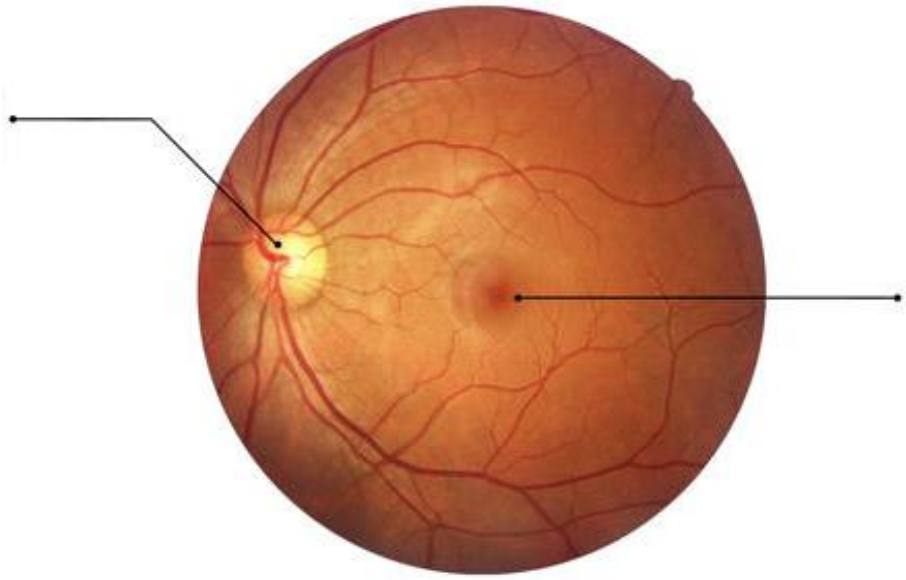


Question 2. Structure and function of eye lids.
Question 3. Describe the layers of retina.
Question 4. Briefly discuss the Structure of lens.
Question 5. Define Myopia ,hyperopia and presbyopia.
Question 6. Explain the role of the optic nerve.
Question 7. Importance of tear production in maintaining eye health.
Question 8. What is Accommodation?

Question 9. Label structures of lacrimal system.



Question 10. Draw and label Visual pathway.
Question 11. Name layers of eye ball and briefly Describe middle layer of eye ball?
Question 12. Explain layers of tear film.
Question 13. Name extraocular muscles and their nerve supply.
Question 14. Name the Structures



Question 15. Explain the layers of cornea.

Unit 2: Clinical Ophthalmology

2.1 TONOMETRY

Tonometry is a diagnostic test that measures your intraocular pressure (IOP), or the pressure inside your eye. Tonometry can help your healthcare provider determine if you're at risk for glaucoma. People with glaucoma have high intraocular pressure because the fluid inside the eye drains too slowly.

2.1.1 Intraocular pressure;

Normal intraocular pressure is 10-20 mmHg.

Suspicion of glaucoma: 20-25mmHg

Glaucoma: above 25 mmHg

2.1. Digital Tension; It is measured by palpating by fingers. Patient is asked to look down and sclera is palpated through upper lid beyond tarsal plate. The amount of fluctuation gives estimation of tension.

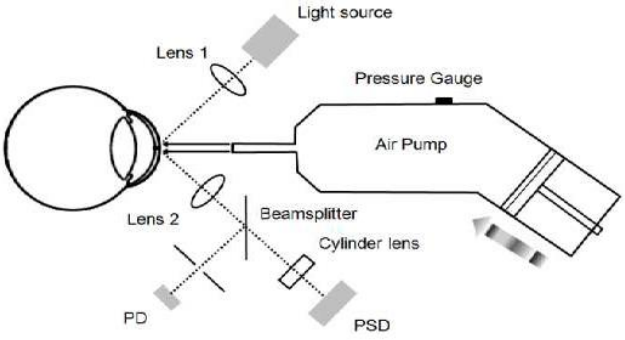
2.1.3 Schiotz tonometer;

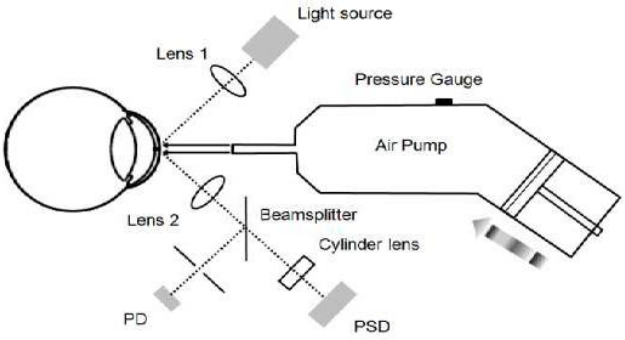
The depth of indentation of cornea is measured.

Advantages—It is easy to use, cheap, convenient to carry and does not need slit lamp.

Disadvantage—ocular rigidity can produce error.

2.1.4 Non-contact tonometry. Also known as air-puff tonometry, this test uses a puff of air to flatten your cornea. Non-contact tonometry isn't the most accurate way to measure the pressure inside your eye. However, it's commonly used as a simple screening tool and is the easiest way to test children





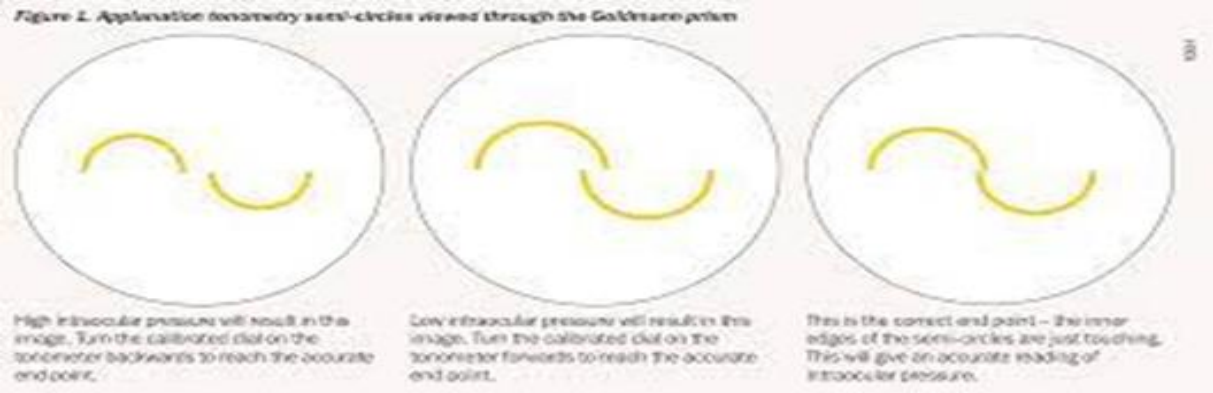
2.1.5 Applanation tonometer;

It is more accurate method. Cornea is flattened by plane surface. The applanation tonometer measures the intraocular pressure by flattening the cornea (rather than

indent) over a specific area 3.06mm. This is more accurate because sclera rigidity is ruled out in this.

Method;

1. Patient's eye is anesthetized with local anesthesia and fluorescein drop is put into eye
2. Put the patient's chin onto chin rest and forehead onto support provided.
3. Slit lamp is moved towards patient's eye while patient is looking straight with open wide eyes.
4. Slit lamp is moved till tip of tonometer touches the cornea.
5. By flattening cornea, a just bit, tonometer detect pressure in the eye.
6. Same procedure is repeated for the 2nd eye



Questions

1) What is tonometry? How it is performed?
2) How the intraocular pressure of the eye is measured? What are different types?
3) How do you perform tonometry in an uncooperative child?

2.2 OCULAR INJURIES

2.2 General considerations for ocular trauma:

Ocular trauma refers to any injury or damage to the eye, its surrounding structures, or the visual system. Here are some general considerations for ocular trauma:

1. **Urgency of evaluation:**

Ocular trauma often requires urgent evaluation by an eye care professional, especially in cases of severe injury or when there is a risk of vision loss.

2. **Multidisciplinary approach:**

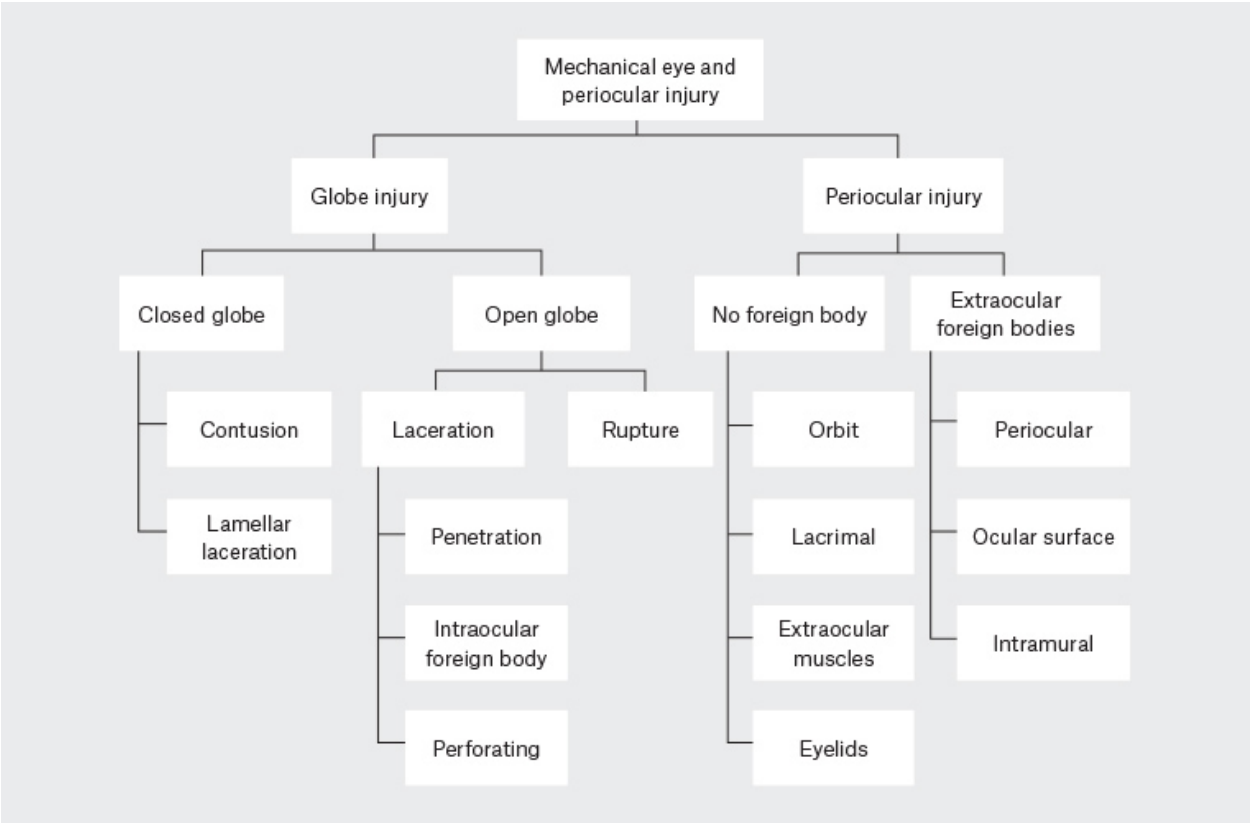
Management may involve collaboration with other medical specialists, such as ophthalmologists, emergency physicians, and trauma surgeons.

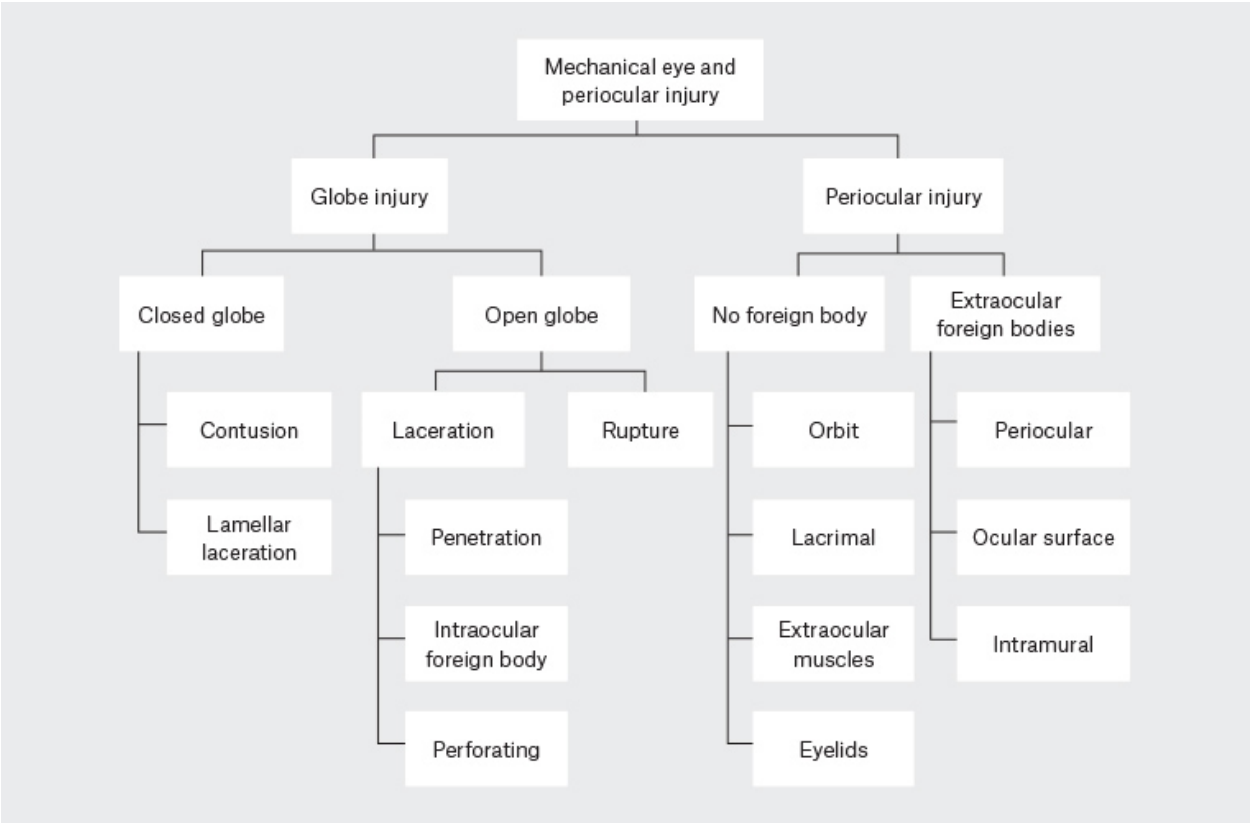
3. **Prevention:**

. Proper eye protection (helmets, safety goggles) especially in high risk activities or occupations, can significantly reduce the risk of trauma.

4**. Variable presentations:**

Ocular trauma can present with a wide range of symptoms, from minor discomfort to severe pain, vision loss, or obvious structural damage.





2.3 Causes of ocular injuries:

1. **Blunt trauma:**

Impact to the eye or surrounding structures, often resulting from accidents, falls, or sports related injuries.

2. **Penetrating and perforating injuries**:

Penetrating injuries by definition penetrate into the eye but not through and through there is no exit wound. Perforating injuries have both entrance and exit wounds. Typically, to constitute one of these injuries, a full thickness rupture of the cornea and/or sclera must be present.

3. **Chemical burns:**

Chemical burns are caused by exposure to corrosive chemicals or irritants that can cause damage to the cornea and other ocular tissues.

4. **Thermal injuries:**

Thermal injuries are caused by exposure to extreme heat or cold that can cause burns to the eye.

5**. Explosive injuries:**

Blast injuries, often seen in certain occupational settings or as a result of accidents involving explosives.

6. **Sports related injuries:**

Injuries sustained during sports activities, particularly those involving high speed projectiles or physical contact.

Fig. 21.25 Traumatic cataract from tennis ball injury.

Fig. 21.26 Dislocated cataract lens into anterior chamber from squash racquet injury.

7. **Motor vehicle accidents:**

Trauma resulting from accidents, often involving impact to the face or head.

8. **Workplace injuries**:

Occupational hazards, especially in industries where eye protection may be crucial, but is not always used.

9. **Assaults:**

Deliberate physical attacks resulting in injuries to the eye or surrounding structures.

10. Animal bites:

Injuries resulting from bites or scratches from animals, which can cause trauma to the eye.

11. Foreign body injuries:

Particles or objects entering the eye, such as dust, metal fragments, or wood, leading to irritation and potential injury.

12. **Recreational activities**:

Injuries sustained during recreational activities, such as fireworks accidents, paintball injuries, or activities involving projectiles.

2.4 injuries to eyelids:

2.4.1 contusion injury – blunt trauma:

Contusions of the eyelids with ecchymosis

Description:

Contusion injuries result from blunt trauma to the eyelids. This can occur due to a direct impact, such as a blow to the eye.

Signs and symptoms:

- Swelling, bruising, and discoloration of the eyelid (black eye)
- Pain and tenderness.
- Possible subconjunctival hemorrhage (bleeding under the conjunctiva).

Management:

Ice packs or cold compresses to reduce swelling.

Pain management with over the counter pain killers.

Detailed evaluation to rule out other injuries, especially if there is associated vision impairment.

2.4.2 **Laceration of eyelid:**

Description:

Lacerations involve a tear or cut in the eyelid tissue and can result from sharp objects, trauma, or accidents.

Signs and symptoms:

- Visible wound or cut on the eyelid.
- Bleeding.
- Pain and possible difficulty blinking.

Management:

- Cleaning the wound with a sterile solution.
- Application of a sterile dressing.

- Medical attention for repair(a delay of >6h will lead to contamination)

iii)

2.4.3 **Injuries involving lacrimal system:**

Description:

Injuries involving the lacrimal system can impact tear production, drainage, or both. Here are some common types of injuries related to the lacrimal system:

1. Lacrimal Gland Injuries:

Trauma: Direct trauma to the lacrimal gland, located in the upper outer corner of the eye socket, can occur due to injuries such as fractures to the orbital bones.

2. Lacrimal Sac Injuries:

Fractures: Facial fractures, particularly those involving the bones around the eye socket (orbit), can lead to damage of the lacrimal sac, the structure that collects tears from the eyes.

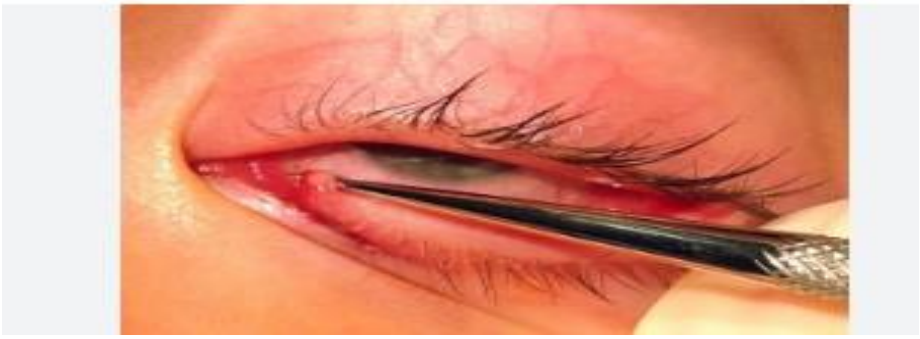
3. Nasolacrimal Duct Injuries:

Fractures: Nasal fractures or fractures near the nose can affect the nasolacrimal duct, the passage that carries tears from the lacrimal sac to the nose.

Direct trauma: Injuries to the face or nose can also cause damage to the nasolacrimal duct, leading to obstruction and impaired tear drainage.

4. Canalicular Lacerations:

Sharp objects: Accidents involving sharp objects, such as a cut or laceration from a foreign body, can damage the canaliculi, the tiny channels that drain tears from the eyes to the lacrimal sac.



5. Tear Film Dysfunction:

Chemical injuries: Exposure to certain chemicals or irritants can disrupt the composition of tears, leading to tear film dysfunction.

6. Obstruction of Tear Drainage:

Infections: Infections of the lacrimal system, such as dacrocystitis (inflammation of the lacrimal sac), can cause obstruction and interfere with tear drainage.

7. Foreign Bodies:

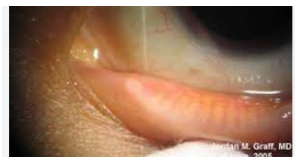
Foreign objects: Foreign bodies lodged in the eye or surrounding structures can cause irritation and lead to tears not draining properly.

8. Complications from Surgery:

Orbital or nasal surgery: Surgeries involving the eye, orbit, or nasal passages may carry a risk of damage to the lacrimal system.

9. Radiation Therapy:

Head and neck radiation: Radiation therapy in the head and neck region, commonly used to treat certain cancers, can sometimes damage the lacrimal System e.g. punctual stenosis



Symptoms:

- Excessive tearing or inability to produce tears.

- Swelling or tenderness around the tear duct area.
- Discharge from the eyes

Management- depends on the type and extent of the injury.
Treatment may involve conservative measures, such as observation and lubrication, or more invasive interventions, including surgery to repair damaged structures.

2.4.5 **Thermal burns of eyelid**:

Thermal burns of the eyelid can result from exposure to heat, flames, hot liquids, or other sources of extreme temperatures. Here are some key points regarding the assessment and management of thermal burns of the eyelid:

Assessment:

1. Extent of the Burn:
   Determine the size and location of the burn on the eyelid and surrounding areas.
2. Depth of the Burn:
   Thermal burns can be classified into first degree (superficial), second degree (partial thickness), and third degree (full thickness) burns. Assess the depth of the burn to guide treatment decisions.


Superficial Partial Thickness Burn

Assess whether the burn involves other structures, such as the cornea or conjunctiva, as this can impact visual function.

First aid:

1. Cooling:
   Immediately after the injury, cool the affected area with lukewarm water. Avoid using extremely cold water, as it can exacerbate tissue damage.
2. Avoid Ice:
   Do not apply ice directly to the burned area, as it may cause further damage.
3. Protection:
   Protect the eye from further injury or irritation. Avoid rubbing the eye.

Medical Attention:

1. Emergency Care: Seek immediate medical attention, especially for severe burns or burns involving a large portion of the eyelid.
2. Professional Evaluation:
   Consult with an ophthalmologist or an eye care professional to assess the extent of the injury and determine the appropriate course of action.
3. Pain Management:

Provide pain management as needed, which may include over the counter pain relievers or prescription medications.

Treatment:

1. Topical Medications:

Depending on the severity of the burn, topical antibiotics or ointments along with lubrication may be prescribed to prevent infection.

2. Dressing and Wound Care:

Dressings may be applied to protect the burn and promote healing. Follow the healthcare provider's instructions for wound care.

3. Tetanus Shot:

Ensure that the individual's tetanus immunization is up to date, especially if the burn resulted from a contaminated source.

4. Follow Up Care:

Schedule follow up appointments with the healthcare provider to monitor the healing process and address any complications.

Thermal burns can lead to various complications depending on the severity and depth of the burn. Here are some potential complications associated with thermal burns:

1. Infection:

Open wounds resulting from thermal burns can provide a pathway for bacteria to enter, increasing the risk of infection. Infected burns may require additional medical attention, including antibiotic treatment.

2. Scarring& Contractures:

Severe burns can lead to the formation of scars, which may affect both the appearance and function of the affected area. (cicatricial ectropion, lagophthalmos)

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6. Nerve Damage:

Burns can damage nerves, leading to numbness, tingling, or altered sensation in the affected area. Nerve damage may affect motor function and can be associated with long term pain.

7. Ocular Complications:

Corneal damage, Conjunctival inflammation, and possible impact on visual acuity. Regular follow up with an ophthalmologist is important to monitor and address ocular complications.

.**b.** 

.**2.5 orbital injuries:**

Orbital injuries involve trauma to the bony socket that houses the eye (orbit) and the surrounding structures. These injuries can result from various causes, including accidents, falls, sports related incidents, or assaults. The severity of orbital injuries can vary, and prompt medical evaluation is crucial for proper diagnosis and management.

1. Orbital fractures:

Description:

Direct injury to the eye, as from a blow, a golf ball, or a piece of equipment, may result in a fracture of the orbital rim or wall.

Two types of fractures may occur.

1 involving the bony rim of the orbit, along with part of the wall of the orbit, and is usually readily detected by x ray film.

2 a blowout fracture of the orbital floor:

Any direct blow to the eye may drive the globe back into the orbit, where a sudden transfer of pressure to the thin orbital wall occurs. The weakest part of the orbital wall (inferior wall) fractures relatively easily because the walls are adjacent to air containing sinuses and are not supported by heavy fluids or tissue

Mechanism of an orbital floor blow out fracture

Signs and symptoms:

- Swelling and bruising around the eye.
- Diplopia (double vision).
- Restricted eye movement.
- Sunken appearance of the eye (enophthalmos).

Right orbital floor blow out fracture. (A) Marked periocular ecchymosis, oedema and subconjunctival haemorrhage; (B) restricted elevation; (C) mild right enophthalmos

Management:

Medical imaging (ct scans) to assess the extent of the fracture.

Surgical intervention may be necessary for severe fractures, especially if there is entrapment of eye muscles.

2. **Orbital (**retrobulbar) hemorrhage**:**

Description:

Bleeding within the orbit, often following trauma which increases the risk of **acute 2.5.1 orbital compartment syndrome:**

(Compressive optic neuropathy and can lead to irreversible blindness of the affected eye in severe cases.)

Signs: Proptosis, eyelid oedema and ecchymosis, haemorrhagic chemosis, ocular motility dysfunction, decreased visual acuity, elevated intraocular pressure, optic disc swelling and a relative afferent pupillary defect are among the possible signs

And **symptoms**:

- Rapid onset of swelling and proptosis (forward displacement) of the eye.
- Pain and restricted eye movement.

Management:

Immediate medical attention required to relieve pressure and prevent vision loss.

Surgical decompression (Canthotomy with cantholysis) may be necessary in certain cases.

Surgical treatment of acute retrobulbar haemorrhage. (A) Lateral canthotomy (arrow showing cut); (B) disinsertion of inferior crus of the lateral canthal tendon

3. **c. ocular surface injuries**:

2.6.1 Conjunctival injuries:
(Discussed earlier)

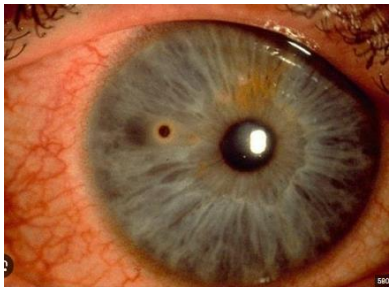
Trauma, foreign bodies, chemical exposure, or infections.
Signs and symptoms:

- Redness
- tearing, and a feeling of irritation.
- Subconjunctival hemorrhage (bloodshot appearance).

Management:
Cleaning the eye with a saline solution.
Lubricating eye drops or ointments.
Topical antibiotics to prevent infection.

2.6.2 corneal foreign bodies:
(Discussed earlier)

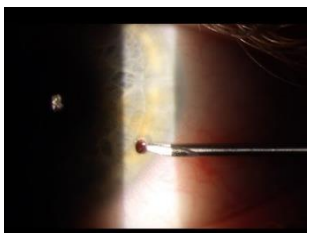
Description:
Objects that become embedded in the cornea, the clear front part of the eye.



causes:
foreign objects, such as dust, metal, or wood, entering the eye.
signs and symptoms:

- pain
- tearing
- redness
- gritty sensation.

management:
removal of the foreign body using sterile instruments.

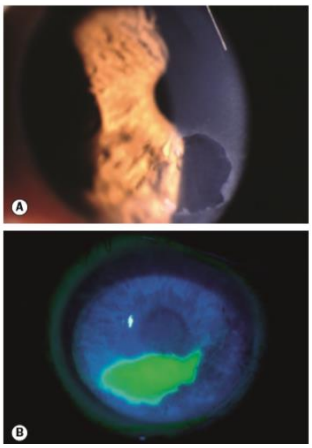


topical antibiotics to prevent infection.
pain management with over the counter analgesics.

3. corneal abrasions:

Description:

scratches or injuries to the cornea, often resulting from trauma or foreign objects.



Corneal complications of blunt trauma. (A) Small unstained corneal abrasion; (B) large corneal abrasion stained with fluorescein;

causes:

scratching, rubbing, or contact with foreign materials.

signs and symptoms:

severe pain, tearing, and sensitivity to light.

foreign body sensation.

management:

antibiotic eye drops or ointments to prevent infection.

lubricating eye drops to promote healing.

pain management with analgesics.

Cycloplegia

avoidance of contact lens use until healed.

2.6.3. **Chemical injuries of the cornea:**

Description:

Acid Burns:

Causes:

Contact with household or industrial chemicals (sulfuric, hydrochloric, nitric, and acetic acid). Acid burns are frequently complicated by glass injuries as a result of flasks and bottles bursting

Signs and symptoms:

(less severe than alkali)

1 redness

2 watering,

3 irritation of the lids and conjunctiva.

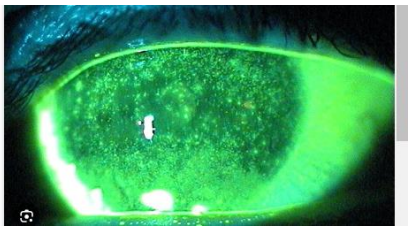
4 With repeated or prolonged exposure, small erosions on the surface of the cornea may result. A copious splash of an acid can produce an extensive burn of the face and eyelids.

Alkali burns:

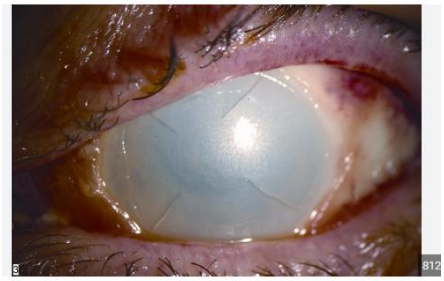
Sodium, potassium, ammonium, and calcium hydroxide are the common alkalis involved in industrial as well as domestic burns. In general, alkali burns are more serious and penetrate the eye more deeply than do acid burns. It is also used in domestic refrigerating apparatus. The severity of lime burns is related to the fact that the alkali becomes adherent to the corneal and Conjunctival tissues and produces chemical reactions between its products and the tissue proteins.

Signs:

Depending on the type and severity, signs of chemical injury may include 1: conjunctivitis, 2: superficial punctate keratitis



3: epithelial defects of the cornea and conjunctiva, 4: blanching of blood vessels (limbal ischemia)



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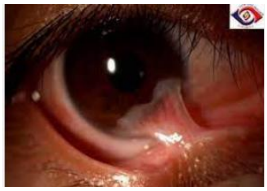
necrosis of tissues

5: symblephron (late)



Management:

First aid care: 1: immediate irrigation with copious amounts of water. For alkali burns, this irrigation should be continued for at least 20 to 30 minutes

2: seeking emergency medical attention.

Second stage emergency care:

. 1: The industrial nurse or ophthalmic assistant should place two or three drops of a suitable topical anesthetic in the eye to relieve the pain and lid spasm.

2: the patient's vision should be tested to assess the degree of damage

3: Irrigation with sterile saline solution is continued if the previous attempts have been unsatisfactory. In the setting of an emergency department, a speculum or can be used to keep the eye open while irrigating solution is delivered through intravenous (IV) tubing. Irrigation should continue for 30 minutes using 1 to 3 L of saline or until the pH is neutralized

4: Double eversion of the upper eyelid should be performed so that any retained particulate matter trapped in the fornices is identified and removed.

5: Debridement of necrotic areas of corneal epithelium should be performed at the slit lamp to promote re epithelialization and remove associated chemical residue

. It is imperative that any patient with an injury caused by alkalis, strong acids, or any other chemicals known to produce severe ocular injury be seen by an ophthalmologist after emergency eye care has been given.

.

topical medications

to reduce inflammation and prevent infection.

1: steroids(frequency according to severity)

2: cycloplegia

3: topical antibiotics

4:Oral ascorbic acid to promote wound healing

5: oral tetracyclines

6: prevention of symblephron formation by breaking adhesions

7: IOP monitoring

Surgery

• Early surgery may be necessary to promote revascularization of the limbus, restore the limbal cell population and re establish the fornices. (amniotic membrane grafting etc.)

- Late surgery may involve:
- ○ Division of conjunctival bands and symblepharon .
- ○ Conjunctival or other mucous membrane grafting

Correction of eyelid deformities such as cicatricial entropion .

○ Keratoplasty for corneal scarring) should be delayed for at least 6 months and preferably longer to allow maximal resolution of inflammation.

○ In a very severely damaged eye a keratoprosthesis may be required

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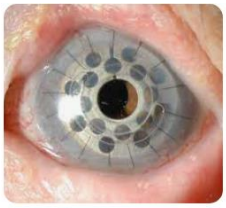
d. 

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2.7 **globe contusion**::

Contusions of the globe may be caused by an explosive force, such as an air blast, a blow to the bony orbit, or direct injury to the eye itself.

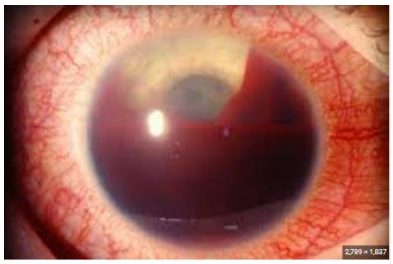
here are some key points about a contusion injury to the and globe:

Early complications:

1:subconjunctival hemorrhage

2: Perforation of globe with prolapse of intra ocular contents

3:hyphema (hemorrhage into the anterior chamber,)



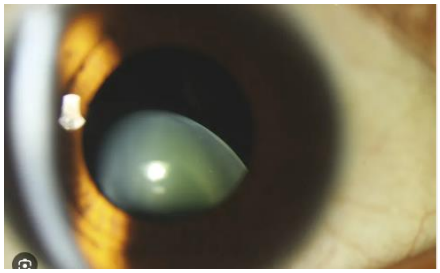
4: iris involvement (iridodialysis, i.e., separation of the iris at its base),

Iris sector loss with iridodialysis from globe injury. Double vision and cosmetically poor appearance

5:tears of the sphincter muscle and iritis,

6: glaucoma secondary to iritis or hyphema,

7: dislocation of the lens



8: vitreous hemorrhage

9: retinal tears,detachment and hemorrhage,

10: choroidal rupture,

11:scleral rupture,

12: avulsion of the optic nerve.

Of the early complications, injury to the anterior segment of the eye is the most frequent because it receives the greater proportion of the force of injury.

Large retinal tear with associated retinal detachment.

Late complications

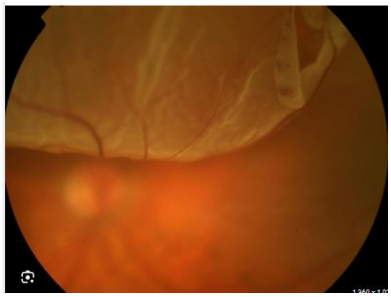
1: glaucoma, which may appear many years after the original injury (usually in the form of angle recession glaucoma),

2: cataract,

3:band keratitis,

4:retinal tears,

5:retinal detachment



6: phthisis bulbi (shrunken and disorganized eyeball).

The patient should be counselled on those potential complications and advised to get regular eye exams, as well as seek medical attention if any of their signs rise up

3. symptoms:

symptoms of a contusion injury may include pain, swelling, bruising, and difficulty opening or moving the eye.

Floaters with vision disturbances may occur

4. Treatment:

1Immediate medical attention is crucial for a thorough evaluation of the extent of the injury.

2 Treatment may involve applying cold compresses to reduce swelling, pain management, and, in some cases, antibiotics to prevent infection.

3 Severe cases may require surgical intervention to address complications.

5. Follow up care:

Regular follow up appointments with an eye care professional are essential to monitor the healing process and address any ongoing issues.

2.8 **Hyphaema**

Hyphema It involves hemorrhage into the anterior chamber

Causes;

1: blunt or lacerating trauma(most common)

2: after intraocular surgery,

3: spontaneously (e.g., in conditions such as rubeosis iridis, , iris melanoma, myotonic dystrophy, keratouveitis (e.g., herpes zoster), leukemia, hemophilia, von Willebrand disease, and in association with the use of substances that alter platelet or thrombin function (e.g., ethanol, aspirin, warfarin

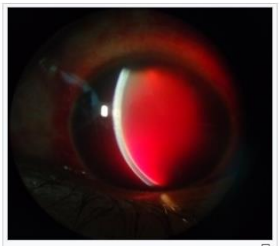
symptoms:

Depend on the cause.

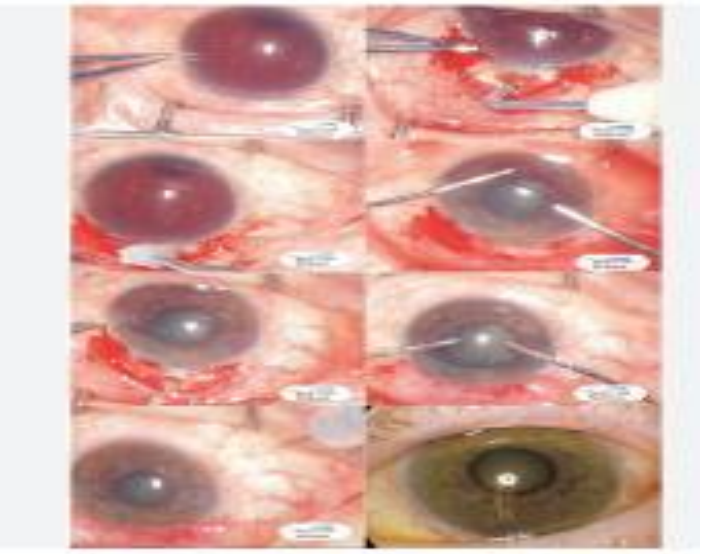
1Blood in the eye

2Decreased vision: the presence of blood can obstruct the normal passage of light, leading to a decrease in vision.

3 Eye pain: trauma to the eye can cause pain or discomfort.
Sensitivity to light: increased sensitivity to light (photophobia) is common with eye injuries.
Tearing: excessive tearing may occur.
Signs:
1:A large hyphema can be noted with pen light examination alone.
2:The height and color of the hyphema should be documented. Blood that has clotted will appear darker in appearance (black).
3: It is important to evaluate intraocular pressure.



Total hyphema
Treatment may involve:
Rest and protection: Maintaining head elevation of at least 45 degrees will allow the hyphema to settle inferiorly within the anterior chamber. This avoids central visual obstruction, as well as limits both corneal endothelial and trabecular meshwork exposure to red blood cells the eye and Avoiding further trauma is essential. The eye may be protected with a shield.
Medication: 1 :topical corticosteroids for reducing inflammation,2: cycloplegcs to manage pain, 3:topical antibiotics to prevent infection 4 IOP management with topical and/or oral anti glaucoma medication
The patient can typically be monitored for the first 4 days with medical treatment alone to allow for spontaneous resolution.
surgery
. , surgical intervention may be indicated in the setting of
1 uncontrolled glaucoma(>50mmhg for >5days)
2: corneal blood staining,
3: the persistence of a large or total hyphema, and
4: active bleeding in the anterior chamber
An anterior chamber washout with irrigation and aspiration is commonly performed first.If intraocular pressure remains uncontrolled, a trabeculectomy along with repeat anterior chamber washout is indicated.



Monitoring: regular follow up appointments are necessary to monitor the healing process and address any complications.

Questions

1) What different types of burns?
2) How do you classify ocular trauma?
3) How will you manage a case of corneal foreign body?
4) How do you manage a case of chemical burn?
5) How will you manage a case of thermal burn?

DISEASES

Disorders of Lid and Lacrimal Apparatus

2.9 Blepharitis: -

Definition:

Blepharitis is a common and chronic inflammation of the eyelids, specifically affecting the eyelash follicles, meibomian glands (oil glands along the eyelid margins), and sometimes the skin around the eyes. It can be associated with bacterial or inflammatory conditions.

Causative Organism:

Blepharitis can have various causes, *Staphylococcus s*pecies are often implicated. Other potential contributing factors include Demodex mites, dysfunction of the meibomian glands and seborrheic dermatitis.

Seborrhea is a common cause of dandruff. Telltale diagnostic patches of seborrheic involvement in such patients are commonly seen in the medial aspect of the brows, the forehead, and sometimes behind the skin of the ear or on the nose

Types:

1. Anterior Blepharitis: Affects the outside front edge of the eyelid where the eyelashes are attached. Common causes include bacteria (Staphylococcus) and seborrheic dermatitis.

2. Posterior Blepharitis: Affects the inner edge of the eyelid that comes in contact with the eyeball. It is often associated with dysfunction of the meibomian glands, which produce the oil that prevents tears from evaporating too quickly.

Symptoms/Signs:

The signs and symptoms of blepharitis can vary but may include:

Red, swollen eyelids

Itching or burning sensation in the eyes
Excessive tearing
-Light sensitivity
Blurred vision
Fluctuating or blurred vision
Crusty debris at the base of eyelashes that comes off easily, leaving an intact lid margin (**seborrheic blepharitis**). **Staphylococcal blepharitis** (The lid margins become ulcerated and congested and adhesive exudate forms on the base of the follicles and on the lid margin. When the scale is removed, it always reveals an ulcerative defect on the lid margin.

Complications:

The ulcerative type of blepharitis is more serious because if the inflammation reaches down to the base of the follicles it can cause permanent scarring, with either loss of lashes and regrowth with accompanying trichiasis (misdirected lashes).

Also the cosmetic consequences are undesirable because the lids become thickened, heavily vascularized, and unattractive.

Management:

1. Eyelid Hygiene: Regular cleaning of the eyelids with warm compresses and gentle scrubbing to remove debris and crusts.
2. Topical Antibiotics: In some cases, topical antibiotics or steroid ointments may be prescribed to control bacterial infection and inflammation.
3. Artificial Tears: Lubricating eye drops or artificial tears can help alleviate dry eye symptoms associated with blepharitis.
4. Meibomian Gland Expression: This involves manually expressing the blocked meibomian glands to improve the flow of oil onto the eye's surface.
5. Oral Medications: In severe cases, oral antibiotics or anti-inflammatory medications may be prescribed.

Prevention:

1. Good Eyelid Hygiene: Regular and gentle cleaning of the eyelids can help prevent the buildup of debris and crusts.
2. Warm Compresses: Applying warm compresses to the eyes can help open clogged meibomian glands and improve oil flow.
3. Avoiding Eye Irritants: Avoiding exposure to smoke, dust, and other environmental irritants can help prevent exacerbation of symptoms.
4. Proper Contact Lens Care: If you wear contact lenses, following proper hygiene and care guidelines is crucial.

5. Regular Eye Exams: Regular eye check-ups with an optometrist or ophthalmologist can help identify and manage blepharitis early on.

2.10 Stye (Hordeolum)

Definition:

A stye or external hordeolum is an acute suppurative inflammation of small sebaceous glands on the lid margin, the glands of Zeis, which empty their secretion into the hair follicles of the cilia.. It typically occurs at the base of an eyelash or within a sebaceous gland of the eyelid.

Causative Organism:

Styes are usually caused by bacterial infection, with ***Staphylococcus aureus*** being the most common causative organism.

Symptoms/Signs:

Common symptoms and signs of a stye include:

Painful red lump on the eyelid
Swelling of the eyelid
Tenderness and discomfort
Watery eyes
Sensation of a foreign body in the eye
Crusting around the eyelid
Pus-filled bump (in some cases)

Management:

1. Warm Compresses: Applying warm compresses to the affected eyelid several times a day can help promote drainage and alleviate symptoms.
2. Topical Antibiotics: In some cases, antibiotic ointments or drops may be recommended to eliminate bacterial infection. Over-the-counter options or prescription medications may be used.
3. Avoid Squeezing: It's crucial to avoid squeezing or trying to pop a stye, as this can lead to further infection and complications.
4. Maintain Good Hygiene: Keeping the eyelids clean and avoiding the use of eye makeup during the infection can help prevent the stye from worsening.
5. Oral Antibiotics: In severe or recurrent cases, oral antibiotics may be prescribed by a healthcare professional to address the bacterial infection.

Prevention:

1. Good Eyelid Hygiene: Regularly cleaning the eyelids and lashes can help prevent the accumulation of bacteria and reduce the risk of stye formation.

2. Avoid Touching Eyes:Avoid touching the eyes with unwashed hands to minimize the risk of introducing bacteria to the eyelids.

3. Remove Eye Makeup: Thoroughly remove eye makeup before bedtime to prevent the clogging of eyelid glands.

4. Avoid Sharing Personal Items: Avoid sharing items like towels, washcloths, or eye makeup to reduce the risk of spreading bacteria.

5. Proper Contact Lens Care: If using contact lenses, follow proper hygiene and care practices to minimize the risk of eye infections.

2.11 Chalazion (Internal Hordeolum)

Definition:

A chalazion is a chronic inflammatory granuloma of the large meibomian glands embedded in the tarsus of the lid. Multiple chalazia can occur in the upper or lower lids. Unlike the infectious causes of the internal and external hordeolum, chalazia are the result of a sterile process

An internal hordeolum is an acute inflammation of the sebaceous glands that reside in the tarsal plates: the meibomian glands.

Symptoms/Signs:

Common symptoms and signs of a chalazion include:

Small, painless lump on the eyelid

Tenderness or swelling of the affected area

Redness of the eyelid

Blurred or distorted vision (if the chalazion presses on the eye)

Discharge of fluid or oil from the affected gland

Sensation of a foreign body in the eye

Management:

1. Warm Compresses: Applying warm compresses to the affected eyelid can help soften the contents of the blocked gland, promote drainage, and reduce inflammation. This is typically done for 10-15 minutes several times a day.

2. Eyelid Massage: Gently massaging the affected eyelid after applying a warm compress may aid in the expression of the blocked oil and promote drainage.

3. Topical Steroids: In some cases topical steroids are prescribed to help reduce inflammation.

4. Antibiotic Ointments: While chalazia are not usually caused by bacterial infection, antibiotic ointments may be recommended if there is a secondary bacterial infection.

5. Intralesional Steroid Injection: For larger or persistent chalazia, we may administer a steroid injection directly into the lump to reduce inflammation.

6. Incision & Curettage: If the cyst is large and thickly walled, it must be opened surgically and evacuated with a curette and blunt dissection.

Prevention:

1. Good Eyelid Hygiene: Regularly cleaning the eyelids and lashes can help prevent the accumulation of debris and reduce the risk of oil gland blockage.

2. Warm Compresses as Preventive Measure: Periodically using warm compresses on the eyelids, even when not experiencing a chalazion, can help maintain the health of the oil glands.

3. Avoid Rubbing Eyes: Avoiding excessive rubbing or touching of the eyes can help prevent irritation and potential blockage of the oil glands.

4. Proper Makeup Removal: Thoroughly removing eye makeup before bedtime can prevent the clogging of oil glands.

5. Address Underlying Conditions: If there is an underlying condition contributing to the development of chalazia, such as blepharitis, addressing that condition can help prevent recurrences.

2.12.Eyelid Abscess (Lid Abscess)

An eyelid abscess is a localized collection of pus within the eyelid, often resulting from a bacterial infection.

-Symptoms/Signs:

Common symptoms and signs include:

1. Pain: The affected area is usually painful and may become more intense as the abscess enlarges.

2. Swelling: There is noticeable swelling of the eyelid, and the skin may appear red and warm to the touch.

3. Tenderness: The abscess is tender to the touch, and there may be discomfort when blinking or moving the eyelid.

4. Pus Formation: As the infection progresses, a visible collection of pus may develop within the abscess.

5. Redness: The surrounding skin of the eyelid is often red and inflamed.

6. Warmth: The area around the abscess may feel warm due to the inflammation.

Management:

1. Warm Compresses: Applying warm compresses to the affected eyelid multiple times a day helps promote drainage, reduce swelling, and alleviate pain.

2. Incision and Drainage: In some cases, we may need to make a small incision in the abscess to allow for drainage of pus. This is typically done under sterile conditions.

3. Antibiotics: If the abscess is associated with a bacterial infection, Injectable,oral or topical antibiotics may be prescribed to eliminate the bacteria and prevent further complications.

4. Pain Medication: Over-the-counter or prescription pain medication may be recommended to manage pain and discomfort.

5. Avoid Squeezing: It is essential to refrain from squeezing or attempting to drain the abscess at home, as this can lead to complications and a worsening of the infection.

Prevention:

1. Good Hygiene: Regularly cleaning the eyelids and maintaining good overall hygiene can help prevent the development of bacterial infections that may lead to abscess formation.

2. Avoid Touching Eyes: Avoid touching or rubbing the eyes with unwashed hands to minimize the risk of introducing bacteria to the eyelids.

3. Proper Makeup Removal: Thoroughly remove eye makeup before bedtime to prevent the accumulation of debris and bacteria.

4. Address Underlying Conditions: If there are underlying conditions such as blepharitis or recurrent styes contributing to abscess formation, addressing these conditions can be crucial in prevention.

5. Avoid Sharing Personal Items: Avoid sharing personal items such as towels or eye makeup to reduce the risk of spreading bacteria.

2.13 LACRIMAL DISEASES

2.13.1 Dacrocystitis:

Dacrocystitis, an inflammation of the lacrimal sac, is indicated by an inflammatory swelling at the site of the sac. This inflamed swelling is seen as a visible red lump just below the caruncle overriding the inframedial aspect of the orbital bone. Sometimes pressure over the sac causes pus or mucoid material to regurgitate through the punctum. This condition usually results from the effects of stricture of a nasolacrimal duct arising from chronic inflammation, usually of nasal origin. Obstruction of the lower end of this duct can be caused by the presence of a nasal polyp and extreme deviation of the septum, or by a marked congestion of the inferior turbinate.

A) Infantile Dacrocystitis:

Cause:

Infantile dacrocystitis is typically caused by the obstruction or underdevelopment of the nasolacrimal duct, which is responsible for draining tears from the eyes into the nose. The blockage can lead to the accumulation of tears and mucus, providing an environment for bacterial growth and infection.

Symptoms/Signs:

Tearing or watering of one or both eyes.
Mucus or discharge from the affected eye.
Swelling and redness near the inner corner of the eye.
Irritability and discomfort.
Recurrent eye infections.

Management:

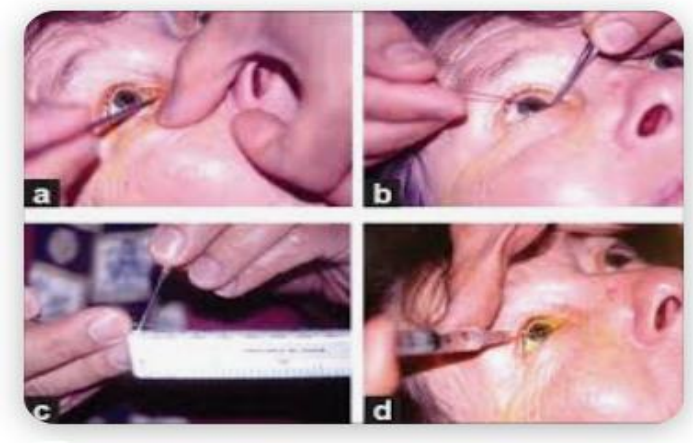
1. Massage: Gentle massage of the tear duct area may help to open the duct and promote drainage.

2. Warm Compresses: Applying warm compresses to the affected eye can help soothe the area and encourage drainage.

3. Topical Antibiotics: In cases where there is bacterial infection, a healthcare professional may prescribe topical antibiotics.

4. Oral Antibiotics: In more severe cases, oral antibiotics may be prescribed.

5**. Probing and Irrigation**: If conservative measures are ineffective, a healthcare professional may perform a simple procedure called probing and irrigation to open the obstructed tear duct.



6. Observation: In some cases, infantile dacrocystitis may resolve on its own with time as the tear duct matures.

b) Adult Dacrocystitis:

Cause:

In adults, dacrocystitis is often caused by an obstruction or infection of the nasolacrimal duct. Common causes include:

Blockage due to age-related changes.

Trauma to the area.

Tumors affecting the tear duct.

Infections.

Symptoms/Signs:

Tearing or watering of one eye.

Redness and swelling near the inner corner of the eye.

Pain or tenderness in the affected area.

Discharge of pus or mucus.

Blurred vision (in severe cases).

Management:

1. Antibiotics: Treatment typically involves a course of antibiotics to clear the infection.

2. Warm Compresses: Applying warm compresses to the affected eye can help relieve symptoms and aid in drainage.

3. Nasolacrimal Duct Massage: Gentle massage of the tear duct area may be recommended to assist in opening the duct.

4. Surgical Intervention: In cases of persistent obstruction or recurrent dacrocystitis, surgical procedures such as dacryocystorhinostomy (DCR) may be considered to create a new drainage pathway for tears.

5. Management of Underlying Causes: Addressing any underlying causes, such as tumors or structural abnormalities, may be necessary for long-term resolution.

Assessment:

- What is Blephritis? Write its types?
- What is difference between stye and chalazion? Give management of chalazion?
- What is Dacrocystitis? What are the causes of dacrocystitis? Give its management?

Diseases of conjunctiva

2.14 Conjunctivitis (pink eye):

Definition:

Conjunctivitis refers to the inflammation of the conjunctiva, the thin, transparent membrane that covers the white part of the eye (sclera) and lines the inner surface of the eyelids. it is commonly known as "pink eye" due to the reddish or pink appearance of the eyes when blood vessels in the conjunctiva become dilated.

Types:

Conjunctivitis can be classified into several types, with the three main categories being:

1. Bacterial conjunctivitis: caused by bacterial infection.
2. Viral conjunctivitis: caused by viruses, often associated with upper respiratory infections.
3. Allergic conjunctivitis: triggered by allergens, such as pollen

2.14.1 bacterial (purulent) conjunctivitis:

i) **diagnosis (symptoms/signs):**

common symptoms and signs of bacterial conjunctivitis include:

redness in the whites of the eyes.
purulent (pus-like) discharge, which can cause the eyelids to stick together.
itching or burning sensation.
tearing or excessive eye watering.
irritation and foreign body sensation.

ii) **common organism of causation:**

bacterial conjunctivitis is often caused by various bacteria, with staphylococcus aureus, streptococcus pneumoniae, and haemophilus influenzae being common culprits.

iii) taking specimen for bacteriological examination (in some cases):

in certain cases, a healthcare professional may take a swab specimen from the infected eye to identify the specific causative bacteria through bacteriological examination. this is more commonly done in severe or persistent cases.

taking a conjunctival swab is a procedure used to collect a sample from the conjunctiva, the thin membrane that covers the white part of the eye. this procedure is commonly performed for diagnostic purposes, especially when investigating conjunctivitis or other eye infections. here's a general guide on how the procedure is typically conducted:

materials needed:

1. sterile cotton-tipped swab
2. sterile saline solution or transport medium (if required for specific testing)
3. gloves
4. gauze or tissue
5. eye disinfectant solution (if needed)

procedure:

1. prepare the patient:
 explain the procedure to the patient, informing them of the steps you will take.
 ask the patient to sit comfortably and tilt their head backward.
 use a tissue or gauze to wipe away any excess tears or discharge from the eye.
2. wear gloves:
 ensure that you are wearing sterile gloves to maintain aseptic conditions.
3. disinfect the eye (if needed):
 if necessary, you may use an eye disinfectant solution to clean the eyelid and lashes. follow the product instructions and allow the area to dry.
4. stabilize the eyelid:
 gently hold the patient's eyelid open using your non-dominant hand's thumb and forefinger. this helps to stabilize the eye and prevents blinking.
5. collect the swab:
 using the sterile cotton-tipped swab, gently touch the conjunctiva, avoiding contact with other parts of the eye, eyelashes, or surrounding skin.
 rotate the swab gently to ensure proper sample collection.

6. place swab in transport medium (if needed):
 if the sample requires transport medium (such as for viral or specific bacterial testing), carefully place the swab in the provided medium or sterile saline solution. follow the laboratory's guidelines for proper handling.
7. label the sample:
 label the swab container with the patient's information, date, and any other necessary details.

8. secure the sample:
securely close the swab container to prevent contamination.
9. dispose of gloves:
safely dispose of the gloves following proper infection control protocols.
10. provide aftercare instructions:
advise the patient on any aftercare instructions, such as avoiding rubbing the eyes or applying eye drops if recommended by the healthcare provider.
11. send the sample to the laboratory:
ensure the timely transfer of the collected sample to the laboratory for analysis. follow the specific transportation and storage requirements as per the testing facility's guidelines.

iv) management:

1. topical antibiotics: prescription of antibiotic eye drops or ointments to eliminate the bacterial infection. common antibiotics include fluoroquinolones, aminoglycosides, or others, depending on the severity and causative organism.
2. warm compresses: application of warm compresses can help soothe the eyes and alleviate discomfort.
3. eye hygiene: encouraging good eye hygiene, including avoiding touching the eyes, using a clean tissue for wiping, and frequent handwashing to prevent the spread of infection.
4. oral antibiotics (in severe cases): in severe or systemic cases, oral antibiotics may be prescribed.
5. avoiding contamination: avoiding sharing personal items like towels, pillows, or eye makeup to prevent the spread of infection.

v) prevention:

1. hand hygiene: regular handwashing helps prevent the spread of bacteria.
2. avoiding touching eyes: minimize touching the eyes, especially with unwashed hands.
3. personal items: avoid sharing personal items to prevent the transmission of bacteria.
4. prompt treatment: seek medical attention promptly if symptoms of conjunctivitis arise, especially if discharge is present.

2.14.2 gonococcal conjunctivitis:

i) definition:

gonococcal conjunctivitis also known as gonococcal ophthalmia neonatorum is a type of bacterial conjunctivitis transmitted by contact of eyes with infected genital secretions from a person with genital gonorrhea infection

ii) causative organism:

the primary causative organism for gonococcal conjunctivitis is neisseria gonorrhoeae, a gram-negative bacterium.

iii) diagnosis:

diagnosis of gonococcal conjunctivitis typically involves:

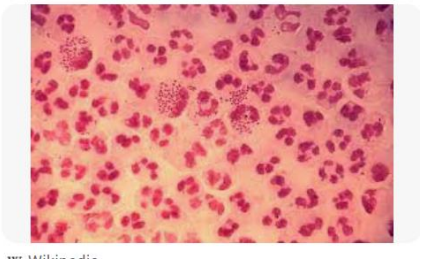
clinical examination of symptoms.

taking a detailed medical history.

laboratory testing of eye discharge to identify the presence of neisseria gonorrhoeae.

iv) gram staining:

gram staining of conjunctival discharge can reveal the characteristic gram-negative diplococci, aiding in the identification of neisseria gonorrhoeae.



v) management (who recommended):

the world health organization (who) recommends the following management for gonococcal conjunctivitis:

1. empirical treatment: immediate initiation of empirical treatment with injectable ceftriaxone, often in combination with oral azithromycin.

2. counseling and partner notification: counseling the patient on safe sexual practices and notifying sexual partners to seek medical evaluation and treatment.

3. systemic treatment: in severe cases, especially when systemic involvement is suspected, systemic treatment with antibiotics may be necessary.

4. follow-up: close follow-up to assess response to treatment and ensure resolution of the infection.

vi) prevention:

1. safe sex practices: promoting safe sex practices, including the use of barrier methods (condoms) during sexual activity.

2. early diagnosis and treatment: early diagnosis and prompt treatment of gonorrhea in sexual partners to prevent the spread of infection.

3. avoiding eye contamination: careful hand hygiene and avoiding contact with the eyes after genital contact can help prevent transmission to the eyes.

2.14.3 **viral conjunctivitis:**

i) causative organism:

viral conjunctivitis can be caused by various viruses, including adenoviruses, herpes simplex virus (hsv),varicella zoster virus and enteroviruses.

ii) symptoms/signs:

common symptoms and signs of viral conjunctivitis include:

watery discharge.

redness in the whites of the eyes.

itching or discomfort.

swelling of the conjunctiva.

photophobia (sensitivity to light)

iii) management:

1. symptomatic treatment: viral conjunctivitis is often self-limiting, and treatment is primarily symptomatic. use of lubricating eye drops or artificial tears can help alleviate discomfort.

2. cold compresses: applying cold compresses to the eyes can reduce swelling and provide relief.

3. antiviral medications (if caused by hsv): in cases of viral conjunctivitis caused by herpes simplex virus, antiviral medications may be prescribed.

4. avoiding contamination: practicing good hygiene, such as frequent handwashing, and avoiding touching the eyes can prevent the spread of the virus.

iv) prevention:

1. hand hygiene: regular handwashing to prevent the transmission of viruses.

2. avoiding eye rubbing: advising individuals with viral conjunctivitis to avoid rubbing their eyes to prevent the spread of the virus to others and to the other eye.

3. isolation: if the viral conjunctivitis is caused by a highly contagious virus, individuals may be advised to avoid close contact with others to prevent transmission.

2.14.4 **allergic conjunctivitis**:

i) types:

1. seasonal allergic conjunctivitis (sac): typically associated with specific allergens that are present during certain seasons, such as pollen during spring or fall.

2. perennial allergic conjunctivitis (pac): occurs year-round and is often triggered by indoor allergens like dust mites, pet dander, or mold.

3. vernal keratoconjunctivitis (vkc):

vernal keratoconjunctivitis (vkc) is a chronic and recurrent form of allergic conjunctivitis. it primarily affects young males and is characterized by inflammation of the conjunctiva, often accompanied by corneal involvement. vkc tends to be more severe than typical allergic conjunctivitis and may cause long-term complications.

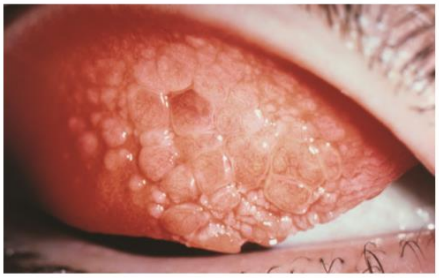


Fig. 23.5 Vernal conjunctivitis. Note cobblestone formation of upper tarsus when lid is everted.

causes:

vkc is triggered by an allergic response to certain environmental factors, although the exact cause is not fully understood. common triggers include pollen, grass, and other airborne allergens.

4. atopic keratoconjunctivitis (akc): common in individuals with a history of atopic dermatitis or eczema. it can be a chronic condition with more severe symptoms.

ii) symptoms:

itching (common symptom).

redness of the eyes.

watery discharge.

swelling of the conjunctiva.

sensation of grittiness or burning.

light sensitivity.

iii) management:

1. avoidance of allergens: identify and minimize exposure to allergens.

2. topical antihistamines or mast cell stabilizers: these can help alleviate symptoms.

3. cold compresses:applying cold compresses can reduce swelling and soothe the eyes.

4. artificial tears: lubricating eye drops can provide relief from dryness.

5. topical corticosteroids (in severe cases): prescribed by a healthcare professional for short-term use in severe cases.

iv) prevention:

1. allergen avoidance: minimize exposure to known allergens.

2. use of protective eyewear: wearing sunglasses can help protect the eyes from airborne allergens.

3. regular cleaning: keeping the home environment clean and minimizing dust can be beneficial.

2.15 trachoma:

i) definition:

trachoma is a chronic, contagious eye infection caused by the bacterium chlamydia trachomatis. it is a leading cause of preventable blindness in certain parts of the world.

ii) causative organism:

chlamydia trachomatis, specifically serovars a, b, ba, and c.

iii) natural history:

trachoma progresses through several stages, starting with repeated episodes of conjunctivitis in childhood, leading to scarring of the conjunctiva, and potentially resulting in the eyelashes turning inward (trichiasis) and causing corneal damage.

iv) diagnosis (clinical):

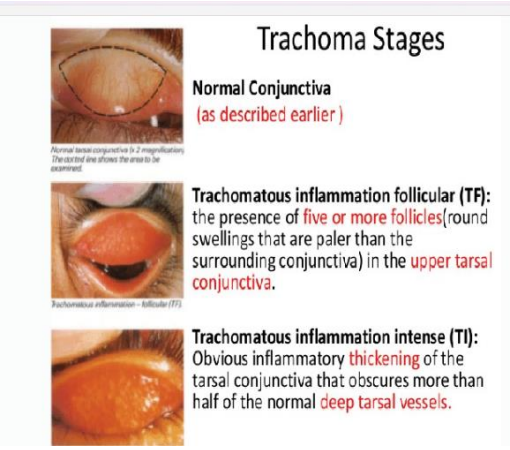
who grading:

tf (trachomatous follicles): presence of five or more follicles in the upper tarsal conjunctiva.

ti (trachomatous intense): inflammatory thickening of the upper tarsal conjunctiva that obscures more than half the normal deep tarsal vessels.

ts (trachomatous scarring): presence of scarring in the tarsal conjunctiva.

tt (trachomatous trichiasis): at least one eyelash touching the eyeball or evidence of recent removal.



v) management:

medical:

antibiotics: azithromycin or tetracycline for the treatment of active infection.

topical antibiotics: in some cases, topical antibiotics may be used.

surgical:

eyelid surgery: for trichiasis, to prevent corneal damage from the inverted eyelashes.

vi) prevention (community control programme):

1. mass drug administration (mda): administering antibiotics to entire at-risk populations.
2. facial cleanliness (f): promoting facial cleanliness to reduce transmission.
3. environmental improvement (e): improving access to water and sanitation.
4. surgery (s): offering surgical intervention for those with trichiasis.

5. antibiotics (a): treating active cases with antibiotics.

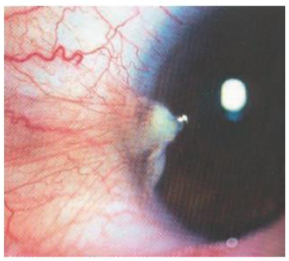
community-based programs often use the acronym safe to represent these strategies.

conjunctival – degenerations

2.16 **pterygium:**

i) definition:

pterygium, from the greek *pterygos* meaning “wing”, is a common ocular surface lesion originating in the limbal conjunctiva within the palpebral fissure with progressive involvement of the cornea. the lesion occurs more frequently at the nasal limbus than the temporal with a characteristic wing-like appearance. it is more associated with a history of increased uv exposure (outdoor work)



ii) symptoms/signs:

redness and inflammation.

itching or burning sensation.

foreign body sensation.

blurred vision (if the pterygium grows onto the cornea).

cosmetic concerns due to the appearance of the growth.

iii) Management:

Indications for Surgery:

Surgical intervention may be considered if the pterygium causes significant symptoms, visual disturbances, or if it grows close to the visual axis. Indications for surgery include:

1. Visual obstruction or distortion.
2. Persistent discomfort or irritation not alleviated by conservative measures.
3. Recurrent inflammation.
4. Cosmetic concerns.

Regular Follow-up:

After surgical removal, regular follow-up appointments with an eye care professional are essential to monitor for recurrence or complications.

Prevention:

1. UV Protection: Wearing sunglasses with UV protection can help prevent the development or recurrence of pterygium.
2. Eye Lubrication: Using artificial tears to maintain proper eye lubrication may reduce irritation.
3. Dust and Wind Protection: Wearing protective eyewear in dusty or windy environments can help prevent irritation.

2.17 Pinguecula:

A relatively common non-malignant, raised yellow-white lesion of the interpalpebral bulbar conjunctiva that does not involve the cornea and represents elastoic degeneration of subepithelial collagen with hyalinized connective tissue. These fleshy lesions are typically found bilaterally and adjacent to the limbus of the nasal bulbar conjunctiva although they can be present temporally as well.

Risk Factors

UV-light exposure, wind, dust, outdoor lifestyle and proximity to the equator. age, male gender, smoking, working outdoors, diabetes mellitus

i) Diagnosis:

. Diagnostic tools may include slit-lamp examination and evaluation of the patient's medical history.

ii) Management:

Pinguecula may not require active treatment unless it causes discomfort or interferes with vision. Management options include:

1. Artificial Tears: Lubricating eye drops can alleviate dryness and irritation.
2. Avoidance of Irritants: Minimizing exposure to environmental irritants, such as dust and wind.
3. Sunglasses: Wearing sunglasses with UV protection can help protect the eyes from harmful UV rays and reduce irritation.
4. Topical Steroids (inflammation control): In some cases, a healthcare professional may prescribe topical steroids to control inflammation.

Assessment:

- What is conjunctivitis? Give its types?
- What is trachoma? What is WHO classification of trachoma?
- What is the difference between pterygium and Pingecula? What is the treatment of pterygium?

DISEASES OF CORNEA

2.18 Corneal Ulcer: Definition

* Types

Corneal Ulcer:

Definition:

A corneal ulcer is a localized, epithelial defect on the cornea,. It can result from various causes, including infections, trauma, or inflammatory conditions, and may lead to significant visual impairment if not promptly and appropriately treated.

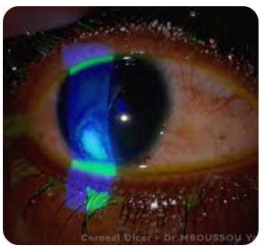
Types:

a) Bacterial Ulcer:

Diagnosis:

Diagnosing a bacterial corneal ulcer involves a comprehensive eye examination and may include the following:

1. Clinical Examination: A slit-lamp examination to assess the size, depth, and location of the ulcer.
2. Fluorescein Staining: Application of fluorescein dye to highlight the ulcer and assess its borders.



3. Corneal Culture: Collecting a sample from the ulcer for laboratory analysis to identify the specific bacteria causing the infection.

Organism Involved in Causation:

Common bacteria associated with bacterial corneal ulcers include:

Staphylococcus aureus
Streptococcus pneumoniae
Pseudomonas aeruginosa
Haemophilus influenzae

Gram-Staining:

Gram staining is a laboratory technique that categorizes bacteria into Gram-positive or Gram-negative based on their cell wall structure. Gram staining may be performed on the corneal culture to identify the type of bacteria involved.

Management:

1. Topical Antibiotics: Broad-spectrum antibiotics based on culture sensitivity.
2. Oral Antibiotics: In severe cases or when systemic involvement is suspected.

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4. Corneal Patching: Helps protect the ulcerated area.
5. Cycloplegics: Used to reduce pain and ciliary spasm.
6. Lubrication

Prevention:

Prompt Treatment of Corneal Injuries: Addressing any corneal abrasions or injuries promptly.

Contact Lens Hygiene: Proper hygiene and care of contact lenses to prevent bacterial contamination.

Eye Protection: Using protective eyewear during activities that pose a risk of eye injury.

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2.19 **Viral Ulcer:**

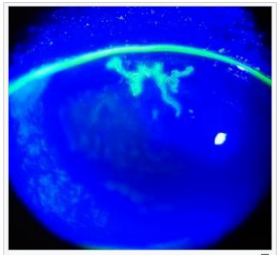
Diagnosis:

Diagnosing a viral corneal ulcer involves a thorough examination and may include the following:

1. Clinical Examination: A slit-lamp examination to assess the characteristics of the ulcer, such as size, depth, and location, corneal sensitivity.
2. Fluorescein Staining: Application of fluorescein dye to highlight the ulcer and assess its borders.
3. Viral Culture or Polymerase Chain Reaction (PCR): Collecting a sample from the ulcer for laboratory analysis to identify the specific virus causing the infection.

Virus Causing Ulcer:

The herpes simplex virus (HSV) is a common cause of viral corneal ulcers



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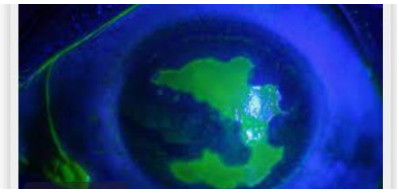
Dendritic ulcer



Geographical ulcer

Other viruses, such as varicella-zoster virus (VZV), can also lead to corneal involvement.

Pseudodendritis in VZV keratitis

Measles and Viral Corneal Ulcer in Children:

Measles, a highly contagious viral infection, can lead to a severe form of viral corneal ulcer in children. The virus can cause widespread systemic effects, including ocular complications.

Prevention:

1. Vaccination: Measles vaccination is a crucial preventive measure, as it reduces the risk of developing measles and associated complications, including ocular manifestations.

2. Eye Hygiene: Practicing good eye hygiene to reduce the risk of viral infections. This includes avoiding rubbing the eyes with unwashed hands and avoiding contact with individuals who have active viral infections.

3. Antiviral Medications: In certain cases, antiviral medications may be used prophylactically to prevent the recurrence of viral corneal ulcers in individuals with a history of herpetic eye disease.

c) Fungal Ulcer:

Diagnosis:

Diagnosing a fungal corneal ulcer involves a comprehensive examination and may include the following:

1. Clinical Examination: A slit-lamp examination to assess the characteristics of the ulcer, such as size, depth, and appearance.

Fungal corneal ulcer with fluffy margins

2. Fluorescein Staining: Application of fluorescein dye to highlight the ulcer and assess its borders.

3. Corneal Scraping or Culture: Collecting a sample from the ulcer for laboratory analysis, including fungal cultures, to identify the specific type of fungus causing the infection.

Common Fungi Causing Ulcers:

Several fungi can be responsible for fungal corneal ulcers. Common pathogens include:

Aspergillus species

Fusarium species

Candida species

Management:

1. Antifungal Medications:

Topical Antifungals: Applied directly to the eye, such as natamycin or amphotericin B.

Systemic Antifungals: In more severe cases or when the infection is deeper and harder to reach with topical medications.

2. Cycloplegics: Used to reduce pain and ciliary spasm

3. topical antibiotics for any superadded bacterial infection

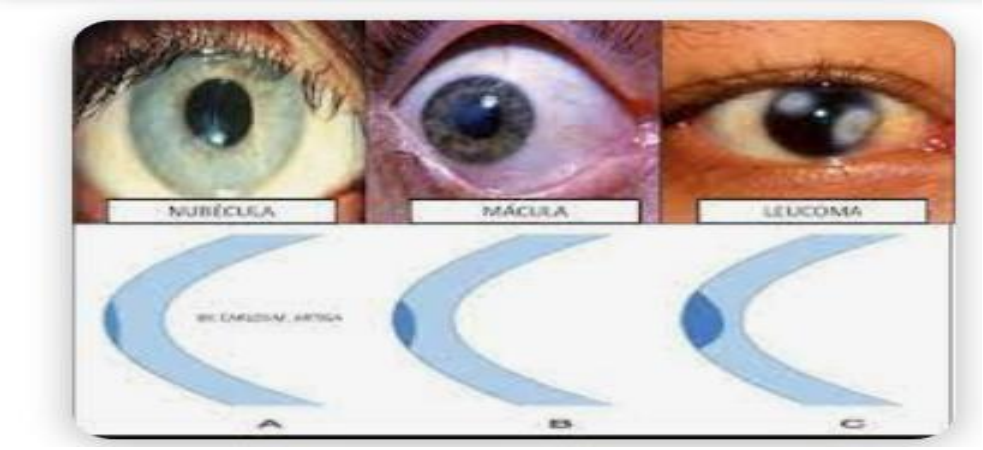
3. Prevention:

1. Avoiding Contact Lens Misuse: Proper hygiene and care of contact lenses to prevent fungal contamination.
2. Protective Eyewear: Using protective eyewear in environments where fungal exposure is possible, such as agricultural settings or construction sites.
3. Prompt Treatment of Corneal Injuries: Addressing any corneal abrasions or injuries promptly to prevent secondary fungal infections.
4. Maintaining Good Eye Hygiene: Practicing good eye hygiene to minimize the risk of infections.

2.20Corneal Scars:

Nomenclature:

Corneal scars refer to areas of fibrous tissue that replace the normal, transparent corneal tissue. They can result from various causes, including infections, injuries, or inflammatory diseases.



Nebular corneal opacity

Nebular corneal opacity is a faint opacity which results due to superficial scars involving Bowman's layer and superficial stroma.

Macular corneal opacity[edit]

Macular corneal opacity is a semidense opacity produced when scarring involves about half the corneal stroma.[4]

Leucomatous corneal opacity (leucoma simplex)

Leucomatous corneal opacity is a dense white opacity which results due to scarring of more than half of the stroma.[4] A number of different presentations of leucomatous corneal opacity exist:

Diseases Causing Scarring of the Cornea:

Several conditions can lead to corneal scarring, including:

1. Corneal Ulcers: Bacterial, viral, or fungal corneal ulcers can cause scarring if not promptly and appropriately treated.
2. Herpetic Keratitis: Infections by the herpes simplex virus (HSV) can lead to corneal scarring, especially if there are recurrent episodes.

3. Trauma: Injuries to the cornea, such as abrasions, lacerations, or foreign body penetration, can result in scarring during the healing process.

4. Inflammatory Conditions: Conditions like keratitis, particularly in autoimmune disorders, can contribute to corneal scarring.

Clinical Features:

The clinical features of corneal scars may include:

1. Opacity: Visible cloudiness or whitening of the cornea.

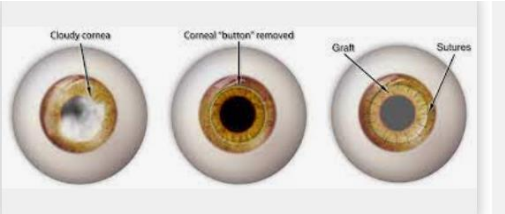
2. Irregular Astigmatism: Corneal scars can cause irregularities in the corneal surface, leading to visual distortion.

3. Reduced Visual Acuity: Depending on the size and location of the scar, visual acuity may be compromised.

Management:

1. Topical Medications: In cases where inflammation or infection is contributing to the scarring, topical medications such as corticosteroids or antimicrobial agents may be prescribed.

2. Corneal Transplant (Keratoplasty): In severe cases where vision is significantly affected, a corneal transplant may be considered to replace the scarred tissue with a healthy donor cornea.



Prevention:

1. Prompt Treatment of Corneal Injuries: Addressing corneal abrasions, ulcers, or injuries promptly to minimize the risk of scarring.

2. Eye Protection: Using protective eyewear during activities that pose a risk of eye injury.

3. Regular Eye Examinations: Regular eye check-ups can help detect and manage conditions that may lead to corneal scarring at an early stage.

. 2.21 **Nutritional Corneal Ulceration and Xerophthalmia:**

2.21.1 Malnutrition:

Malnutrition can occur due to inadequate intake of essential nutrients, poor absorption, or excessive loss of nutrients. It is a complex health issue influenced by various factors, including dietary habits, access to nutritious food, socioeconomic conditions, and underlying health conditions.. In the context of the eye, malnutrition can lead to various ocular manifestations, including corneal ulceration.

General Considerations:

Nutritional corneal ulceration and xerophthalmia are often associated with Vitamin A deficiency, a critical nutrient for maintaining the health of the cornea and other ocular structures.

Diagnosis:

1. History:

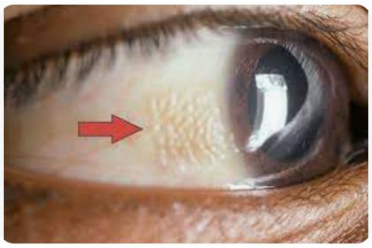
Dietary History: Inquiring about the individual's dietary habits, especially the intake of Vitamin A-rich foods.

Presence of Night Blindness: Nocturnal visual difficulties can be an early sign of Vitamin A deficiency.

2. Signs:

Xerophthalmia: Dryness of the conjunctiva and cornea due to inadequate tear production.

Bitot's Spots: Foamy, white lesions on the conjunctiva, often indicating a deficiency in Vitamin A.



Corneal Ulceration: The cornea may develop ulcers due to its compromised health.

Management:

1. Vitamin A Supplementation:

Oral Vitamin A: Supplements to correct the deficiency.

High-Dose Therapy: In severe cases, high-dose Vitamin A therapy may be initiated under medical supervision.

2. Topical Lubricants:

Artificial Tears: To alleviate symptoms of dryness and promote healing.

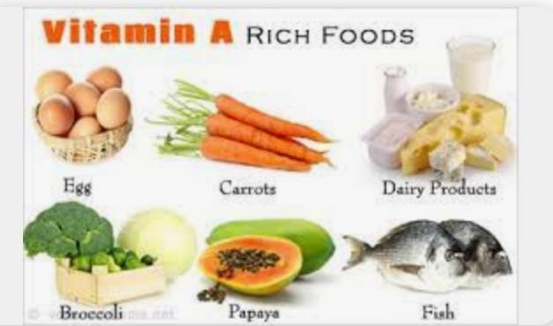
3. Treatment of Corneal Ulcer:

Topical Antibiotics: If there is evidence of bacterial infection in the corneal ulcer.

Anti-inflammatory Medications: In some cases, to reduce inflammation.

4. Nutritional Counseling:

Dietary Education: Providing information on foods rich in Vitamin A, encouraging a balanced diet.



Prevention:

1. Dietary Modification:

Encouraging a diet rich in Vitamin A sources, including:

Leafy green vegetables.

Orange and yellow fruits and vegetables.

Liver and fish oil.

2. Supplementation Programs:

Implementing Vitamin A supplementation programs, especially in regions where deficiencies are prevalent.

3. Public Health Education:

Raising awareness about the importance of nutrition for eye health.

Educating communities about the signs of Vitamin A deficiency and the need for timely intervention.

4. Regular Eye Check-ups:

Periodic eye examinations to detect early signs of nutritional deficiencies and ocular conditions.

Assessment

- what is corneal ulcer? Give its types?
- in which diseases coneal sensitivity is reduced? How do we check cornea sensitivity?
- what xerophthalmia? How can it be prevented?
- What are the types of corneal opacity? Give management

.**LENS**

2.22 Cataract:

Definition:

A cataract is a medical condition characterized by clouding or opacity of the natural lens within the eye. This clouding typically occurs as a result of the aging process, but it can also be caused by various factors such as injury, certain medications, or underlying medical conditions.

Extent of the Problem:

Cataracts are a prevalent global health issue, particularly among the elderly population. The World Health Organization (WHO) identifies cataracts as a leading cause of vision impairment and blindness worldwide. The condition significantly affects the quality of life for those affected, impacting their ability to perform daily activities and maintain independence.

2.22.1Aetiology of Cataract:

The primary cause of cataracts is aging, as the proteins in the eye's lens break down and clump together over time, leading to clouding. However, other factors can contribute to the development of cataracts, including:

1. Genetics: A family history of cataracts may increase the likelihood of developing the condition.
2. Trauma: Injury to the eye can cause cataracts to form.
3. Medical Conditions: Diabetes, hypertension, and other systemic diseases can be associated with cataract development.
4. Medications: Prolonged use of certain medications, such as corticosteroids, may increase the risk of cataracts.
5. Exposure to Ultraviolet (UV) Radiation: Long-term exposure to sunlight, especially without adequate eye protection, can contribute to cataract formation.

Classification of Cataract:

Cataracts can be classified based on various criteria, including their location within the lens and the cause of their development. Common classifications include:

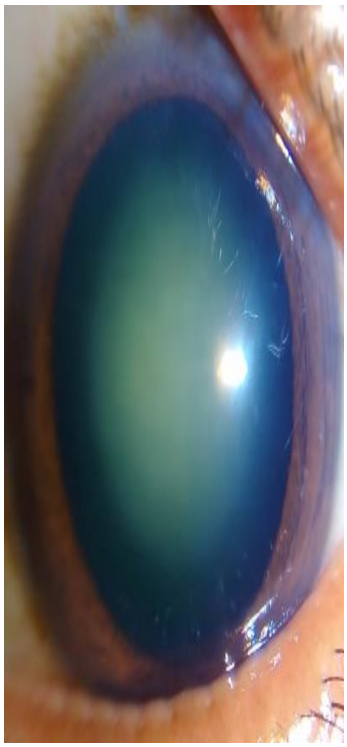
1. Age-related Cataracts: The most common type, associated with aging.
2. Congenital Cataracts: Present at birth and may be caused by genetic factors or maternal infections during pregnancy.
3. Traumatic Cataracts: Result from eye injuries.
4. Secondary Cataracts: Develop as a complication of other eye conditions or medical treatments.
5. Cataract due to storage diseases: storage diseases comprise several inherited diseases caused by abnormalities of various enzymes involved in metabolism. Cataract can be there ocular manifestation.

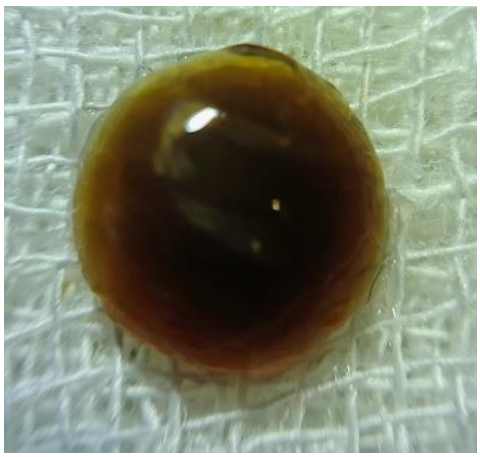
2.22.2Morphological Types of cataract:

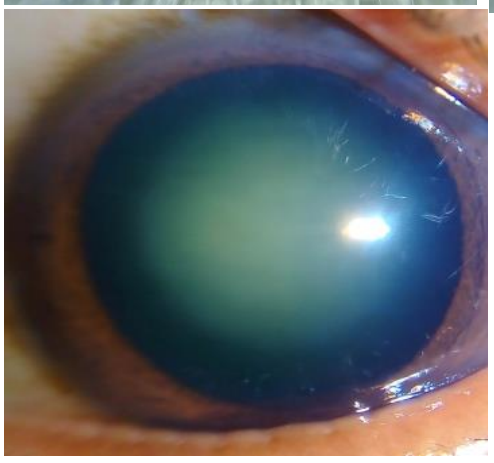
Cataracts refer to the clouding of the lens in the eye, leading to a decrease in vision. There are several morphological types of cataracts, each characterized by the location and appearance of the opacity within the lens. The main types include:

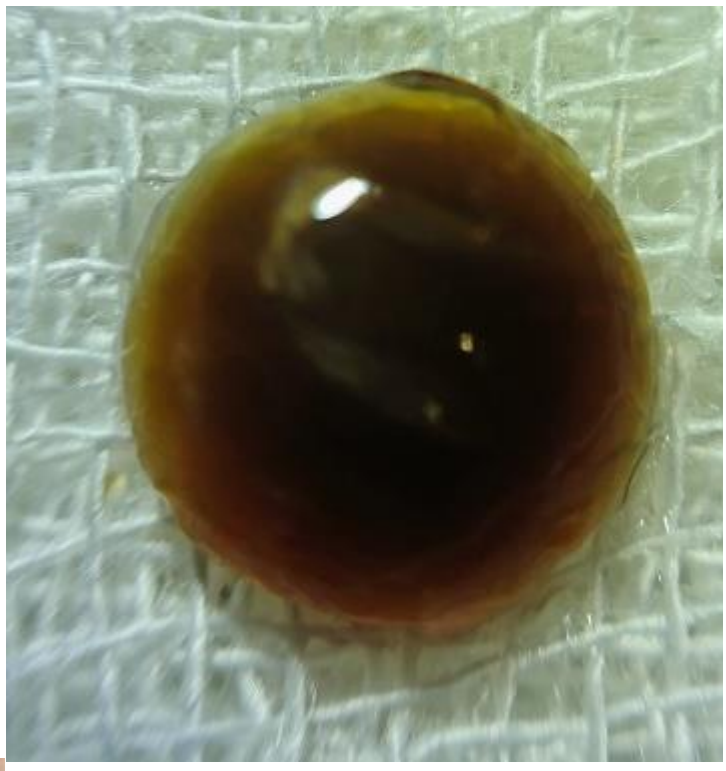
1. Nuclear Cataract:

This type involves clouding of the central or "nuclear" region of the lens. It often occurs due to changes in the proteins within the lens nucleus.





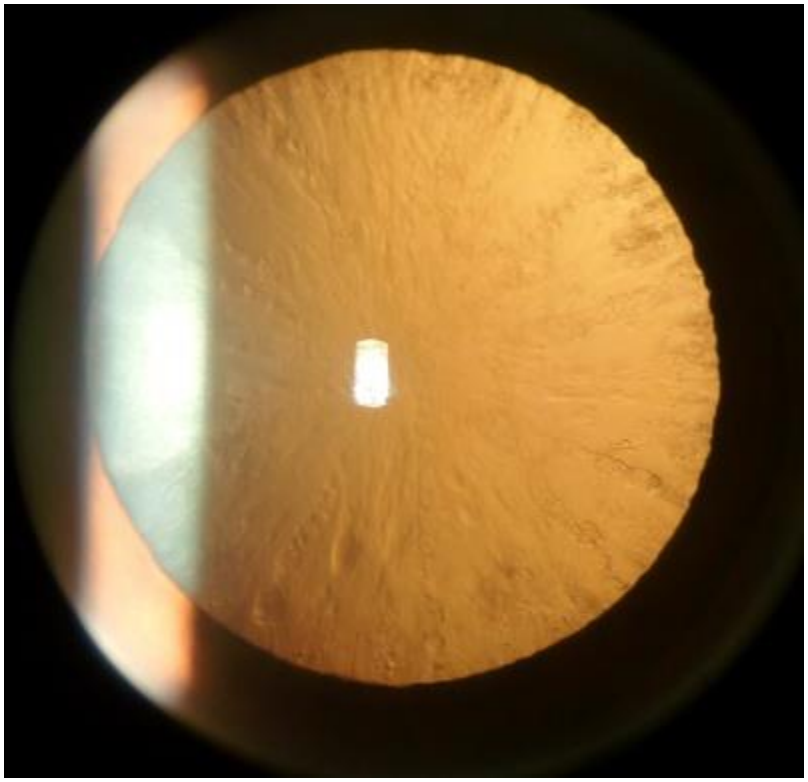




Nuclear sclerotic cataract of a 70 years old male (Diffuse illumination).

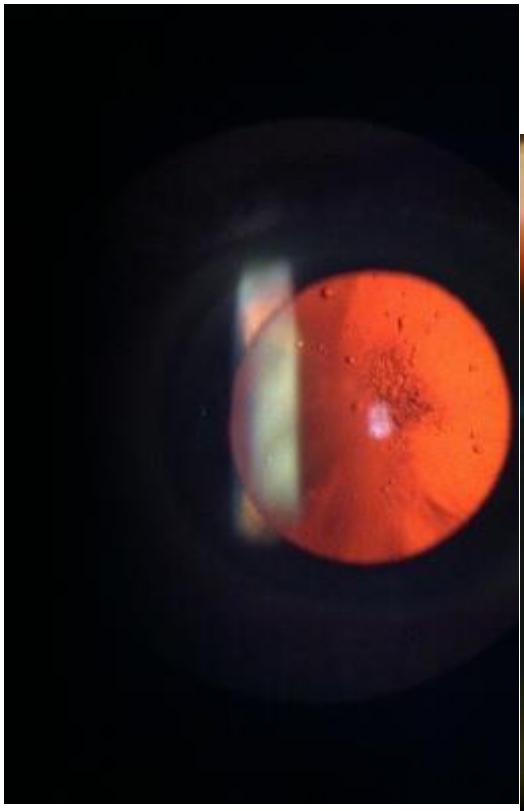
2. Cortical Cataract:

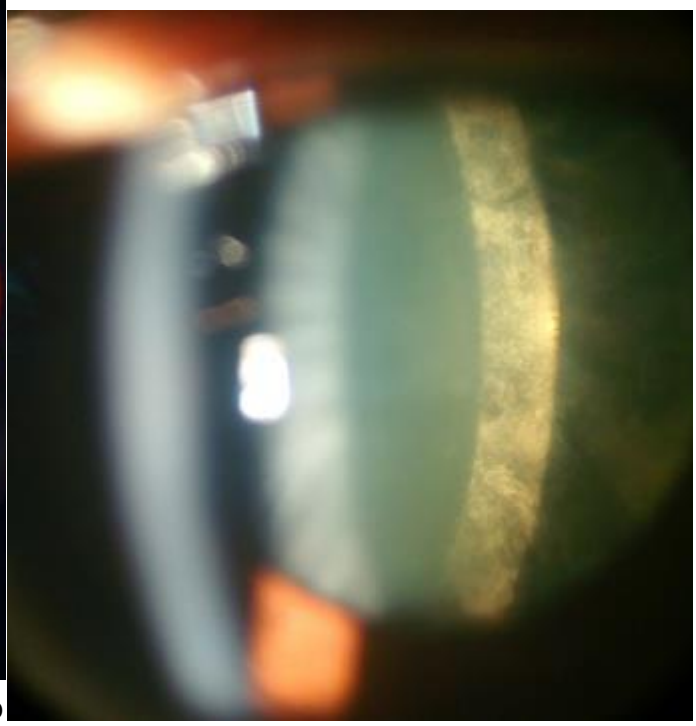
Cortical cataracts affect the outer edges or cortex of the lens. They typically begin as wedge shaped opacities and then extend inward towards the center.



3. Posterior Subcapsular Cataract (PSC):

These cataracts form at the posterior surface of the lens, just beneath the lens capsule. They often affect the vision more quickly than other types and can cause glare and halos around lights.

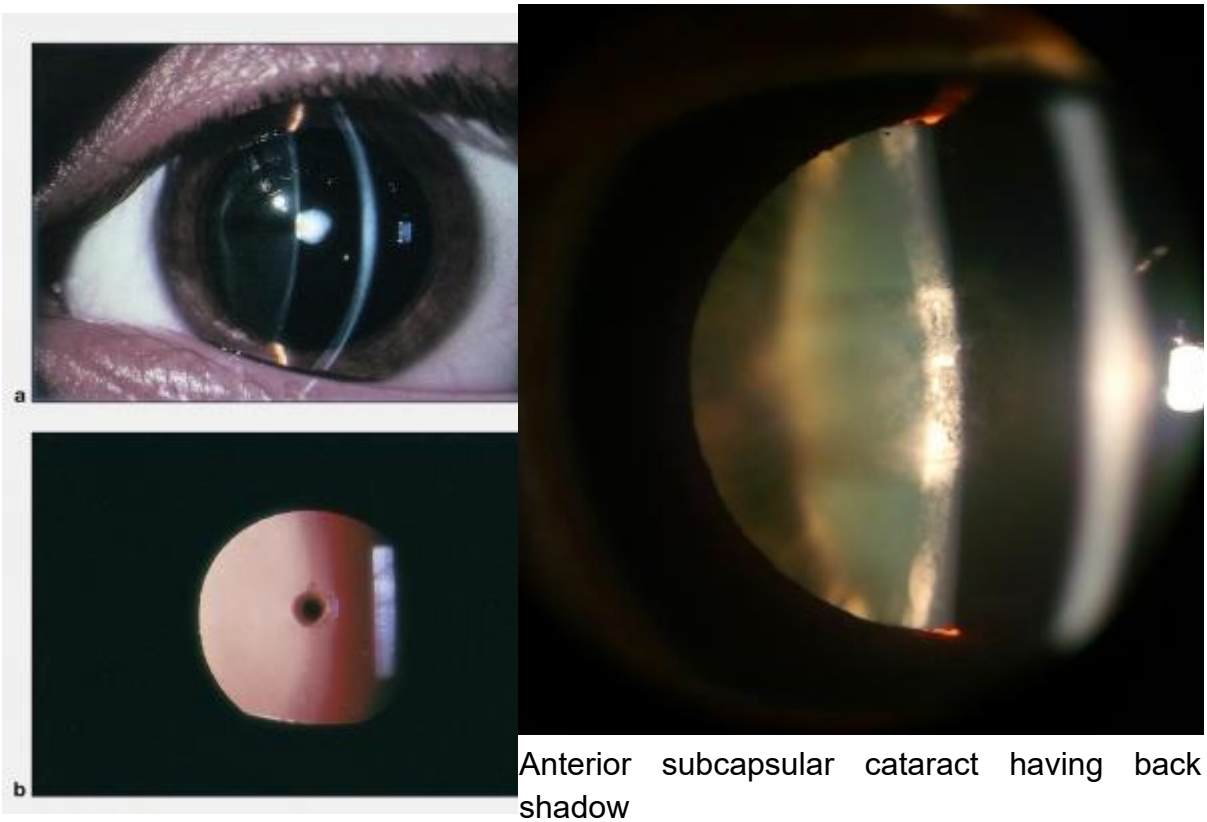




Small, central, posterior sub capsular cataract (as well as some cortical changes) viewed with retroillumination

4. Anterior Subcapsular Cataract:

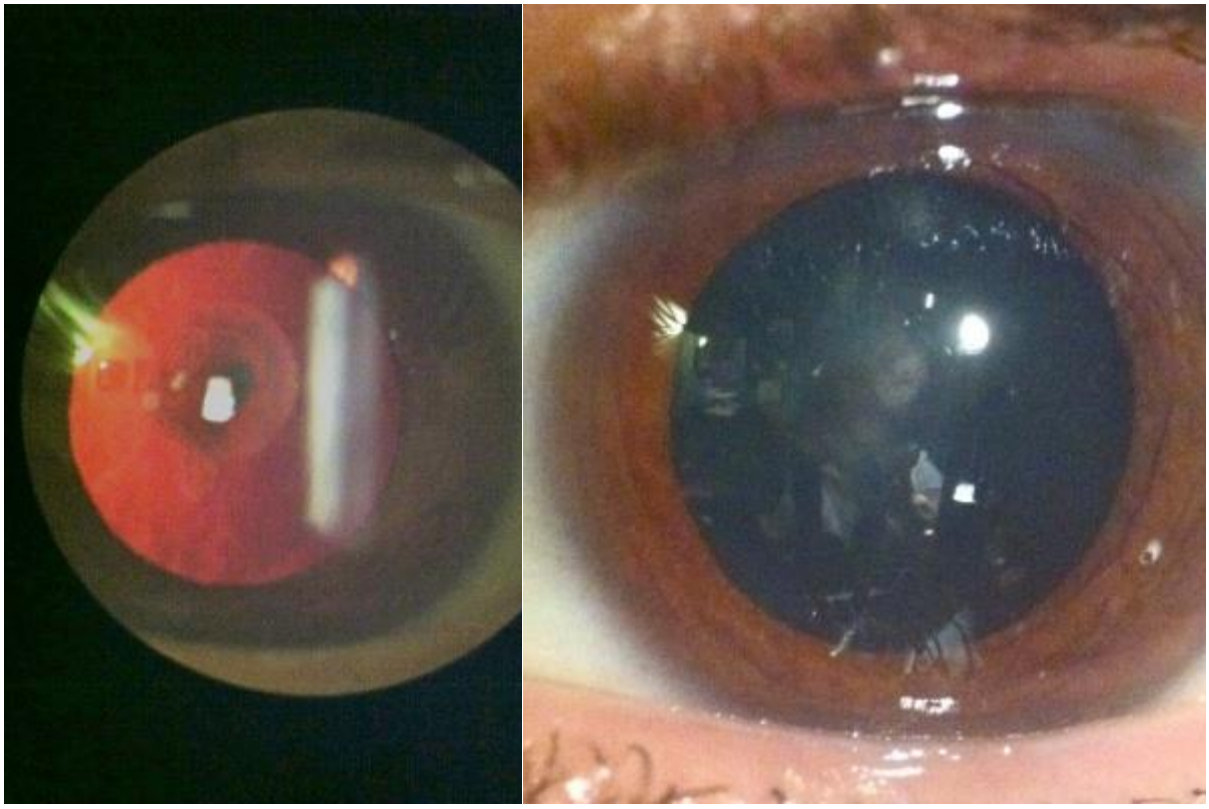
Unlike PSC, this type forms at the front or anterior surface of the lens , just beneath the lens capsule. It can impact vision, especially in bright light conditions.



Anterior subcapsular cataract having back shadow

5. Congenital Cataract:

Present at birth or develops during early childhood, congenital cataracts can be inherited or caused by infections, trauma, or metabolic disorders during pregnancy.

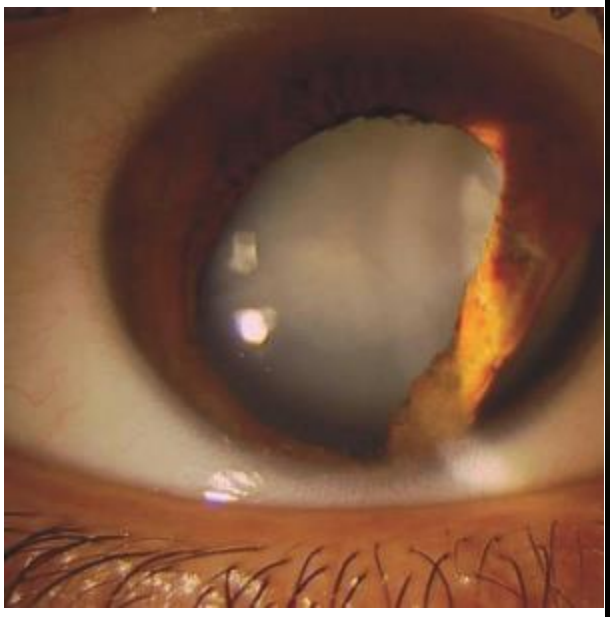


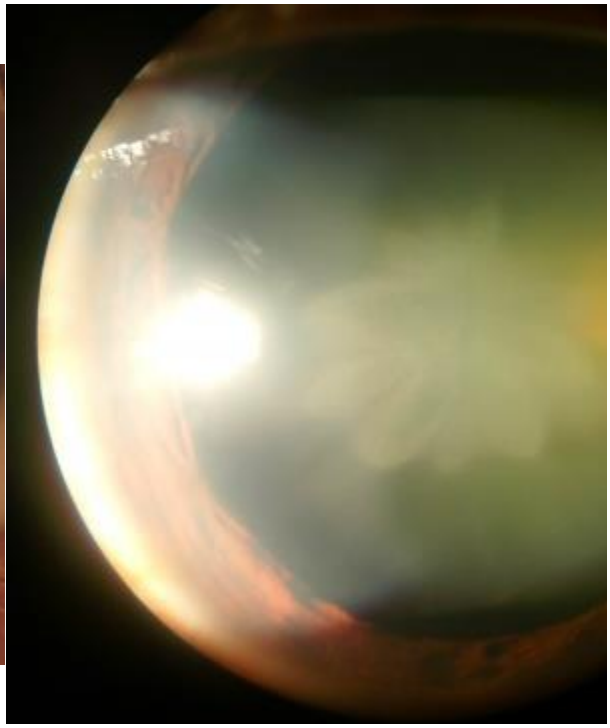
Congenital polar cataract on retroillumination

Congenital polar cataract on diffuse direct illumination

6. Traumatic Cataract:

Resulting from an injury to the eye, traumatic cataracts can develop immediately after the injury or appear years later.





7. Radiation Cataract:

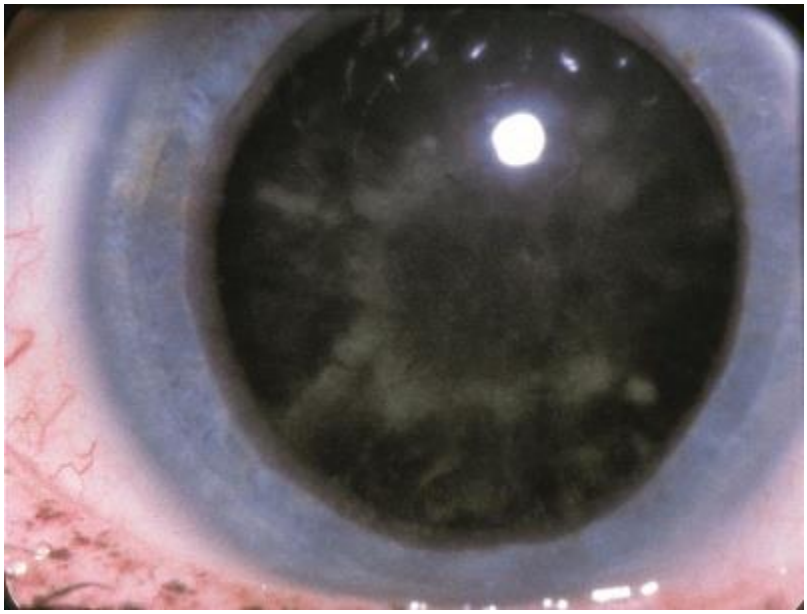
Exposure to certain types of radiation, such as that used in cancer treatment, can lead to the development of cataracts.

8. Age Related(senile) Cataract:

The most common type of cataract, it is associated with the aging process and typically develops slowly over time. It can involve various parts of the lens, leading to a gradual decline in vision.

9. Diabetic Snowflake

Snowflakes appears as gray-white subcapsular opacities. Often, these cataracts progress rapidly and the entire lens becomes intumescent and white.



Cataracts often occur at younger ages in diabetic patients due to osmotic stress from intracellular accumulation of sorbitol in the lens secondary to elevated intraocular glucose. A rapid onset form of cataract, which is quite uncommon, may be found in some diabetic patients with very elevated blood sugars, especially younger type 1 diabetics.

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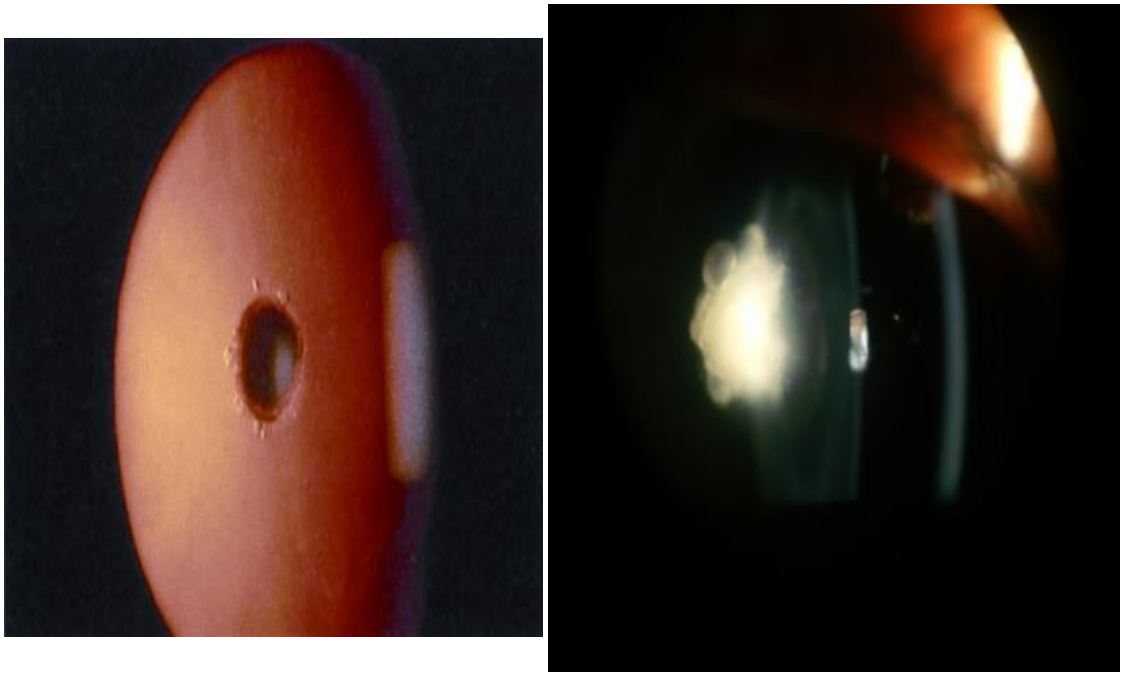
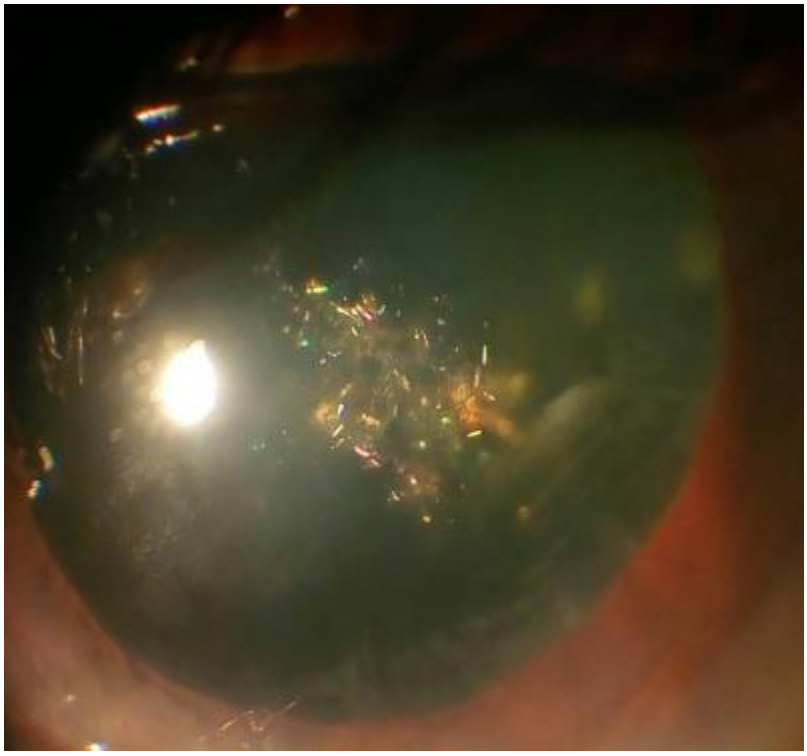


Posterior polar cataracts are characterized by well-demarcated white opacities in the center of the posterior capsule. These opacities often project forward as cylinders penetrating into the posterior lens cortex. Posterior polar cataracts are typically congenital and autosomal dominantly inherited.

Polychromatic



Christmas tree cataract (Diffuse illumination) of a 70 years old male

Also known as a "Christmas Tree" cataract, these consist of highly reflective, iridescent corneal crystals of various colors. They may be seen as a rare variant of senile cataractous development and they are also found with a higher prevalence in patients with myotonic dystrophy.

Cerulean cataracts:

Cerulean cataracts, also known as blue dot cataracts, are developmental cataracts characterized by blue and white opacifications scattered in the nucleus and cortex of the lens. Patients with cerulean cataracts are usually asymptomatic until 18-24 months of age and often do not need them removed before adulthood.

Symptoms/Signs of Cataract:

The symptoms of cataracts can vary, but common signs include:

1. Blurred Vision: Objects may appear hazy or less clear.
2. Increased Sensitivity to Glare: Lights may seem too bright, especially at night.
3. Reduced Color Perception: Colors may appear faded or less vibrant.
4. Double Vision: Seeing double in one eye.
5. Frequent Changes in Eyeglass Prescription: The need for new prescriptions may become more frequent.
6. Difficulty Seeing in Low Light Conditions: Vision may be particularly challenging in dimly lit environments.

It's crucial for individuals experiencing these symptoms to seek prompt medical attention, as cataracts can often be effectively treated with surgical intervention, restoring clearer vision and improving overall quality of life. Regular eye exams are essential for early detection and management of cataracts.

2.22.3Management of Cataract:

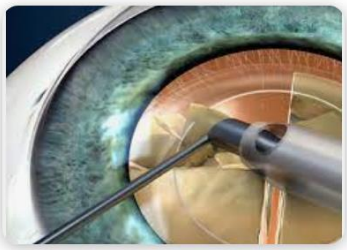
1. Non-Surgical Approaches:

Prescription Glasses/Contact Lenses: In the early stages, vision correction with glasses or contact lenses may help improve visual acuity.

Better Lighting: Adequate lighting in daily activities can assist individuals in managing cataract-related vision issues.

2. Surgical Intervention:

Phacoemulsification: The most common surgical technique for cataract removal.



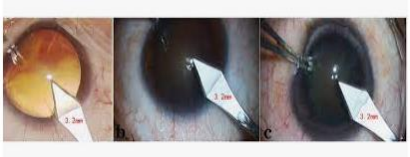
Extracapsular Cataract Extraction (ECCE): An older technique where the surgeon removes the cloudy lens but leaves the posterior capsule intact.

Intraocular Lens (IOL) Implantation: After cataract removal, an artificial lens is implanted to restore clear vision.

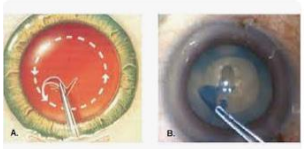
Surgical Technique of Phacoemulsification:

Phacoemulsification is a modern and widely used surgical technique for cataract removal. Here is a simplified overview of the process:

1. Anesthesia: Local anesthesia is typically used to numb the eye. In some cases, mild sedation may also be administered.
2. Incision: A small incision (around 2-3 mm) is made on the cornea to access the lens.



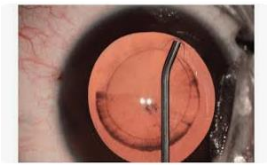
3. Capsulorhexis: The surgeon creates a circular opening in the lens capsule, allowing access to the cataract.



3. Hydroprocedures

These procedures facilitate nucleus rotation and manipulation during phacoemulsification.

i. Hydrodissection—It is the seperation of the capsule from the cortex by slowly injecting balanced saline solution between the two.



ii. Hydrodelineation—A 26 gauze needle is inserted between the hard central nucleus and epinucleus and slowly balanced saline solution is injected. Thus cleavage is done between nucleus and epinucleus

4. Phacoemulsification: Ultrasonic vibrations are used to break up the cataract into tiny fragments, which are then suctioned out.

5. IOL Implantation: An artificial intraocular lens is inserted into the lens capsule to replace the natural lens.

6. Closure: The small incision is usually self-sealing(can be closed by stromal hydration), eliminating the need for stitches.

7. Recovery: Patients are monitored postoperatively, and vision typically improves rapidly. Prescription eye drops are often prescribed to prevent infection and aid healing.

Indications for Surgery in Cataract Patients:

The decision to proceed with cataract surgery is based on several factors, and it is typically recommended when the cataract significantly interferes with daily activities and quality of life. Indications include:

1. Visual Impairment: When cataracts cause a substantial decline in visual acuity that cannot be adequately corrected with glasses or contact lenses.
2. Impact on Daily Activities: If cataracts interfere with activities such as reading, driving, or recognizing faces.
3. Glare and Halos: Increased sensitivity to glare, particularly at night, can be a significant indication.
4. Decreased Contrast Sensitivity: Difficulty distinguishing between shades of color

or contrast.

5. Progressive Nature: Cataracts that are worsening over time and affecting vision despite other interventions.
6. Other Eye Conditions: If cataracts are complicating the management of other eye conditions, such as diabetic retinopathy.

The decision for surgery is individualized, and the ophthalmologist assesses the patient's overall health, lifestyle, and visual needs before recommending cataract surgery. Regular eye examinations play a crucial role in monitoring the progression of cataracts and determining the optimal time for surgical intervention.

2.22.4 Preoperative Care for Cataract Surgery:

1. Comprehensive Eye Examination:

Assessing the overall eye health, measuring visual acuity, and determining the power of the intraocular lens (IOL) to be implanted.

2. Medical History and Medication Review:

Reviewing the patient's medical history, including any allergies, current medications, and pre-existing conditions.

3. Patient Counseling:

Providing information about the surgical procedure, potential risks, benefits, and expected outcomes.

4. Biometry and IOL Calculation:

Measuring the length of the eye and calculating the appropriate power of the IOL to be implanted for optimal vision correction.

5. Preoperative Testing:

Conducting necessary tests such as blood pressure measurement, blood tests, and electrocardiogram (ECG) based on the patient's overall health.

6. Medication Adjustments:

Adjusting or discontinuing certain medications that may interfere with the surgery or increase the risk of complications.

7. Fasting:

Instructing the patient to fast for a specified period before surgery to reduce the risk of aspiration during anesthesia.

8. Topical Medications:

Prescribing preoperative topical medications (eye drops) to minimize the risk of infection and inflammation.

2.22.5 Postoperative Care of Cataract Surgery:

1. Recovery Room Observation:

Monitoring the patient in the recovery area for any immediate complications or discomfort.

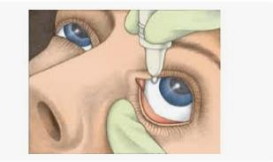
2. Prescription Medications:

Prescribing postoperative eye drops to prevent infection, control inflammation, and promote healing.

2.25 GENERAL PRINCIPLE – INSTILLING DROPS/OINTMENT

- The eyedropper should not touch patients eye while instilling drops as it can cause trauma and contaminate the remaining medicine.
- The drops and ointment should be administered in the correct strength, to the correct patient, into the correct eye, at the correct time and at the appropriate interval.
- The eye drops should also be monitored for discoloration or sedimentation which indicates that the ophthalmic solution is decomposing. In such case a new dose of medicine should be obtained and the affected bottle discarded.
- Always make sure if patient is contraindicated to some medicine.
- Medication that has passed its expiry date must not be used. Any opened drops or ointment must not be used after 28 days.

- An appropriate time interval of approximately 3min is necessary between each drop/ointment in order to prevent dilution and over flow.
- A 5mm strip of ointment should be applied to the inner edge of the lower fornix



3. Physical Activity Restrictions:

Advising the patient to avoid strenuous activities and heavy lifting for a specified period.

4. Eye Shield or Patch:

Providing an eye shield or patch to protect the eye and prevent accidental rubbing or pressure on the operated eye.

5. Follow-up Appointments:

Scheduling follow-up appointments to monitor the healing process, assess vision, and make any necessary adjustments.

6. Avoiding Water Exposure:

Instructing the patient to avoid water exposure to the eye, including swimming and hot tubs, for a specified period.

7. Sunglasses:

Recommending the use of sunglasses to protect the eyes from bright light and UV radiation.

8. Medication Compliance:

Emphasizing the importance of using prescribed eye drops as directed for the specified duration.

9. Reporting Complications:

Instructing the patient to report any unusual symptoms, such as increased pain, redness, or changes in vision.

10. Gradual Resumption of Normal Activities:

Advising the patient on the gradual resumption of normal daily activities based on the surgeon's recommendations.

Postoperative care is crucial for ensuring a successful recovery and optimal visual outcomes after cataract surgery. Regular follow-up appointments allow the ophthalmologist to assess the healing process and address any concerns that may arise during the recovery period.

Complications:

2.26 Complications of Cataract Surgery:

Operative Complications of Cataract Surgery:

1. Intraoperative Rupture of Posterior Capsule:

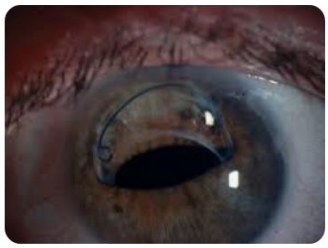
Accidental tear or rupture of the posterior capsule during surgery, which may require additional maneuvers or techniques to address.

2. Vitreous Loss:

Loss of the gel-like substance (vitreous) within the eye, often associated with posterior capsule rupture. It may increase the risk of retinal complications.

3. IOL Dislocation:

Displacement of the intraocular lens from its intended position, either during or after surgery, requiring repositioning or additional surgical intervention.



4. Corneal Edema:

Swelling of the cornea, which may occur due to increased surgical manipulation or changes in the fluid balance within the eye.

5. Endophthalmitis:

Severe infection within the eye, which is a rare but serious complication. It requires immediate treatment with antibiotics.

6. Corneal Abrasions or Injuries:

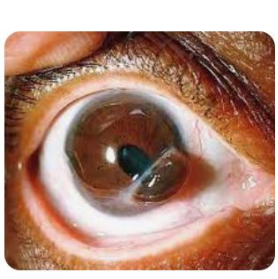
Damage to the cornea during surgery, leading to abrasions or other injuries that may affect visual recovery.

7. Hyphema:

Accumulation of blood in the anterior chamber of the eye, which may occur due to bleeding during surgery.

8. Iris Prolapse:

Protrusion of the iris through the surgical incision, which may require repositioning.



9. Phaco burn:

Phaco probe can cause thermal damage to the collagen fibers in the sclerocorneal tunnel once the temperature reaches 60 degrees Celsius, leading to a “phacoburn”

over 1 to 3 seconds.The wound burn results in the contracture of the incision site and surrounding tissue.

Postoperative Complications of Cataract Surgery:

1. Infection (Endophthalmitis):

Although rare, postoperative infection can lead to severe inflammation within the eye and requires immediate treatment with antibiotics.

2. Swelling of the Macula (Cystoid Macular Edema):

Accumulation of fluid in the central part of the retina, which may cause temporary or persistent vision loss.

3. Corneal Edema:

Continued or delayed swelling of the cornea after surgery, affecting visual recovery.

4. IOL Dislocation or Decentration:

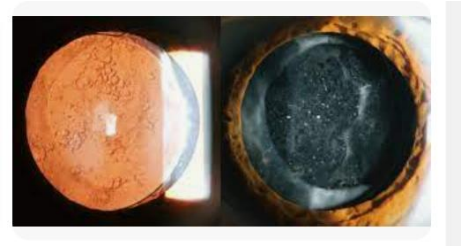
Late displacement or misalignment of the intraocular lens, which may necessitate additional surgical intervention.

5. Increased Intraocular Pressure (IOP):

Elevated pressure within the eye, which can lead to glaucoma. Regular monitoring and appropriate management are essential.

7. Secondary Cataract (Posterior Capsule Opacification):

Clouding of the posterior capsule, which can occur months or years after cataract surgery. It is treatable with a YAG laser capsulotomy.

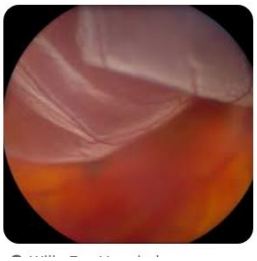


8. Dissatisfaction with Visual Outcome:

Some patients may experience dissatisfaction with their visual outcome, which can be due to residual refractive errors or other factors.

9. Retinal Detachment:

Although rare, retinal detachment can occur following cataract surgery, especially in individuals with pre-existing risk factors.



10. Photic Phenomena:

Seeing glare, halos, or other visual disturbances, especially in low-light conditions or at night.

Assessment:

- what is cataract? Give its types?
- what is the management of cataract? Enlist steps of phacoemulsification?
- what is pre-op care of cataract patients?
- what is post op care of cataract patients?
- what are the complications of cataract surgery?

DISEASES OF UVEAL TRACT

UVEITIS

2.26UVEITIS

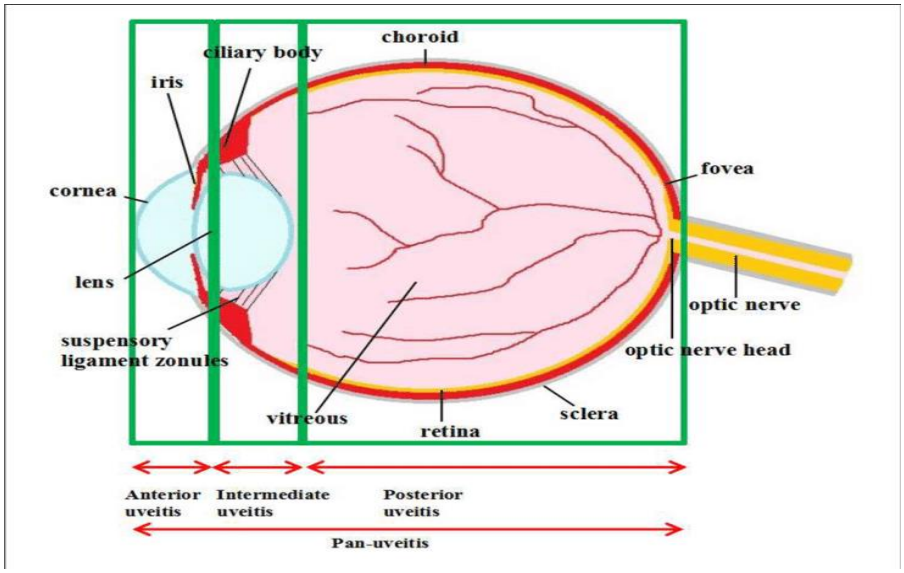
It is the inflammation of the uveal tract.

Types

Types2.26.1Types

It depends on the part of uveal tract that is involved

1) **Anterior uveitis;**
    - Iritis
    - Iridocyclitis
    - Anterior cyclitis
2) **Intermediate uveitis;**
    - Pars planitis
    - Posterior cyclitis
    - Hyalitis
3) **Posterior Uveitis;**
    - Choroiditis
    - Chorioretinitis
    - Retinochoriditis



4) **Pan uveitis;**
    - Inflammation of all uveal parts

Depending upon mode of onset and symptoms

1) **Acute Uveitis;**
   Onset is sudden with acute symptoms and resolve within 6 weeks to 3months
2) **Chronic Uveitis;**
   Onset is gradual with late symptoms and persists for longer than 3 months.
3) **Recurrent Uveitis;**
   Repeated episodes separated by period of inactivity for 3months or longer.

Depending upon inflammatory reaction

1) **Non granulomatuous uveitis;**
   Reaction includes lymphocyte and polymorph and plasma cell with fine and medium KPs.
2) **Granulomatous uveitis;**
   Reaction includes lymphocytes, epitheloid and giant cells with mutton fat KPs and iris nodules.

2.26.2 Causes;

1) **Infective**
    - Exogenous infection
      Microorganisms enter after perforation, rupture or surgery
    - Endogenous infection
      Microorganisms enter uveal tract through blood
        - ✓ Bacteria Tuberculosis, syphilis
        - ✓ Virus Herpes Zoster, HIV virus (AIDS)
        - ✓ Fungi Candida Albicans, Histoplasmosis
        - ✓ Protozoan's Toxoplasmosis
        - ✓ Parasites Toxocariasis
2) **Non infective**

- Secondary
  Caused by toxins released from adjacent eye structures
  - ✓ Corneal ulcer
  - ✓ Scleritis
  - ✓ Retinitis
- Autoimmune diseases
  - ✓ Eye conditions
    Caused by hypersensitivity and immune reaction
    i. Phacoantigenic uveitis
    ii. Sympathetic opthalmitis
  - ✓ Systemic diseases
    i. Ankylosing sponylitis
    ii. Psoriatic Arthritis
    iii. Juvenile Idiopathic Arthritis
    iv. Behcet's Disease
    v. Sarcoidosis
    vi. Inflammatory bowel disease
  - ✓ Idiopathic
    The exact cause is unknown
    i. Acute iridocyclitis
    ii. Fuch's Iridocyclitis
    iii. Glaucomatocyclitic crisis

2.27Iridocyclitis/ Anterior Uveitis

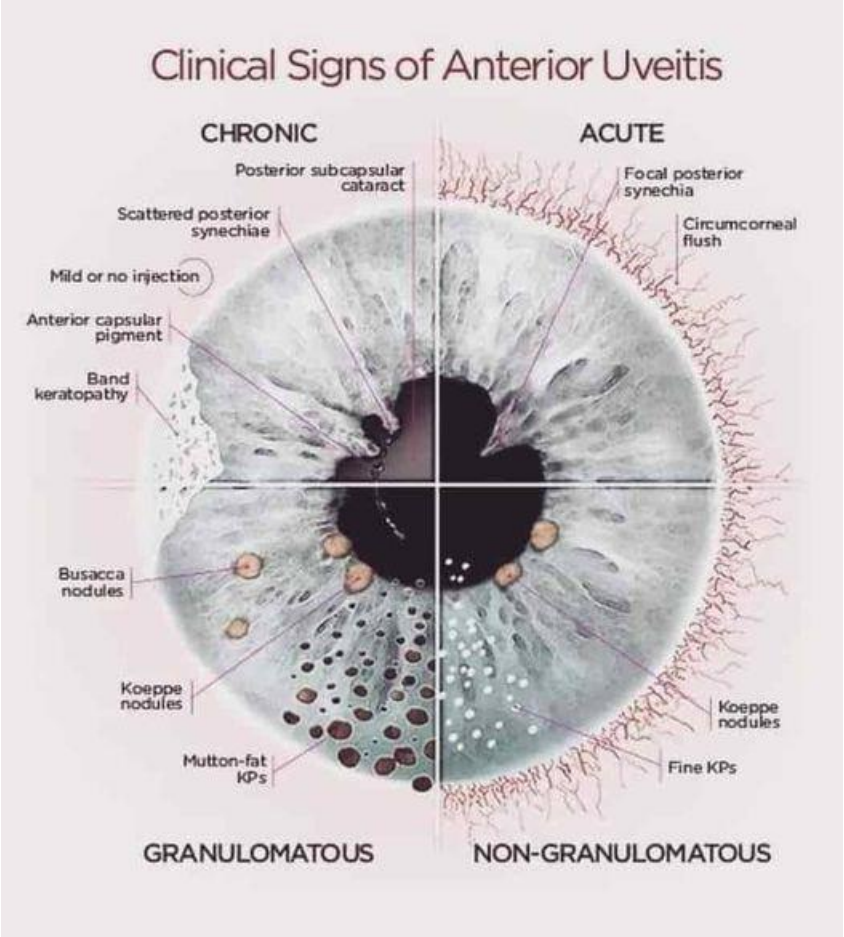
Inflammation of the iris and ciliary body.

Cause

Idiopathic unknown

Pathogenesis

It results from acute inflammation of the iris and ciliary body-→ spasm of ciliary body and vascular dilatation → increased capillary permeability→ movement of inflammatory cells into the eye → Secondary glaucoma



Clinical features

Symptoms;

i. Sudden onset of deep pain more at night
ii. Decreased vision
iii. Watering/ lacrimation
iv. Redness
v. Photophobia

Signs;

i. Visual acuity reduced
ii. Limbus circumcorneal congestion
iii. Cornea KPs present. KP (Keratitic Precipitates are inflammatory cells deposited on endothelium. They are the main feature)
iv. Aqueous flare
v. Anterior chamber reaction
vi. Iris muddy appearance
vii. Pupil constricted due to pupillary sphincter spasm
viii. Posterior synechiae adhesion between pupil and anterior lens capsule
ix. Anterior vitreous shows cells
x. Red reflex is poor
xi. Tenderness on plapation

xii. IOP may be normal, high or low.

Management

- Investigations
  Investigations are usually negative
  - ✓ Complete Blood Count (CBC)
  - ✓ Erthrocyte Sedimentation Rate (ESR)
  - ✓ Blood Sugar
  - ✓ Serology Test for Syphilis, Toxoplasmosis and histoplasmosis
  - ✓ ANA, RA factor, cANCA
  - ✓ Serum angiotensin Converting enzyme (ACE)
  - ✓ Skin tuberculin test
  - ✓ Radiological xray of chest and sacroiliac joint
  - ✓ HLA typing
  - ✓ OCT (Optical Coherence Tomography)
  - ✓ Vitreous biopsy when not responding to treatment
- Treatment
  Aim is to
  - i. Relieve patient's symptoms
  - ii. Treat underlying cause
  - iii. Prevent complications

1) Mydriatic and cycloplegic agents;
   - Atropine sulfate 1% drops or ointment 2-3 times per day
   - Homatropine 2% drops 2-3 times per day
   - Cyclopentolate 1% drops 3-4 times per day

   Aim is to
   - i. Relieve spasm of cilairy body and iris
   - ii. Dilatation of pupil protects formation of posterior synechiae
   - iii. Decrease capillary permeability causing decreased exudation
2) Steroid;
   - Topical eye drops of prednisolone or dexamethasone 4-6 times per day
   - Topical ointment at bed time
   - Periocular injection; subconjunctival and subtenon given in severe cases
3) Systemic NSAIDs
   Associated with arthritis
4) Systemic Steroids
   Prednisolone 1 to 1.5mg/kg body weight divided doses are used in severe cases
5) Antimetabolites
   Azathioprine single dose 2mg/kg/day
   Methotrexate weekly dose 10-15mg/week
6) Immunosuppressants

Cyclosporine Neoral dose 2mg/day and sandimmune 2.5mg/day

7) Antibiotics
   Topical drops, periocular injections and systemic therapy
8) Intraocular steroid
   Intravitreal triamcinolone acetonide 4mg in 0.1ml for unresponsive CMO

Complications

1) Complicated cataract
2) Secondary glaucoma obstruction of trabecular meshwork by inflammatory cells
3) Cyclitic membrane organization of exudates present behind the lens
4) Choroiditis-
5) Retinal complications Cystoid macular edema, Exudative Retinal detachment
6) Optic disc edema
7) Band keratopathy
8) Vitreous opacities
9) Hypotony chronic inflammation can lead to ciliary body damage and permanent of decreased intraocular pressure
10) Phthisis bulbi

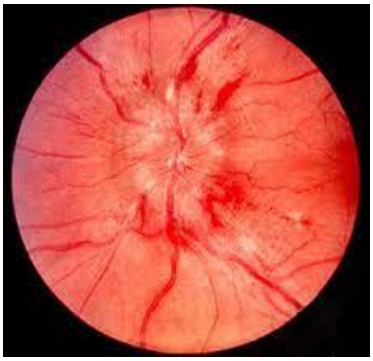


Figure shows Exudative Retinal Detachment

Figure shows papilledema

Figure shows band keratopathy

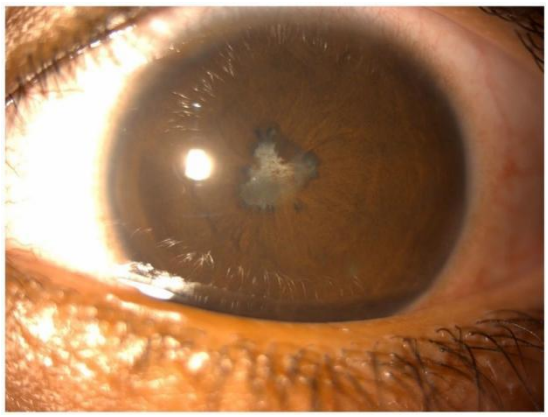


Figure shows complicated cataract

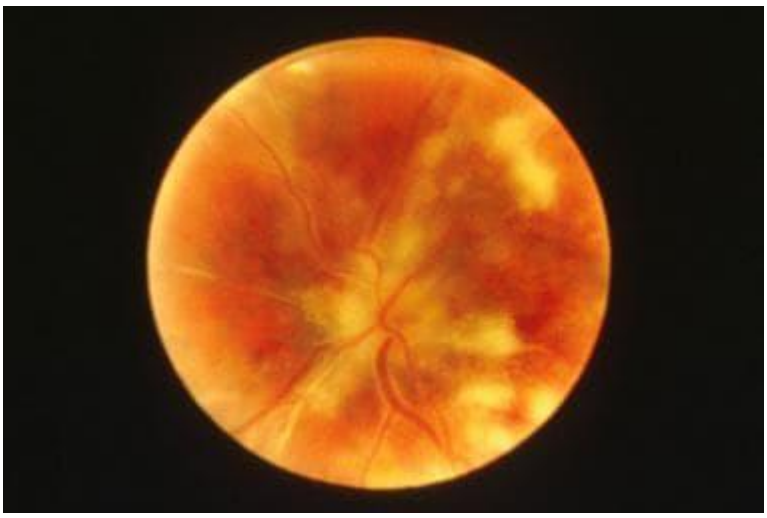
2.28 Posterior uveitis/ Choroiditis

Inflammation of choroid which almost always involves surrounding retina and resulting lesion is called chorioretinitis.

Causes

Infective bacterial, fungal and viral

Non infective sarcoidosis and collagen vascular diseases and unknown causes.



Clinical features

Symptoms

i. Gradual painless visual loss
ii. Floaters black spots moving in front of eye. This is due to clumping in vitreous
iii. Metamorphopsia objects appear distorted
iv. Micropsia objects appear smaller due to separation of visual receptors
v. Macropsia objects appear larger due to crowding together of rods and cones
vi. Photopsis Flashes of light due to irritation of rods and cones
vii. Postive scotoma Fixed spot in field of vision corresponding to the lesion

Signs

Depend on the causative agents. Some general signs are

i. Inflammatory cells and vitritis
ii. Exudates, edema and infiltrations in retina and choroid
iii. Sheathing of vessels
iv. Disc edema
v. Retinal hemorrhages
vi. Spill over uveitis
vii. Complicated cataract
viii. Choroidal neovascularisation
ix. Glaucoma
x. Retinal Detachment
xi. Macular Star(specific)

Complications

i. Dragging of macula
ii. Cataract
iii. Glaucoma
iv. Retinal detachment
v. Choroidal neovascularisation
vi. Cystoid macular edema
vii. Posterior synechiae

Treatment

Non specific includes steroids and immunosuppressive drugs

Specific depends on the causative agent.

Assessment

What is uveitis?

How do you classify uveitis?

What is anterior uveitis? What ar its clinical features?

What are the complications of anterior uveitis?

How will you manage a patient of anterior uveitis?

What is posterior uveitis?

What are the complications of posterior uveitis?

What are the signs of Posterior uveitis?

What are the signs of anterior uveitis?

UNIT 3: PHARMACOLOGY

3.1 Methods of drugs delivery to the eyes

There are various methods of delivering drugs to the eye, each designed to target specific parts of the eye and treat various ocular conditions. Here are some common methods:

3.1.1 **Eye Drops:** This is the most common method for delivering medications to the eye. Eye drops are instilled directly onto the surface of the eye and are used to treat conditions such as infections, glaucoma, dry eyes, or inflammation. The drops can contain antibiotics, anti-inflammatories, lubricants, or medications to reduce intraocular pressure.

3.1.2 **Ointments:** Similar to eye drops, ointments are applied to the eye's surface, but they have a thicker consistency and provide longer contact time with the eye. They are used for conditions like dry eyes, infections, or inflammation.

3.1.3 **Injections:** Intraocular injections involve delivering medication directly into the eye. This method is used for more severe conditions, such as macular degeneration, diabetic retinopathy, or certain infections. Injections can be administered into the vitreous cavity (intravitreal injections) or around the eye (subconjunctival or periocular injections)

3.1.4 **Implants/Pellets:** Small implants or pellets are inserted into the eye to slowly release medication over an extended period. They can be used to treat conditions like chronic uveitis or glaucoma.

3.1.5 **Eye Inserts:** These are small, flexible devices placed inside the lower eyelid, slowly releasing medication over time. They are used for conditions requiring prolonged drug release, such as chronic dry eyes

3.1.6 **Topical Gels and Solutions:** These are thicker than eye drops and are used for longer contact time on the eye's surface. They can be used for certain infections or inflammation.

3.1.7 **Iontophoresis:** This is a technique that uses a small electrical current to drive medications through the surface of the eye. It's used in specific cases to enhance drug penetration.

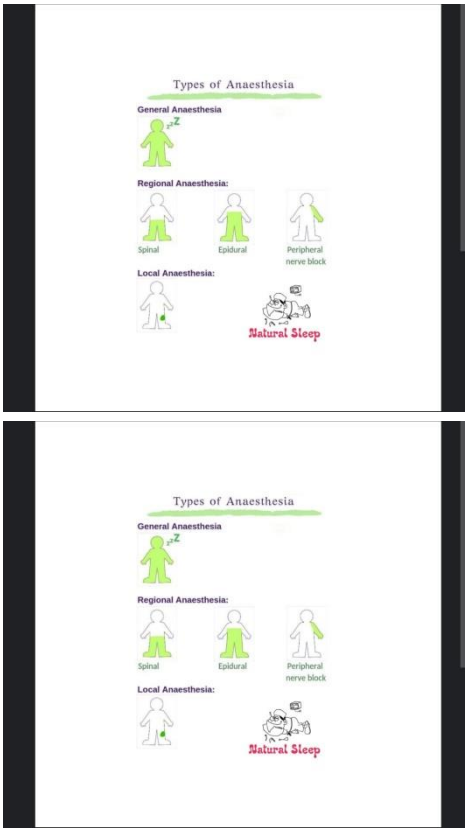
The choice of delivery method depends on factors such as the type of medication, the condition being treated, the target site within the eye, and the desired duration of drug action. Each method has its advantages and is tailored to suit the specific needs of the patient and the condition being treated

3.2 Anesthetic Drugs:

Anesthetic drugs are medications used to induce anesthesia, a state of controlled unconsciousness or insensitivity to pain during medical procedures

Types of Anesthetic Drugs:

These drugs can be classified based on their primary effects and methods of administration into several categories:



3.2.1 General Anesthetics:

These drugs produce a reversible loss of consciousness, often administered via inhalation (inhaled anesthetics) or intravenously (intravenous anesthetics). General anesthetics include:

1. **Inhalation agents:** Examples include sevoflurane, desflurane, isoflurane, and nitrous oxide.
2. **Intravenous agents:** Such as propofol, thiopental, etomidate, and ketamine

3.2.2 Local Anesthetics:

These medications block nerve impulses in a specific area of the body, resulting in loss of sensation in that region. They are commonly used for minor surgical procedures or for pain relief. Local anesthetics include lidocaine, bupivacaine, ropivacaine, and procaine

3.2.3 Regional Anesthetics:

Similar to local anesthetics, regional anesthetics block nerve impulses but in larger nerve areas or specific regions of the body, providing anesthesia to a larger portion of the body. Examples include epidural and spinal anesthesia, often administered for childbirth or lower abdominal surgeries

3.2.4 Topical Anesthetics:

These are applied to the surface of the skin or mucous membranes to numb the area and are used for minor procedures or to relieve itching or discomfort. Examples include benzocaine, lidocaine patches, and tetracaine.

Anesthetic drugs work by interrupting nerve signals that transmit sensations of pain or by inducing a controlled state of unconsciousness, allowing medical procedures to be performed without discomfort or pain for the patient. The selection of anesthetic drugs depends on various factors such as the type of procedure, the patient's health condition, desired level of sedation, and potential side effects. Administering anesthetics requires careful monitoring and expertise

3.3 Importance of local anesthetics in ophthalmology:

Local anesthetics play a crucial role in ophthalmic surgery by providing targeted anesthesia to specific areas of the eye, allowing procedures to be performed while the patient remains awake or minimally sedated. Here are some key aspects highlighting the importance of local anesthetics in ophthalmic surgery:

3.3.1 Precise anesthesia:

Ophthalmic surgeries require delicate and precise anesthesia to numb specific structures of the eye while preserving the patient's overall consciousness. Local anesthetics enable this targeted numbing effect, allowing surgeons to perform intricate procedures without causing pain

3.3.2 Minimized systemic effects:

Local anesthetics provide anesthesia directly to the surgical site, minimizing systemic absorption and reducing the risk of adverse effects associated with general anesthesia or systemic medications. This is particularly important in ophthalmic surgeries where minimizing systemic impact is critical

3.3.3 Maintained ocular integrity:

By providing localized anesthesia, local anesthetics enable surgeries while preserving the integrity and stability of the eye. This is crucial in maintaining

intraocular pressure and preventing damage or distortion to the delicate structures of the eye during the procedure

3.3.4 Improved patient comfort:

Local anesthesia allows patients to remain awake or experience minimal sedation during the surgery, reducing post-operative recovery time and minimizing potential side effects associated with general anesthesia

3.3.5 Controlled pain management:

Ophthalmic surgeries often involve sensitive areas and delicate tissues. Local anesthetics provide effective pain control, ensuring patient comfort during the procedure and reducing the need for additional pain management measures post-surgery

The use of local anesthetics in ophthalmic surgery is fundamental in ensuring a successful procedure while prioritizing patient safety, comfort, and maintaining the intricate structures and functions of the eye

3.4 Routes of local anesthesia:

Local anesthesia in ophthalmic procedures can be administered through various routes to provide effective anesthesia to the eye and its surrounding structures. The choice of the route often depends on the specific surgery, the depth of anesthesia required, and the patient's comfort. Some common routes of local anesthesia in ophthalmic procedures include:

3.4.1 Topical Anesthesia (Surface):

Eye drops or ointments containing local anesthetics such as tetracaine, proparacaine, or lidocaine are applied to the surface of the eye (cornea and conjunctiva) to provide anesthesia for minor procedures, diagnostic tests, or eye examinations. These are commonly used in procedures like tonometry or foreign body removal

3.4.2 Subconjunctival Injection:

A local anesthetic solution is injected just under the conjunctiva (the thin, transparent membrane covering the sclera) to provide anesthesia for minor surgical procedures involving the conjunctiva or superficial eye structures. It's often used for procedures like pterygium excision

3.4.3 Peribulbar Injection:

This involves injecting a local anesthetic solution into the tissue around the eyeball but outside the muscle cone, providing anesthesia for more extensive surgeries involving the anterior segment of the eye. Peribulbar anesthesia is used in cataract surgery or other anterior segment procedures

3.4.4 Retrobulbar Injection:

An injection of local anesthetic is delivered behind the eye, directly into the retrobulbar space. This technique provides anesthesia for surgeries involving the posterior segment of the eye, such as vitreoretinal procedures

3.4.5 Intracameral Injection:

During intraocular surgeries like cataract surgery, a small volume of diluted local anesthetic is injected into the anterior chamber of the eye, providing anesthesia to the intraocular structures

3.4.6 Subcuteous injection:

The subcutaneous injection involves administering medication into the fatty tissue layer beneath the skin

The choice of technique depends on the specific requirements of the procedure, the surgeon's preference, and the patient's comfort and safety

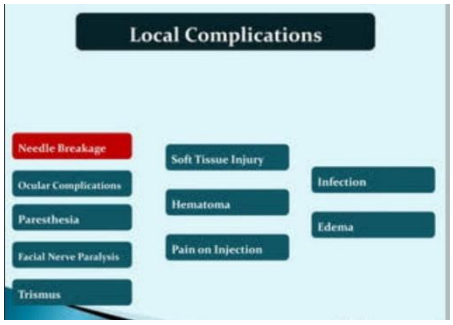
3.5 Mechanism of action of anesthetics:

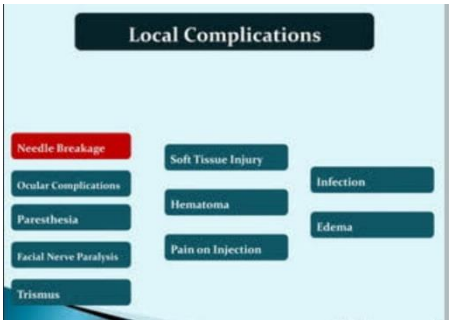
The mechanism of action of anesthetics, both local and general, involves their interaction with various components of the nervous system, leading to the inhibition or alteration of nerve function, ultimately resulting in a loss of sensation or consciousness. Local anesthetics work by blocking the nerve conduction. General

anesthetics act in CNS by enchancing inhibitory neurotransmitters and reducing excitatory neurotransmitters

3.6 Complications of local anesthetics:

Local anesthetics are generally considered safe when administered correctly and in appropriate doses. However, like any medication, they can potentially cause side effects or complications, particularly if used improperly or in excessive amounts. Some possible complications of local anesthetics include:





3.6.1 Allergic reactions:

Although rare, some individuals may be allergic to certain local anesthetics, leading to allergic reactions ranging from mild skin irritation to severe allergic responses like anaphylaxis

3.6.2 Local tissue reactions:

Injection of local anesthetics can sometimes cause local irritation, swelling, redness, or bruising at the injection site

3.6.3 Nerve damage:

While uncommon, improper administration or placement of the local anesthetic solution can potentially lead to nerve damage, resulting in temporary or, in rare cases, permanent sensory or motor deficits in the area

3.6.4 Systemic toxicity:

If excessive amounts of local anesthetic enter the bloodstream, they can cause systemic toxicity, affecting the central nervous system, cardiovascular system, and other organs. Symptoms may include dizziness, confusion, seizures, arrhythmias, cardiovascular collapse, and respiratory depression

3.6.5 Methemoglobinemia:

Some specific local anesthetics, such as prilocaine or benzocaine, can cause methemoglobinemia, a condition where the blood's ability to carry oxygen is reduced. This condition is more likely to occur in certain susceptible individuals or when high doses are used

3.6.6 Cardiovascular effects:

In rare cases, local anesthetics can cause changes in heart rate or rhythm, leading to palpitations or more serious cardiac issues in sensitive individuals

3.7 General Anesthesia:

General anesthesia is a medical state induced intentionally to render a patient unconscious and insensible to pain during surgical procedures or certain medical interventions. It involves the use of medications to produce reversible unconsciousness and loss of sensation throughout the entire body

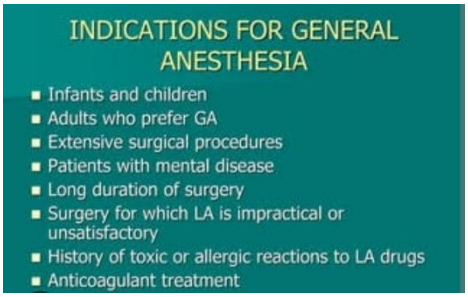
Indications:

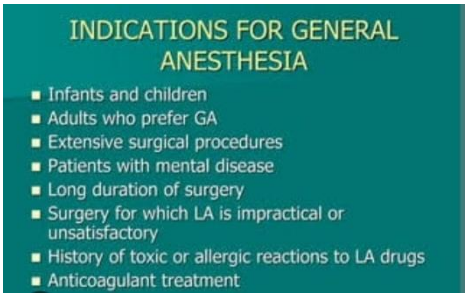
3.7.1 Surgical procedures:

General anesthesia is commonly used for various surgeries, ranging from minor procedures to complex operations, where the patient needs to be completely unconscious and pain-free

3.7.2 Diagnostic procedures:

In some cases, where a patient needs to remain completely still or relaxed during diagnostic tests (such as certain imaging studies), general anesthesia might be used





3.7.3 Invasive interventions:

Certain medical interventions, like interventional cardiology procedures or some endoscopic procedures, might require general anesthesia for patient comfort and procedural success

3.7.4 Emergency situations:

In urgent or life-threatening situations where rapid unconsciousness and pain control are necessary, general anesthesia might be employed.

3.8 Complications of General anestheisa:

3.8.1 **Postoperative nausea and vomiting:** A common side effect of general anesthesia, particularly after certain surgeries. Medications can help manage these symptoms

3.8.2 **Respiratory issues:** General anesthesia can suppress the respiratory drive and cause temporary breathing difficulties or, in rare cases, respiratory arrest. Proper monitoring and support are crucial

3.8.3 **Cardiovascular effects:** General anesthesia can cause fluctuations in blood pressure, heart rate, and cardiac output, potentially leading to irregular heart rhythms or heart complications, especially in patients with pre-existing cardiac conditions

3.8.4 **Allergic reactions:** Rarely, patients may have allergic reactions to components of the anesthetic drugs, leading to complications that range from mild rashes to severe anaphylactic reactions

3.8.5 **Malignant hyperthermia:** A rare but potentially life-threatening condition triggered by certain anesthetic medications, resulting in a rapid rise in body temperature and muscle contractions

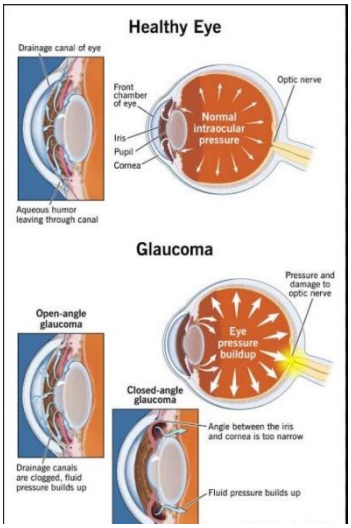
3.8.6 **Rare complications:** These may include damage to teeth or soft tissues in the mouth during intubation, sore throat, or eye injuries during positioning for surgery

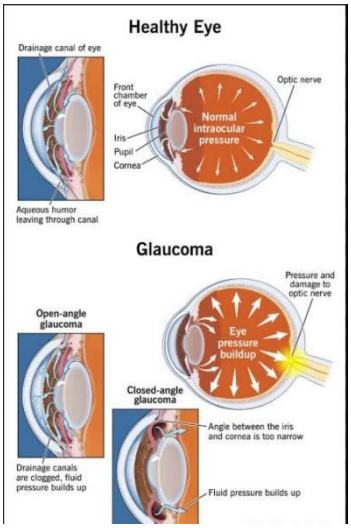
3.9 Lubricants and artificial tears:

Lubricants and artificial tears are ophthalmic solutions used to relieve dryness and discomfort in the eyes caused by insufficient tear production or certain eye conditions

3.10 Glaucoma:

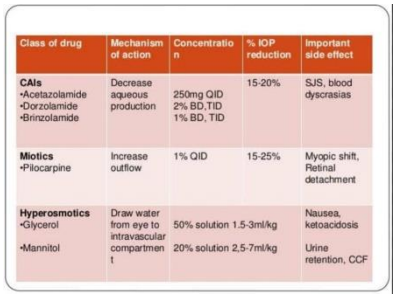
Glaucoma encompasses a group of progressive eye conditions characterized by damage to the optic nerve, leading to gradual and irreversible vision loss. This damage is often associated with elevated intraocular pressure (IOP), but it can also occur with "normal" or even low IOP in some cases, as seen in normal-tension glaucoma. The optic nerve damage results in peripheral vision loss that, if untreated, can progress to tunnel vision and eventually blindness. Glaucoma is often asymptomatic in its early stages, highlighting the importance of regular eye exams for early detection and management to prevent vision impairment



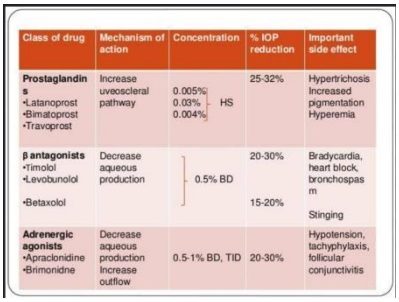


Classification of anti-glaucoma drugs:

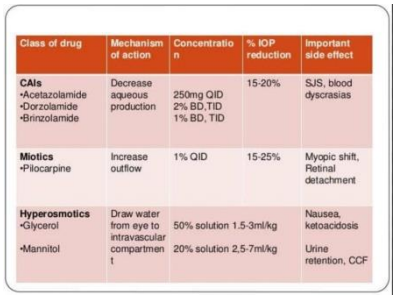
There are several classes of antiglaucoma drugs, each with its own mode of action, concentrations used, effects on the eye, therapeutic uses, and potential adverse effects:



Class of drug	Mechanism of action	Concentration	% IOP reduction	Important side effect
CAIs •Acetazolamide •Dorzolamide •Brinzolamide	Decrease aqueous production	250mg QID 2% BD,TID 1% BD, TID	15-20%	SJS, blood dyscrasias
Miotics •Pilocarpine	Increase outflow	1% QID	15-25%	Myopic shift, Retinal detachment
Hyperosmotics •Glycerol •Mannitol	Draw water from eye to intravascular compartment	50% solution 1.5-3ml/kg 20% solution 2,5-7ml/kg		Nausea, ketoacidosis Urine retention, CCF



Class of drug	Mechanism of action	Concentration	% IOP reduction	Important side effect
Prostaglandins •Latanoprost •Bimatoprost •Travoprost	Increase uveoscleral pathway	0.005% 0.03% 0.004% } HS	25-32%	Hypertrichosis Increased pigmentation Hyperemia
β antagonists •Timolol •Levobunolol •Betaxolol	Decrease aqueous production	0.5% BD	20-30% 15-20%	Bradycardia, heart block, bronchospasm Stinging
Adrenergic agonists •Apraclonidine •Brimonidne	Decrease aqueous production Increase outflow	0.5-1% BD, TID	20-30%	Hypotension, tachyphylaxis, follicular conjunctivitis



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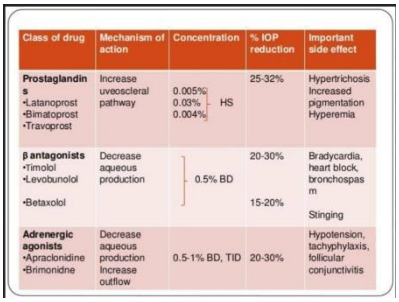
3.10.1



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Prostaglandin Analogs:

Examples include latanoprost, bimatoprost, and travoprost

They work by increasing the outflow of aqueous humor (the fluid in the eye), reducing intraocular pressure. These drugs are usually administered in the form of eye drops, typically once daily in the evening. Common adverse effects include eye redness, stinging, and changes in eyelash growth

3.10.2 Beta-Blockers:

Drugs like timolol, betaxolol, and carteolol reduce aqueous humor production by blocking beta receptors. They are available as eye drops and may cause systemic side effects like decreased heart rate and bronchospasm in susceptible individuals. Concentrations vary, but timolol, for example, is commonly used as 0.25% or 0.5% eye drops.

3.10.3 Alpha Agonists:

Brimonidine is an example that decreases aqueous humor production while increasing its outflow. It's available as an eye drop and can cause ocular allergic reactions, eye redness, and systemic side effects like dry mouth or dizziness

3.10.4 Carbonic Anhydrase Inhibitors:

Dorzolamide and brinzolamide reduce aqueous humor production when administered as eye drops. They might cause a bitter taste, eye burning, and occasionally systemic side effects like tingling in fingers or toes. Concentrations used are typically 1%.

3.10.5 Rho Kinase Inhibitors:

Netarsudil is a newer class that works by increasing aqueous humor outflow. It's applied as an eye drop and can cause conjunctival hyperemia and corneal verticillata (whorl-like patterns on the cornea)

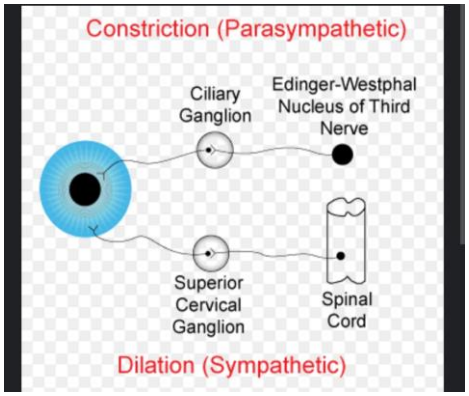
3.10.6 Miotics:

Examples include pilocarpine and carbachol. They increase the outflow of aqueous humor by constricting the pupil and the ciliary muscle. These are less commonly used due to side effects like headache, blurred vision, and poor night vision

3.11 Mydriasis

Mydriasis refers to the dilation of the pupil, which is controlled by the autonomic nervous system (ANS), specifically through the actions of the iris muscles.

Role of autonomic nervous system:



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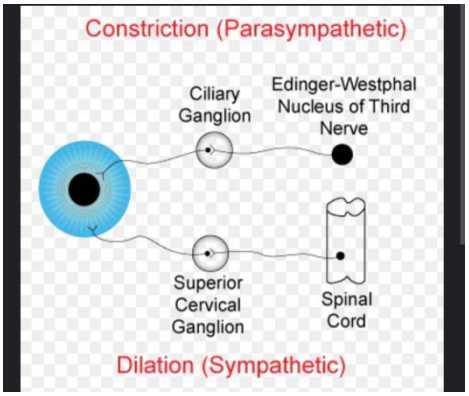


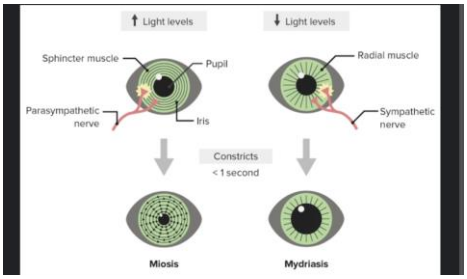
Sympathetic Stimulation:

- Mydriasis occurs predominantly due to sympathetic nervous system activation.
- When the sympathetic nerves are stimulated, they release norepinephrine (noradrenaline) onto the radial muscles (dilator pupillae) of the iris.
- Norepinephrine binds to alpha-adrenergic receptors on these muscles, causing contraction.
- Contraction of the radial muscles pulls the iris outward, causing pupil dilation

3.11.2 Parasympathetic Influence:

- Under normal conditions, the parasympathetic nervous system dominates control over the pupil size through the actions of the circular muscles (sphincter pupillae) of the iris.
- Stimulation of the parasympathetic nerves releases acetylcholine onto muscarinic receptors in the circular muscles, causing their contraction.
- Contraction of the circular muscles constricts the pupil (miosis)

3.12 Regulation:



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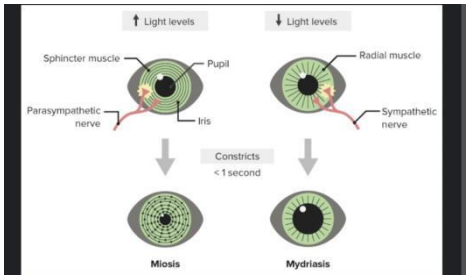


Light Reflex: In response to bright light, the parasympathetic system is activated, causing pupil constriction (miosis) to reduce the amount of light entering the eye.

3.12.2 Fight or Flight Response: During fight or flight situations or in low-light conditions, the sympathetic system is activated, leading to mydriasis, which increases visual sensitivity.

The balance between sympathetic and parasympathetic activity regulates pupil size, allowing for appropriate adjustments in response to changing light conditions and arousal states to optimize visual function.

3.12.3 Mydriatic Drugs:

Mydriatic drugs are medications that induce pupil dilation (mydriasis). They can be classified based on their mechanisms of action and include several groups:

3.12.4 Cycloplegic drugs:

Cycloplegic drugs, like atropine, cyclopentolate, and homatropine, temporarily paralyze the ciliary muscle in the eye, causing paralysis of accommodation (the ability of the eye to focus on near objects)

3.13 Classification of mydriatic drugs:

3.13.1 Sympathomimetic Agents:

Mechanism: Stimulate the sympathetic nervous system, mimicking the effects of norepinephrine on alpha-adrenergic receptors in the iris.

Examples: Phenylephrine (Concentrations may range from 2.5% to 10%), Epinephrine, Naphazoline.

Mode of Action: These drugs activate alpha-adrenergic receptors on the radial muscles of the iris, causing their contraction and resulting in pupil dilation

3.13.2 Anticholinergic Agents:

Mechanism: Block the effects of acetylcholine on muscarinic receptors in the iris, inhibiting parasympathetic input, these drugs also causes cycloplegia (temporary paralyze the ciliary muscle)

Examples: Atropine, Tropicamide (Typically used at concentrations of 0.5% to 1%), Cyclopentolate (Concentrations often range from 0.5% to 1%).

Mode of Action: By blocking muscarinic receptors on the circular muscles of the iris, these drugs prevent their contraction, allowing the radial muscles to dominate and resulting in pupil dilation

3.14 Theraputic roles of mydriatic drugs and cycloplegic drugs:

3.14.1 Diagnostic Aid:

These drugs dilate the pupils, allowing eye care professionals to better examine the structures at the back of the eye, such as the retina and optic nerve. This is crucial for diagnosing various eye conditions like retinal detachments, macular degeneration, diabetic retinopathy, and glaucoma.

3.14.2 Preparation for Eye Exams:

During comprehensive eye exams or specific diagnostic procedures like fundus photography or retinal imaging, mydriatic drugs are used to achieve maximum pupil dilation. This enables a clear and detailed view of the inside of the eye, aiding in a more accurate assessment of eye health

3.14.3 Facilitating Surgery:

Prior to certain eye surgeries (such as cataract surgery or retinal procedures), mydriatic drugs are administered to dilate the pupil. This dilation allows surgeons to access and operate on the internal structures of the eye more easily and with better visibility, increasing the success rate of the procedure.

3.14.4 Managing Inflammation:

In some cases, mydriatic drugs are used to manage inflammation in the eye, often associated with conditions like uveitis. Dilating the pupil can help alleviate pain and discomfort caused by inflammation

3.15 Effects of these drugs on other systems in body:

Mydriatic drugs primarily affect the eyes by dilating the pupils, but they can also have effects on other systems of the body due to their systemic absorption or indirect actions:

3.15.1 Cardiovascular System: Some mydriatic drugs, like phenylephrine, can cause an increase in heart rate and blood pressure due to their vasoconstrictive properties.

3.15.2 Central Nervous System: In some cases, these drugs can cross the blood-brain barrier, potentially causing symptoms such as restlessness, confusion, or even hallucinations, especially in susceptible individuals or with higher doses

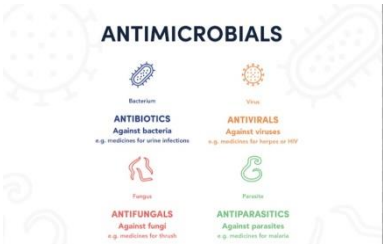
3.15.3 Urinary and Gastrointestinal Systems: Certain mydriatic drugs may lead to urinary retention or exacerbate symptoms in individuals with prostate issues. They can also cause dry mouth, blurred vision, and possible constipation due to their anticholinergic effects

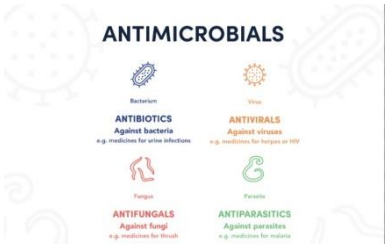
3.15.4 **Respiratory System:** High doses of mydriatic drugs with anticholinergic properties might lead to respiratory issues, particularly in individuals with respiratory conditions like asthma or chronic obstructive pulmonary disease (COPD)

3.15.5 **Skin:** Some individuals may experience allergic reactions or skin sensitivity to mydriatic drugs, leading to rashes or itching.

3.16 Antimicrobials:

Antimicrobials are substances or agents that are used to inhibit the growth or kill microorganisms, such as bacteria, viruses, fungi, or parasites. They encompass a wide range of medications, compounds, or treatments designed to combat infections caused by various pathogens





3.16.1 Common microorganisms:

Bacteria:

1. Escherichia coli (E. coli): A type of bacteria found in the intestines, some strains of which can cause infections
2. Staphylococcus aureus: A common bacterium responsible for various infections, including skin infections and sometimes more severe conditions
3. Streptococcus: A genus of bacteria causing various illnesses, including strep throat and pneumonia
4. Clostridium difficile: A bacterium causing severe diarrhea and colitis, often associated with antibiotic use
5. Salmonella: Bacteria causing food poisoning and gastrointestinal infections

Viruses:

1. Influenza virus: Responsible for seasonal flu outbreaks
2. Human Immunodeficiency Virus (HIV): Causes acquired immunodeficiency syndrome (AIDS)
3. Herpes simplex virus: Causes oral and genital herpes infections
4. Human Papillomavirus (HPV): Associated with various types of cancers and genital warts
5. Hepatitis viruses (A, B, C): Viruses causing inflammation of the liver

Fungi:

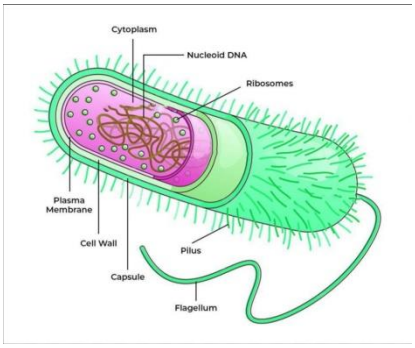
1. Candida albicans: A common yeast causing infections like thrush or vaginal yeast infections.
2. Aspergillus: Fungi found in soil and organic matter, sometimes causing lung infections in susceptible individuals.
3. Dermatophytes: Fungi responsible for skin infections like ringworm or athlete's foot

Parasites:

- Plasmodium: Parasite causing malaria, transmitted by mosquitoes.
- Giardia lamblia: Parasite causing gastrointestinal infections.
- Toxoplasma gondii: Parasite leading to toxoplasmosis, often found in cat feces and undercooked meat

3.16.2 Structure of Bacteria:

Bacteria are unicellular microorganisms with a relatively simple cellular structure compared to eukaryotic cells. Here's a breakdown of their typical structure:



Cell Envelope:

- Cell Wall:Most bacteria have a cell wall, which provides structural support and protection. The composition varies; some bacteria have thick layers of peptidoglycan (as in Gram-positive bacteria), while others have thinner peptidoglycan layers (as in Gram-negative bacteria) surrounded by an outer membrane
- Cell Membrane (Plasma Membrane):Beneath the cell wall lies the cell membrane, a phospholipid bilayer that regulates the passage of substances in and out of the cell, maintaining its internal environment.

Cytoplasmic Components:

- **Cytoplasm:**Inside the cell membrane is the cytoplasm, a gel-like substance where various cellular structures and metabolic processes occur
- Genetic Material:Bacterial DNA is typically a single circular chromosome located in the nucleoid region within the cytoplasm. Some bacteria also contain plasmids—small, circular, extrachromosomal DNA molecules that can carry additional genetic information

Organelles and Structures:

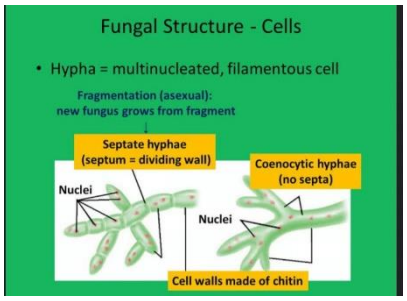
- Ribosomes:Bacterial cells contain ribosomes responsible for protein synthesis. These ribosomes are smaller and structurally different from those found in eukaryotic cells
- Flagella:Some bacteria have flagella, whip-like appendages that enable movement by rotating like propellers
- Pili or Fimbriae:These hair-like structures aid in adherence to surfaces or other cells and can be involved in bacterial motility or the transfer of genetic material.

Outer Structures (in some bacteria):

- Capsule:Some bacteria have a capsule, an outer protective layer outside the cell wall. The capsule helps protect the bacterium from the host's immune system and facilitates adherence to surfaces
- Glycocalyx: This is a general term encompassing the capsule and slime layers produced by certain bacteria, providing protection and aiding in adherence.

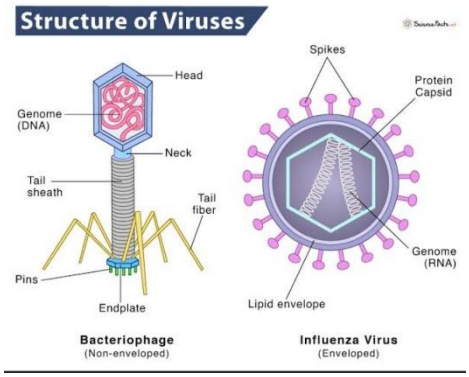
The structure of bacteria can vary among different species and even among strains within the same species. These structural components contribute to the bacteria's survival, function, interactions with their environment, and adaptation to various conditions

3.16.3 Structure of Fungi:



Fungi are eukaryotic organisms with a cell wall made of chitin and glucans. Their body consists of thread-like structures called hyphae forming networks called mycelium. They reproduce through spores in structures like sporangia or mushrooms. Fungi vary in shapes and sizes, from single-celled yeasts to complex multicellular molds, and play vital roles in ecosystems

3.16.4 Structure of Virus:



Viruses have a simple structure consisting of:

Genetic Material: Either DNA or RNA, containing the genetic instructions for replication. It can be single or double-stranded, linear, or circular.

Protein Capsid: A protective protein coat that surrounds and encases the genetic material. The capsid is made up of protein subunits called capsomeres.

Envelope (in some viruses): Some viruses have an additional outer envelope composed of lipids and proteins. This envelope surrounds the capsid and helps the virus in evading the host's immune system

Spikes or Glycoproteins: These protrude from the viral envelope and are involved in attachment to host cells, allowing the virus to infect the host.

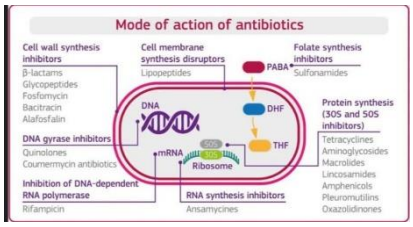
Viruses lack cellular structures and cannot carry out metabolic processes independently. They require a host cell to replicate and multiply. This basic structure enables viruses to infect cells, hijack cellular machinery, and reproduce within host organisms, causing a wide range of diseases

Classfication of antimicrobials:

Antimicrobials can be classified based in the following major categories:

3.16.5 Antibiotics:

These are substances derived ftom fungi or other bacterias. Fleming discoveres “Penicillin” in the year 1929. In the last few years many such drugs have been discovered such as cephalosporin, aminoglycosides and various tetracyclines.



- **Penicillins:**
  These include Amoxicillin, Penicillin G/V.
  Mode of Action: Inhibit bacterial cell wall synthesis by binding to penicillin-binding proteins (PBPs), leading to cell wall disruption and bacterial cell death.
  Resistance: Bacterial production of beta-lactamases, altered PBPs.
  Pharmacokinetics: Generally well-absorbed orally; excreted via kidneys.
  Spectrum: Effective against Gram-positive bacteria; some are effective against Gram-negative bacteria as well.
  Adverse Effects: Common side effects include allergic reactions (ranging from mild rashes to severe anaphylaxis), diarrhea, and in some cases, antibiotic-associated colitis (such as Clostridium difficile infection).
- **Cephalosporin:**
  These include cefaclor, cefixime, cetazidime and ceftraixone
  Mode of Action: Inhibit bacterial cell wall synthesis by binding to penicillin-binding proteins (PBPs), leading to cell wall disruption and bacterial cell death
  Spectrum: They have a broad spectrum of activity against both Gram-positive and Gram-negative bacteria
  Resistance: Beta-lactamases, altered PBPs.
  Pharmacokinetics: Vary among generations; most are renally excreted.
  Adverse Effects: Common side effects include gastrointestinal disturbances (nausea, diarrhea), allergic reactions (similar to penicillins), and in some cases, antibiotic-associated colitis. Certain generations of cephalosporins may have a higher risk of inducing bleeding due to interference with blood clotting factors
- **Macrolides:**
  These include Erythromycin, Azithromycin.

Mode of Action: Inhibit bacterial protein synthesis by binding to the bacterial ribosome

Spectrum: Effective against Gram-positive bacteria and some Gram-negative bacteria, as well as atypical pathogens

Resistance: Altered ribosomal binding sites, efflux pumps.

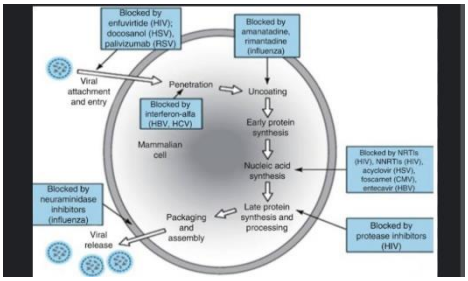
Pharmacokinetics: Well-absorbed orally; metabolized in the liver.

Adverse Effects: Common side effects include gastrointestinal disturbances (nausea, abdominal pain, diarrhea), and less frequently, allergic reactions or liver enzyme abnormalities

- **Fluoroquinolones:**
  These include Ciprofloxacin, ofloxacin and Levofloxacin.
  Mode of Action: Inhibit bacterial DNA gyrase and topoisomerases, affecting bacterial DNA replication and repair.
  Spectrum: Broad-spectrum antibiotics effective against both Gram-positive and Gram-negative bacteria.
  Resistance: Mutations in DNA gyrase, efflux pumps.
  Pharmacokinetics: Well-absorbed orally; excreted mainly via kidneys.
  Adverse Effects: Common side effects include gastrointestinal upset, headache, dizziness, tendon rupture (rare but serious), and in some cases, increased risk of tendinitis
- **Tetracyclines:**
  These include Doxycycline and Tetracycline
  Mode of Action: Inhibit bacterial protein synthesis by binding to the bacterial ribosome
  Spectrum: Broad-spectrum antibiotics effective against a wide range of bacteria, both Gram-positive and Gram-negative
  Resistance: Efflux pumps, ribosomal protection proteins
  Pharmacokinetics: Well-absorbed orally; eliminated via feces and urine.
  Adverse Effects: Common side effects include gastrointestinal upset, photosensitivity, and tooth discoloration if used in children whose teeth are still developing
- **Glycopeptides:** Vancomycin, Teicoplanin. They disrupt bacterial cell wall synthesis by binding to the cell wall precursor molecules
- **Aminoglycosides:**
  These include streptomycin, Gentamicin, Tobramycin, kanamycin and neomycin
  Mode of Action: Inhibit bacterial protein synthesis by binding to the bacterial ribosome.
  Spectrum: Effective against Gram-negative bacteria and some Gram-positive bacteria.
  Resistance: Enzymatic modification, decreased uptake
  Pharmacokinetics: Poor oral absorption; excreted primarily by kidneys.

Adverse Effects: Common side effects include kidney damage, hearing loss (especially with prolonged use or high doses), and potential neuromuscular blockade.

3.16.6 Antivirals:



Nucleoside/nucleotide analogs:

Mode of Action: Mimic the structure of nucleosides or nucleotides, interfering with viral DNA or RNA synthesis.

Therapeutic Uses: Effective against specific viruses such as herpesviruses (e.g., HSV, VZV), HIV, and hepatitis viruses

Pharmacokinetics: Often available in oral and/or intravenous formulations; undergo metabolism in the body and are excreted via urine

Adverse Effects: Side effects may include nausea, vomiting, diarrhea, and in some cases, kidney dysfunction.

Protease inhibitors:

Mode of Action: Block viral protease enzymes necessary for the maturation of infectious viral particles.

Therapeutic Uses: Primarily employed in HIV treatment to inhibit the replication of the virus.

Pharmacokinetics: Usually available orally; metabolized in the liver and eliminated via feces and urine.

Adverse Effects: Common adverse effects include gastrointestinal issues, metabolic abnormalities, and potential interactions with other medications

Neuraminidase inhibitors:

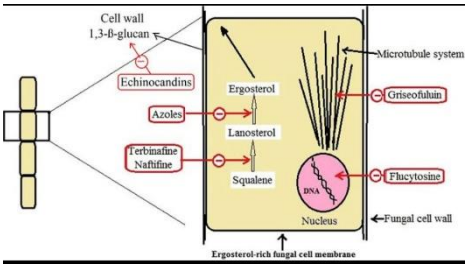
Mode of Action: Prevent the release of mature virus particles from infected cells.

Therapeutic Uses: Effective against influenza viruses, reducing symptoms and duration of illness when taken early.

Pharmacokinetics: Available as oral or inhaled preparations; metabolized in the liver and excreted in urine.

Adverse Effects: Side effects may include nausea, vomiting, and occasionally neuropsychiatric effects (more commonly seen in children).

3.16.7 Antifungals:



Azoles:

These include fluconazole, itraconazole and ketoconazole

Mode of Action: Inhibit fungal cell membrane synthesis by blocking the synthesis of ergosterol, an essential component of fungal cell membranes

Spectrum: Broad-spectrum against various fungal infections.

Pharmacokinetics: Often available in oral and topical formulations; can be systemically administered in severe cases. Metabolized in the liver.

Adverse Effects: Commonly include gastrointestinal disturbances, headache, and in rare cases, liver toxicity

Polyenes:

These include amphotericin B and nystatin

Mode of Action: Bind to fungal cell membranes, causing leakage of cell contents by creating pores in the membrane.

Spectrum: Effective against a wide range of fungal infections, particularly serious systemic infections.

Pharmacokinetics: Often administered intravenously due to poor oral absorption. Excreted primarily by the kidneys.

Adverse Effects: Can cause kidney damage, electrolyte imbalances, and infusion-related reactions

Echinocandins:

These include caspofungin, micafungin and anidulafungin

Mode of Action: Inhibit fungal cell wall synthesis by inhibiting the synthesis of β-(1,3)-D-glucan, an essential component of the fungal cell wall

Spectrum: Effective against certain systemic fungal infections

Pharmacokinetics: Typically administered intravenously. Metabolized in the liver

Adverse Effects: Commonly include gastrointestinal disturbances, headache, and in rare cases, liver enzyme abnormalities

Allylamines and Other Antifungals:

These include terbinafine and naftifine

Mode of Action: Inhibit fungal cell wall or membrane synthesis through various mechanisms

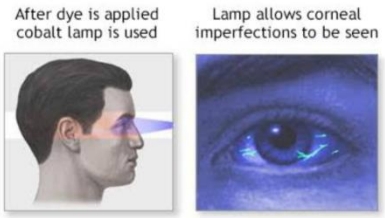
Spectrum: Varies depending on the specific drug; used for specific fungal infections

Pharmacokinetics: Varies among different drugs within this category

Adverse Effects: Can include skin reactions, gastrointestinal issues, and in some cases, liver toxicity

3.17 Fluorescein Dye:

Fluorescein is a diagnostic dye used in ophthalmology to detect and highlight abnormalities in the eye, particularly for corneal injuries or irregularities



3.17.1 Routes of Administration:

Fluorescein is primarily administered topically onto the eye's surface.

3.17.2 Concentration:

Typically, fluorescein is available as a 0.25% to 2% sterile ophthalmic solution.

3.17.3 Method of Instillation:

It's usually applied as eye drops or sometimes as a strip soaked in the dye and then applied to the conjunctiva of the eye

3.17.4 Appearance:

The solution appears as a yellowish-orange color.

3.17.5 Side Effects:

Common side effects of fluorescein include temporary stinging or burning sensation upon instillation. Some individuals might experience mild nausea or vomiting due to the taste of the dye if it is swallowed inadvertently. Allergic reactions are rare but possible.

3.17.6 Purpose of staining

This dye aids in diagnosing corneal abrasions, ulcers, or other corneal irregularities by highlighting these areas under a blue light during an eye examination called fluorescein angiography or a fluorescein staining test

3.18 Rose Bengal dye:

Rose Bengal is another diagnostic dye used in ophthalmology, particularly in evaluating ocular surface disorders and identifying damage to the cornea and conjunctiva.

3.18.1 Routes of Administration:

Rose Bengal is typically administered topically onto the eye's surface.

3.18.2 Concentration:

Rose Bengal is commonly available as a 1% ophthalmic solution.

3.18.3 Method of Instillation:

Similar to fluorescein, it's applied as eye drops or sometimes on a strip soaked in the dye and then placed on the conjunctiva of the eye

3.18.4 Appearance:

The solution appears as a reddish-pink color.

3.18.5 Side Effects:

Side effects associated with Rose Bengal may include a transient stinging or burning sensation upon application. Some individuals might experience mild irritation or discomfort. Allergic reactions are possible but rare

3.18.6 Purpose of staining:

Rose Bengal aids in the diagnosis of ocular surface disorders such as dry eye syndrome, conjunctival and corneal damage, and helps in evaluating the integrity of the ocular surface by highlighting damaged or irregular areas. It's used during an eye examination called Rose Bengal staining or ocular surface staining

3.19 Precautions for dyes:

1. Patients should inform their healthcare provider about any known allergies, particularly to dyes or medications
2. Ensure the solution is sterile and free from particles before instillation
3. Avoid contact between the dropper tip and the eye to prevent contamination
4. Care should be taken to avoid contamination of the solution
5. Individuals with a history of allergy to fluorescein or similar dyes should use this dye cautiously or consider alternative diagnostic methods
6. Remove contact lenses before applying the dye

3.20 Diagnostic agents:

In ophthalmology, diagnostic agents are specifically used to help identify and assess abnormalities or conditions affecting the eyes and related structures. These agents can include dyes (Fluorescein, Rose Bengal), imaging contrast agents, or drugs (mydriatic/cycloplegics) that help in visualizing, highlighting, or detecting specific features or abnormalities

3.21 Theraputic agents:

In ophthalmology, therapeutic agents are specifically targeted to treat various eye conditions, infections, inflammations, or other ocular disorders. These agents can include medications (antimicrobials, steroids) administered as eye drops, ointments, or oral medications, as well as procedures such as surgeries or laser therapies aimed at improving or maintaining eye health, reducing symptoms, or preventing further deterioration of vision or eye-related issues. Their primary purpose is to promote healing, manage symptoms, or halt the progression of eye diseases and conditions to improve overall ocular health and vision.

3.22 Artificial Tears:

3.22.1 Composition:

Artificial tears are solutions designed to mimic the composition of natural tears. They typically contain water, electrolytes (such as sodium and potassium), and viscosity agents (like hydroxypropyl methylcellulose, carboxymethylcellulose, or polyethylene glycol). Some formulations may also include preservatives to prolong shelf life.

3.22.2 Purpose:

These drops are used to provide immediate relief by hydrating the surface of the eye, lubricating it, and aiding in the formation of a stable tear film. They help alleviate symptoms such as dryness, irritation, redness, or discomfort caused by environmental factors, prolonged screen time, or mild dry eye conditions

3.22.3 Types:

Artificial tears come in various formulations, including preservative-free options for individuals sensitive to preservatives, gel-based drops for longer-lasting relief, and ointments for overnight use due to their thicker consistency.

3.22.4 Usage:

They are instilled directly into the eye as drops and can be applied as needed throughout the day, depending on the severity of dryness or discomfort.

3.23 Lubricants:

3.23.1 Composition:

Lubricants, similar to artificial tears, aim to provide moisture and lubrication to the ocular surface. They might contain water, viscosity agents, and other ingredients to enhance their longevity on the eye's surface.

3.23.2 Purpose:

Lubricants are often recommended for individuals experiencing persistent or chronic dry eye symptoms. They offer longer-lasting relief compared to standard artificial tears and are typically more viscous or thicker in consistency

3.23.3 Types:

Lubricants are available in various forms, including gels, ointments, or thicker solutions. Gels and ointments provide prolonged relief due to their increased viscosity but may cause temporary blurring of vision immediately after application.

3.23.4 Usage:

Lubricants are applied less frequently than artificial tears and are often used before bedtime or as directed by an eye care professional. They provide prolonged relief by forming a protective layer on the eye's surface.

Both artificial tears and lubricants are available without a prescription and can be used for temporary relief of mild to moderate dry eye symptoms

Assessment

Question 1

What is ocular pharmacology? Give a brief overview of steroids, types, mechanism of action, indications and side effects.

Question 2

Give a brief overview of NSAIDs, types, mechanism of action, indications and side effects.

Question 3

What are anesthetic drugs? Give an overview of their types and their importance in ocular pharmacology.

Question 4

Give a brief overview of different routes of local anesthesia in ophthalmology and complications of local anesthetics.

Question 5

What are the indications and complications of general anesthesia?

Question 6

Describe structure of bacteria and give mechanism of action, pharmacokinetics, spectrum and side effects of major classes of antibiotics.

Question 7

Describe structure of viruses and give mechanism of action, pharmacokinetics, spectrum and side effects of antivirals.

Question 8

Describe structure of fungi and give mechanism of action, pharmacokinetics, spectrum and side effects of antifungals.

Question 9

What is mydriasis? Give role of autonomic nervous system in this process. Explain mydriatic and cycloplegic drugs, their theraputic role and side effects.

Question 10

What is glaucoma? Classify antiglaucoma drugs, their mechanism of action and side effects.

Question 11

What are different types of dyes used in ophthalmology? Their role in patient care and enlists precautions for these dyes

Question 12

What is the difference between a diagnostic agent and theraputic agent? Describe the method of instillation of eye drops/ointment.

Questio 13

What are peribulbar and retrobulbar injections? Enlist their indications and drugs used in these procedures

Questiom 14

What is a subconjunctival injection? Explain the steps, enlists indications, and common drugs used

4.1: Properties of Light

1. Light travels in a straight line

Light travelling in a straight line represents a ray of light. A set of straight lines represent a beam of light. The beam may be parallel, converging or diverging. The branch of optics based on this property of light is known as Geometrical Optics

2. Light gets reflected

When the light traveling in a medium is incident on another medium, part of the light is sent back into the first medium. This is reflection. The surface separating the two media is the reflecting surface. Sometimes this surface is coated (silvered) to increase reflection. When the surface is smooth and polished it is a regular reflection giving rise to an image. Irregular reflection (scattering) occurs when the surface is not smooth.

3. Light gets refracted

When light travelling in one medium enters another there is deviation (bending) in its path. This is known as refraction which arises because of differences in the speed of light in different media.

4. Scattering

Particles of dust, moisture, scratches on mirror, lens and prism surfaces cause scattering (irregular reflection) of light. Scattering results in loss of brightness and glare.

5. Interference

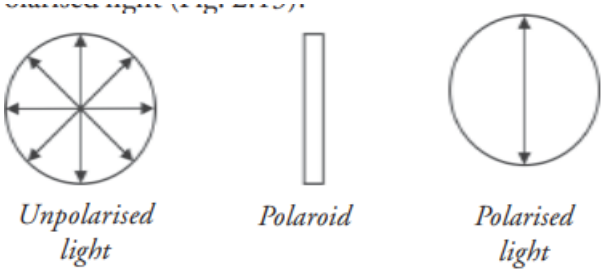
Light waves of same wavelength from different sources undergo interference. The waves reinforce (add up) producing brightness or destroy each other producing darkness. The interference effect is used in antireflection coating on the surfaces of spectacle lenses.

6. Diffraction

Because of the wave nature, light bends. This is known as diffraction. Since the wavelength of light is very small the bending is also very small and light appears to travel in straight line path. The diffraction effect limits the clarity of the final image formed in optical instruments including the eye.

7. Polarisation

Light waves are transverse in nature. The vibrations of electric field (or magnetic field) that constitute light are at right angles to the direction of propagation of light. Ordinary light is unpolarised and has vibrations in all directions. Unpolarised light passing through a device known as Polaroid has the vibration confined to one direction. Reflection of light (unpolarised) from some surfaces also gives rise to polarised light



When polarised light is viewed through a polaroid there is variation in the brightness of light seen through it depending on its orientation. The light is even cut off in two orientations. This property of Polaroid to cut out strongly polarised reflected light is used in special sun glasses known as Polaroid glasses.

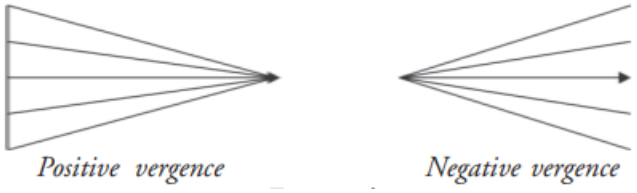
4.2 Vergence

This is a useful concept used by optometrists in their calculations

A parallel beam of light neither converges nor diverges. Its vergence is defined as zero.

A converging beam of light has positive vergence while a diverging beam has negative vergence. The vergence of a beam is measured in dioptre units. The vergence of a beam at a location is the reciprocal of the distance of the location in meter units from the point where the beam converges or appears to diverge.

A positive lens having a power + D introduces a positive vergence of D to a parallel beam of light while a negative lens of power – D introduces a negative vergence of D to a parallel beam of light.



Questions

1. What are different properties of light?
2. What is the clinical significance of diffraction?
3. What are the practical applications of polarization?

Chapter no 2: Reflection, Refraction and Refractive Index

Reflection

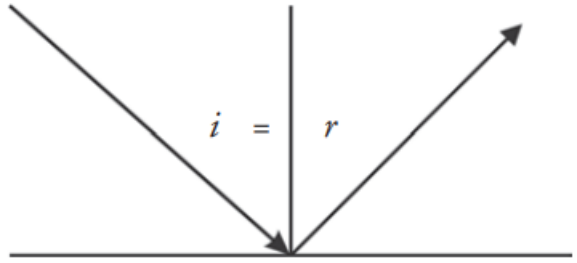
4.3Reflection

When the light traveling in a medium is incident on another medium, part of the light is sent back into the first medium. This is reflection. The surface separating the two media is the reflecting surface. Sometimes this surface is coated (silvered) to increase reflection. When the surface is smooth and polished it is a regular reflection giving rise to an image. Irregular reflection (scattering) occurs when the surface is not smooth.

4.3.1Laws of reflection

First Law: The incident ray, the reflected ray and the normal ray at the point of incidence on the reflecting surface are all in the same plane.

Second Law: The angle of incidence is equal to the Plane mirror is used in refraction cubicles to reduce the length of the cubicle to half its length. However the Snellen's chart used with plane mirror will have objects with left right inversion so the patient sees the correct image inside the mirror.



Refraction

4.4Refraction

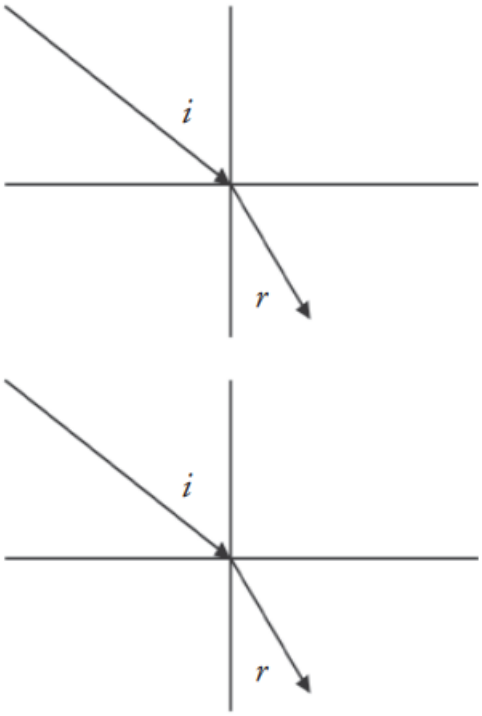
When light travelling in one medium enters another there is deviation (bending) in its path. This is known as refraction which arises because of differences in the speed of light in different media.

4.4.1 Laws of refraction

First Law: The incident ray, the reflected ray and the normal ray at the point of incidence on the refracting surface are in the same plane

Second Law: The ratio of the sine of the angle of incidence to the sine of angle of refraction is a constant which is known as the refractive index of the second medium with respect to the first medium.

(sin i / sin r = constant).



4.5 Refractive index

It is the ratio of speed of light in air to the speed of light in the medium. The speed of light in air is maximum (180,000 m/s). Hence the refractive index of a medium is always greater than 1. For air n = 1, for water n = 1.33, for glass n = 1.5 Prisms and lenses used in ophthalmic practices are refraction devices.

4.6 Mirrors and Prisms

Mirrors

Plane4.6.1Plane mirrors

Plane mirrors are mirrors with flat (planar) and smooth reflecting surfaces.

Characteristics of an image formed by a plane mirror

1. Erect
2. Virtual
3. Laterally inverted
4. Lies along a line perpendicular to the reflecting surface
5. Is as behind the reflecting surface as the object is in front of it

Virtual Image

An image which cannot be captured on a screen is a virtual image. It is erect (upright)

Real Image

- An image which can be captured on a screen is a real image.
- It is inverted (upside-down)

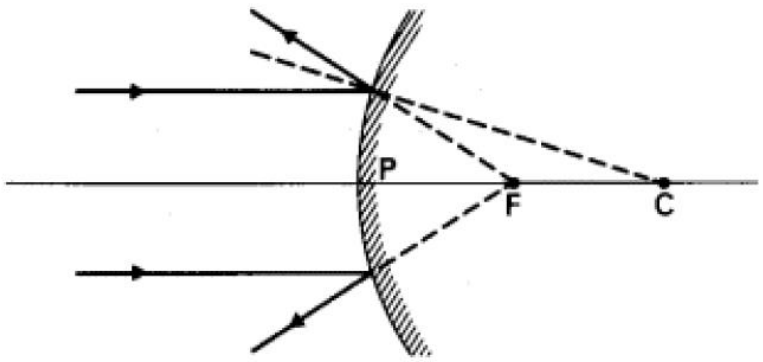
4.6.2 Spherical Mirror

A reflecting surface having the form of a portion of a sphere is called a spherical mirror. Spherical mirror can be thought of as a portion of a sphere which was sliced and then silvered. It can be of two types

1. Convex mirror

   A spherical mirror with its reflective surface outside the curve is called a concave mirror.

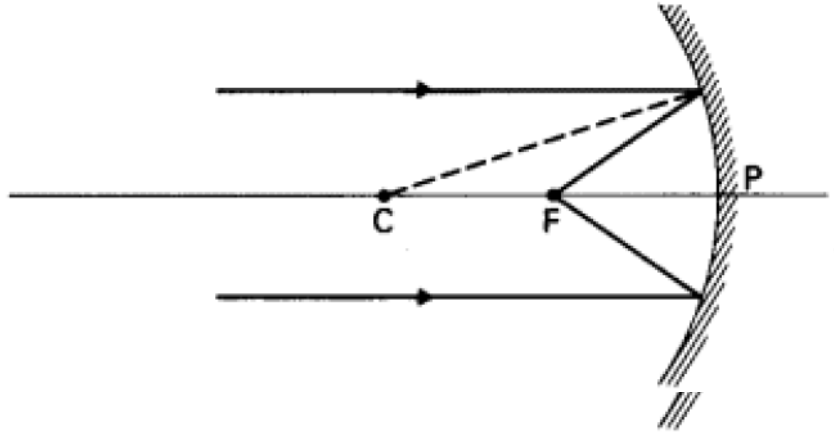
   b Convex mirror

2. Concave mirror

   A spherical mirror with its reflective surface inside the curve is called a concave mirror.

a Concave mirror



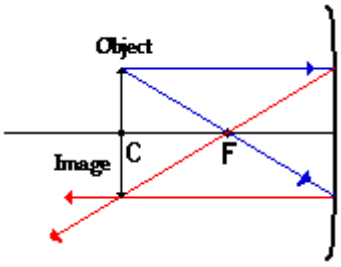
4.6.2.1 Important Terms

- Center of curvature: The center of the sphere of which the spherical mirror is a part, is called center of curvature.Denoted by **C**
- Pole of mirror: The center of the reflecting surface of the spherical mirror is called pole.It is the geometric center of the spherical mirror.Denoted by **P**
- Principle axis: The line joining the center of curvature and the pole of a spherical mirror is called the principle axis.
- Radius of curvature: The distance from the center of curvature and the pole (CP) is called the radius of the curvature.It is the radius of the sphere of which the spherical mirror is a part.It is denoted by r
- Principle focus/focal point: Midway between the center of curvature and the pole of the spherical mirror is the principle focus.It is the point at which the incident light rays parallel to the principle axis converge after reflection in case of a concave mirror or appear to diverge from in convex mirror.It is denoted by **F**.
- Focal length: The distance between the Principle focus and the pole (FP) is the focal length.It is equal to half of the radius of the curvature.
- It is denoted by f.

4.6.2.2 Ray diagrams for concave mirrors

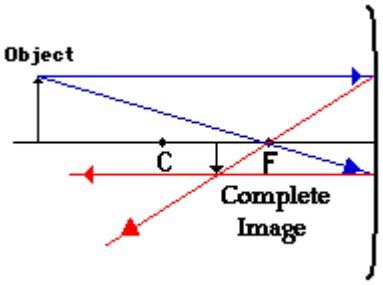
Case 1 When the object is at **C.**

1. **L**ocation: At **C**
2. **O**rientation: Inverted
3. **S**ize: Equal
4. **T**ype of Image: Real



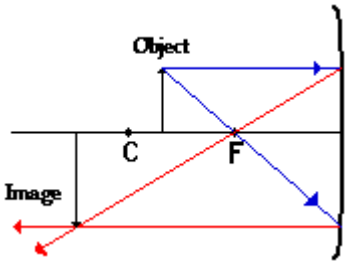
Case 2: When the object is beyond **C.**

1. **L**ocation: Somewhere between **C** and **F**
2. **O**rientation: Inverted
3. **S**ize: Reduced in size
4. **T**ype of Image: Real



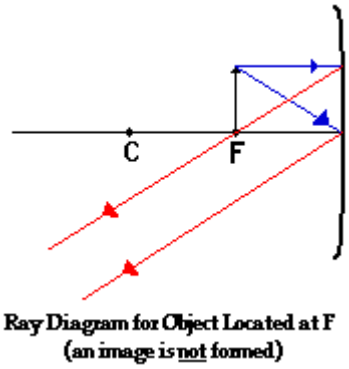
Case 3: When the object is between C and F

1. **L**ocation: Beyond **C**
2. **O**rientation: Inverted
3. **S**ize: Larger than object
4. **T**type of Image: Real



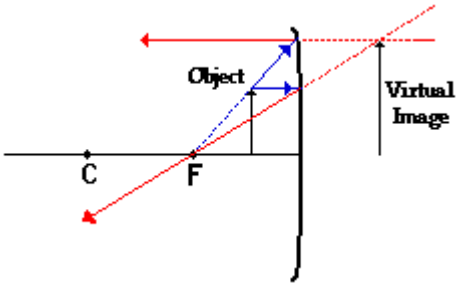
Case 4: When the object is at F

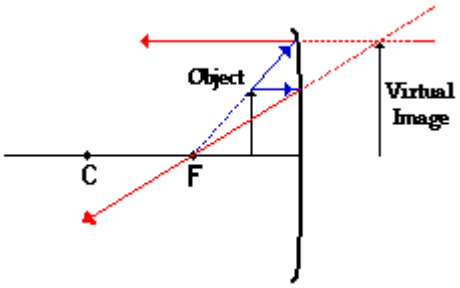
1. **L**ocation: No Image Formed
2. **O**rientation: No Image Formed
3. **S**ize: No Image Formed
4. **T**ype of Image: No Image Formed



Case 5: When the object is in front of F.

1. **L**ocation: Behind the mirror
2. **O**rientation: Upright
3. **S**ize: Larger than the object
4. **T**ype of Image: Virtual

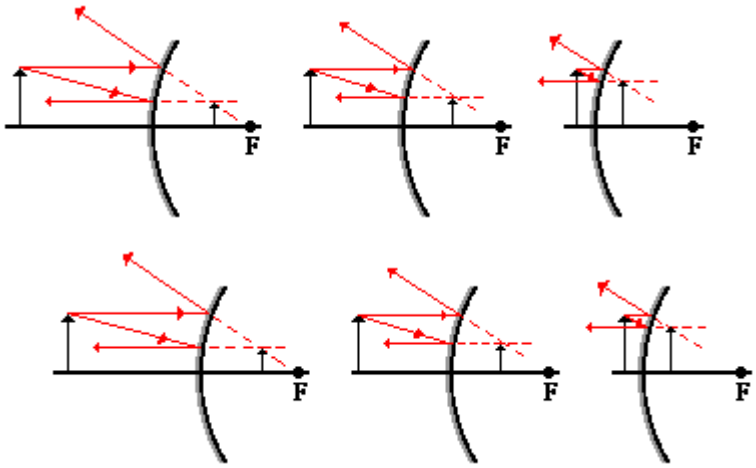




4.6.2.3 Ray diagrams for the convex mirror

An image formed by a convex mirror is always

1. Behind the mirror
2. Virtual
3. Upright
4. Smaller than the object size



4.6.2.4 Mirror equation for the spherical mirrors

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} = \frac{2}{r}$$

Where

$\mathrm{v} =$ The distance of image from the mirror

$u =$ The distance of object from the mirror

$f =$ The focal length of the mirror

$r =$ The radius of the curvature of the mirror

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} = \frac{2}{r}$$

Where

$\mathrm{v} = \text{The distance of image from the mirror}$

$u = \text{The distance of object from the mirror}$

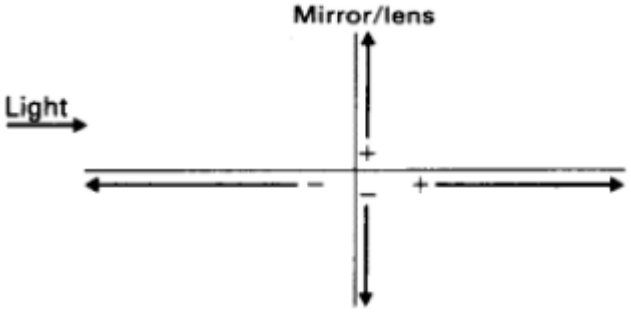
$f = \text{The focal length of the mirror}$

$r = \text{The radius of the curvature of the mirror}$

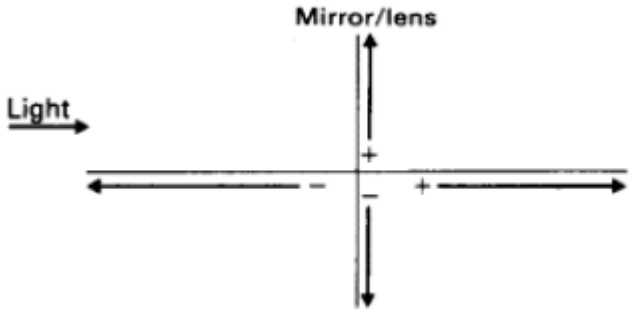
4.6.2.5 Sign Convention

When using mirror equation for the spherical formula sign convention must be adhered to.

1. All the distances are measured from pole to the point in question.
2. Distances measured in the same direction as that of incident light ray are positive.
3. Distances measured in the opposite direction of the incident light ray are negative.
4. Image size for erect images (above the principle axis) is positive.
5. Image size for inverted images (below the principle axis) is negative.



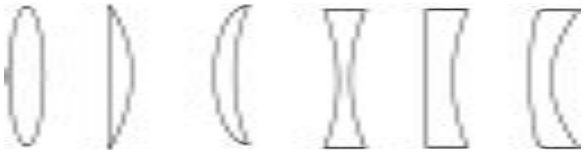
Lens



4.7Lens

A lens is a transparent medium bounded by two curved surfaces or one curved surface and a plane surface. Its most common application is correcting certain problems in eye sight.

Lenses can be of six different types
Biconvex lens - both sides are convex
Plano-convex lens - one side is plane, the other side is convex
Meniscus lens - convex meniscus: meniscus shaped with greater convex curvature
Biconcave lens - both sides are concave
Plano-concave lens - one side is plane and other side is concave
Meniscus lens - concave meniscus: meniscus with greater concave curvature

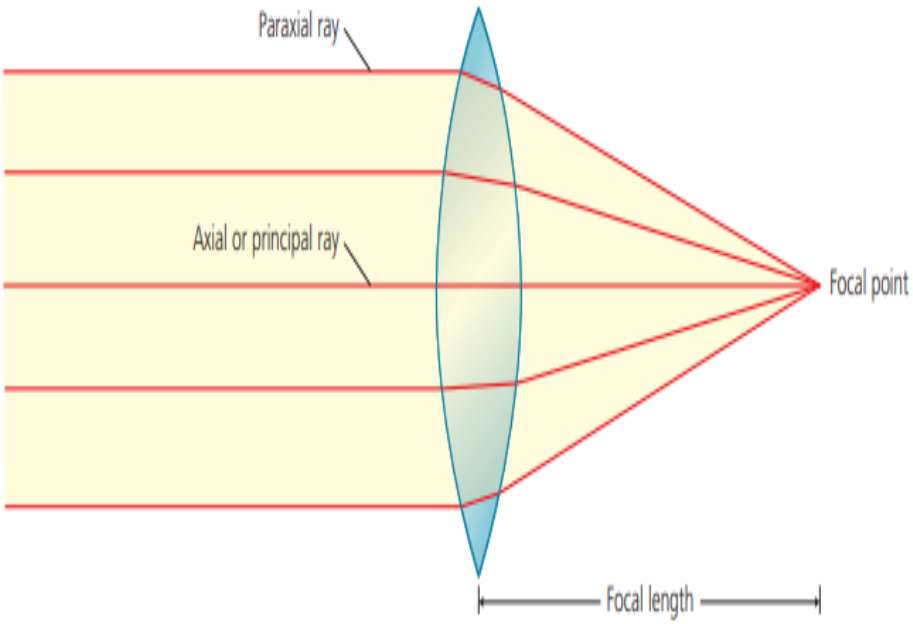


1 2 3 4 5 6

4.7.1 Spherical lenses:

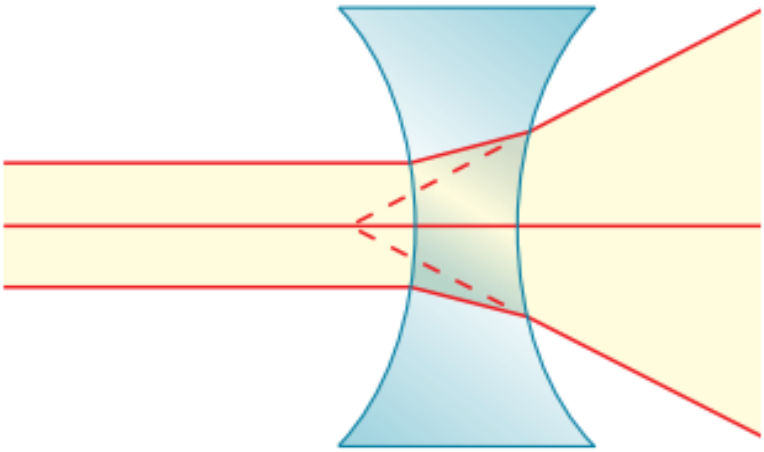
Spherical lenses are optical lenses whose surfaces are sections of spheres.
There are two primary types of lenses based on their curvature:

1. Convex lens (converging lens): thicker at the center than at the edges, a convex lens causes parallel light rays to converge at a focal point after passing through the lens. Convex lenses are commonly used to focus light and create real images.



Convergence of rays by a convex lens to a focal point

2. Concave lens (diverging lens): thinner at the center than at the edges, a concave lens causes parallel light rays to diverge as if they originated from a virtual focal point behind the lens. Concave lenses are used to spread out light.



Concave lens demonstrating an imaginary or virtual point of focus in front of the lens

4.7.1.1 Some important terms relating to lenses

Optical centre: It is a point on a lens where a ray of light passing through it goes straight (there is no deviation).

Principal axis: It is the line joining the centres of curvature of the two curved sides of the lens. In case of plano-convex or plano-concave lenses it is perpendicular to the flat surface from the centre of curvature of the other curved surface.

Focal point (Principal focus): A beam of light parallel to the principal axis of a lens after refraction converges towards a point on the principal axis (convex lens) or appears to diverge from a point on the principal axis (concave lens). This is called the focal point. There are two focal points on either side of a lens at equal distances from the optic centre.

Focal length: The distance of the focal point from the optic centre is the focal length.

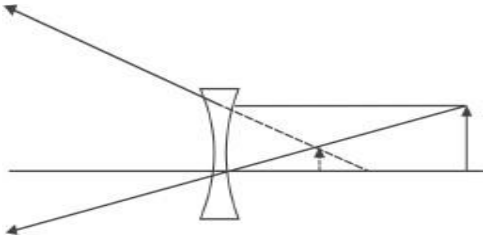
Power of a lens: The reciprocal of the focal length measured in metre units is the power of the lens in diopter (D = 1/ f). It is taken as positive for convex lenses and negative for concave lenses.

4.7.1.2 Formation of images in lenses

Two rays are used to locate the image. A ray of light passing through the optic centre goes undeviated. A second ray of light, parallel to the principal axis, after refraction in case of convex lens converges and proceeds in the direction of the focal point on the other side. In concave lens it diverges and appears to come from the focal point on the same side.

Characteristic of the image formed using a concave lens for all locations of the object

Image is formed on the same side of the lens as the object; virtual, erect and smaller in size. Concave lens is used in the correction of short sight (myopia). The eyes of a person wearing such a lens will appear smaller. This is one reason why people requiring high negative powers prefer contact lens instead of spectacle lens. Also the object seen through such a lens will appear farther than where they are actually located.



Characteristic of the image in convex lens

Case (i): Object located between the lens and principal focus

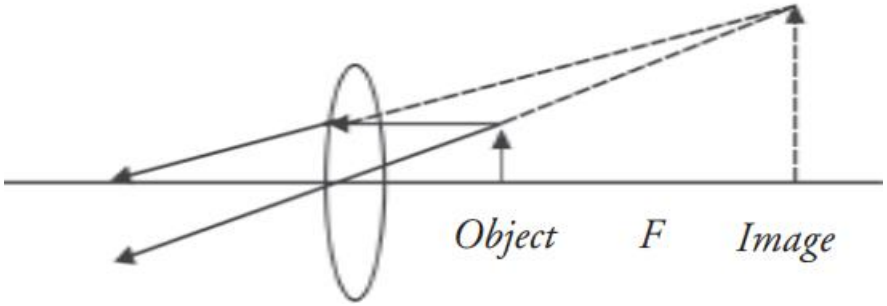


Image if formed on the same side of the lens as the object; virtual, erect and magnified. This is the principle of a simple microscope, single loop and hand -held magnifier.

Case (ii): Object located between the principal focus (F) and twice the focal length (2F) on one side.

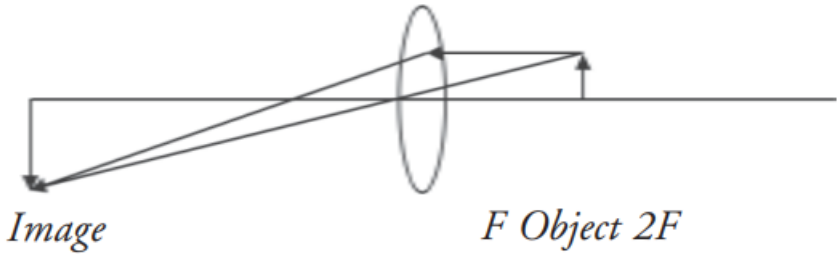
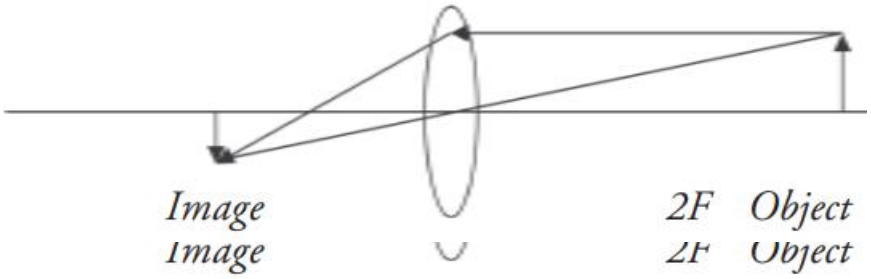


Image is formed beyond 2F on the other side, real, inverted and magnified

Case (iii): Object beyond 2F on one side

Image is formed between F and 2F on the other side, real, inverted and smaller in size. Convex lens is used in the correction of long sight (hypermetropia / hyperopia). Objects seen through such a lens appear farther than where they actually are



4.7.1.3 Thin lens equation

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

where:

u = Distance of object from lens

f = Focal length of lens

v = Distance of image from lens

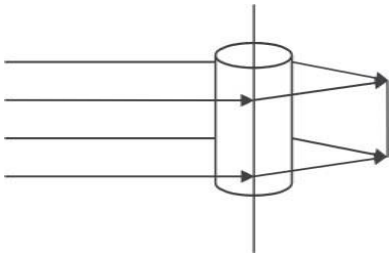
If the lens equation yields a negative image distance, then the image is a virtual image on the same side of the lens as the object. If it yields a negative focal length, then the lens is a diverging lens rather than the converging lens in the illustration. The lens equation can be used to calculate the image distance for either real or virtual images and for either positive on negative lenses.

4.7.1.4 Quick test for lenses

To distinguish between positive and negative lens look at an object at a distance from the lens and move the lens gently. If the image also moves in the same direction (with motion) it is negative lens. If the image moves in the opposite direction (against motion) it is positive lens.

4.7.2 Cylindrical lenses

Lenses in which one of the curved surfaces is cylindrical are known as cylindrical lenses. They are used in correcting astigmatism. A cylinder has no curvature in a direction parallel to its axis. So it has no refractive power in that direction. It is curved in the direction perpendicular to its axis and therefore has a refractive power.



4.8 Prism:

A prism is a triangular piece of glass or plastic with an apex and a base. Rays of light, entering from air and going through a prism, bend toward the base of the prism. This phenomenon is related to the oblique surface of the prism and its medium.

The magnitude of the prismatic effect depends on the size of the angle at the apex of the prism. Light always is bent in the direction of the base of a prism. When one looks through a prism, however, the object of regard appears displaced toward its apex

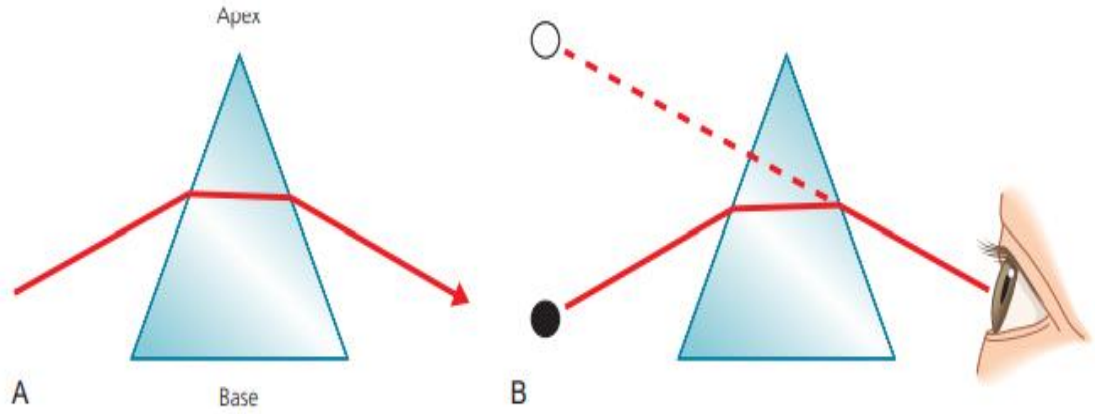


Fig. 3.19 (A) Light is deviated by the prism toward its base. (B) The observer views an object through the prism and the object appears to be displaced toward its apex.

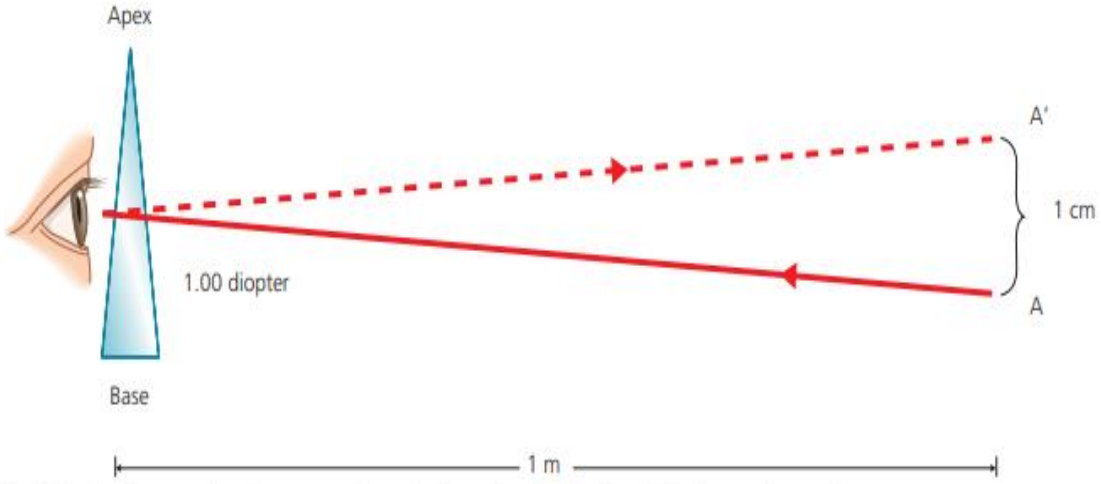


Fig. 3.20 An object at point A appears to be at A′ when viewed through a 1.00 diopter prism at 1 m.

Fig. 10.19 Prism bars used to measure the amplitude or power of fusion.

Fig. 10.17 Prism cover test. Handheld prisms are introduced to neutralize a deviation.

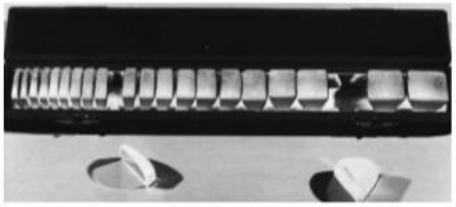


Fig. 10.18 Loose or individual prisms set.

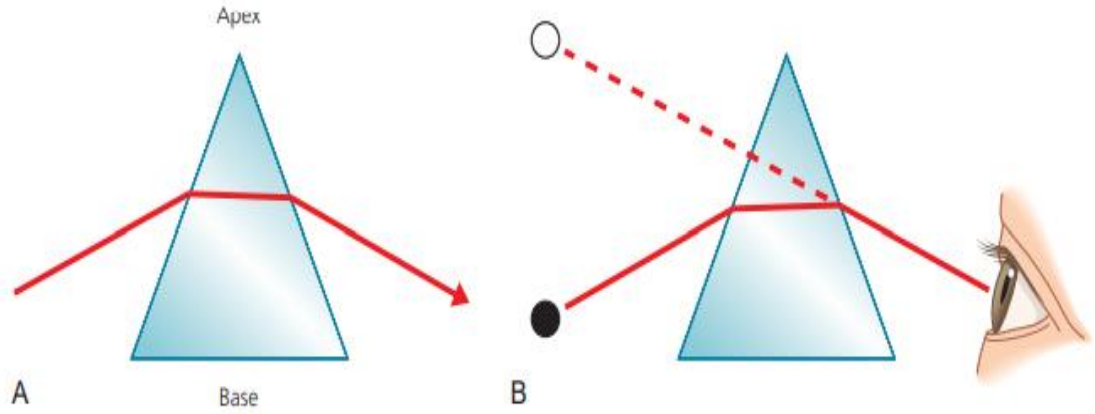
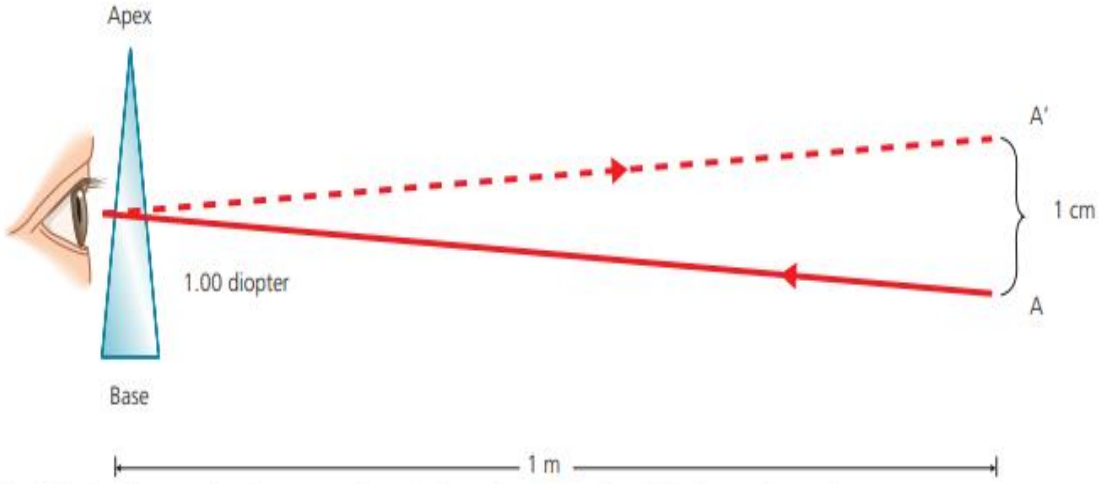


Fig. 3.19 (A) Light is deviated by the prism toward its base. (B) The observer views an object through the prism and the object appears to be displaced toward its apex.



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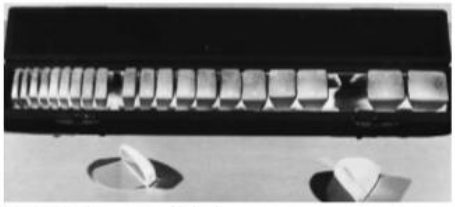


Fig. 10.18 Loose or individual prisms set.

4.8.1 How are prisms measured?

Prisms used in ophthalmology are calibrated in diopters. By definition, 1 prism diopter (d) is that prism which appears to displace an object 1cm at a distance of 1 m from the eye. At 0.5m, if the object is displaced 1cm, then the dioptric power of the prism is 2.00 diopters. At 2m, if the object is displaced 1cm, then the dioptric power is 0.50 diopter.

This is expressed by the formula: p= c / d

Where: p = prism power c = displacement of object in centimeters d = distance from prism in meters

4.8.2 Use of Prisms:

4.8.2.1Diagnostic Prisms:

1. Assessment of Squint and Heterophoria:
    - Objective measurement with prism cover test.
    - Subjective measurement with Maddox rod.
    - Evaluation of diplopia likelihood after squint surgery.
    - Fusional reserve measurement, especially in children under 2 years.
2. Four-Dioptre Prism Test:
    - Sensitive test for small esotropia (microtropia).
    - Placing a four-dioptre prism base-out causes no movement in the deviating eye but movement occurs in the fixing eye.

Forms of Prism Used in Diagnosis:

- Single unmounted prisms, trial lens set prisms, and prism bars.

4.8.2.2 Therapeutic Prisms:

1. Convergence Insufficiency:
    - Used to build up fusional reserve.
    - Prisms worn base-out during exercise periods, not constantly.
2. Relieving Diplopia in Squint:
    - For decompensated heterophorias, small vertical squints, and some paralytic squints.
    - Reserved for cases where surgery is not indicated.

Forms of Therapeutic Prism:

1. Temporary Wear:
    - Clip-on spectacle prisms for trial wear.
    - Fresnel prisms (plastic sheets with tiny prisms) for lighter and temporary use.
2. Permanent Wear:
    - Prism incorporation into spectacles by decentering the existing spherical lens or mounting prisms directly.

Chapter no 4.9 Refractive Errors and Management

Refractive errors are the most common eye disorders and not a disease. A refractive error means that the shape of the human eyes do not refract the light rays correctly on the retina resulting blurred vision.

Emmetropia is a normal refractive condition of the eye in which the parallel light rays from infinity comes to a focus exactly on the retina without any accommodative changes. So the vision is clear at all distances.

In case the rays are focused either infront or behind the retina, then it is termed as ametropia. It can be classified as short sightedness or myopia and long sightedness or hypermetropia.

4.9.1 Myopia

Myopia is one type of refractive error where the parallel rays of light are brought into focus in front of the retina when accommodation is at rest. This is also called short sightedness or nearsightedness. Nearsightedness is an error of visual focusing that makes distant objects appear blurred.

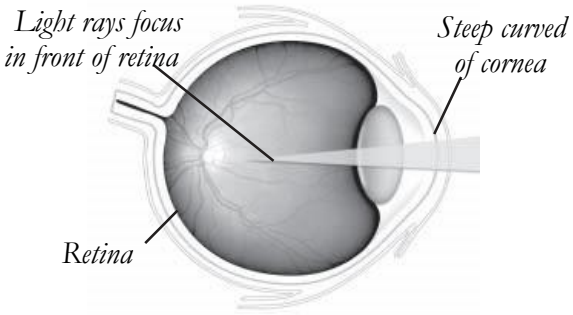


Fig.- Myopia

4.9.1.1 Aetiology

1. Axial myopia - is due to increase in the anteroposterior length of the eye ball
2. Curvature myopia - is due to increases in curvature of cornea or one or both the surfaces of the lens. Increases of 1 mm causes a refractive change of 6D
3. Index myopia - a change of refractive index in the lens results in index myopia
4. Positional myopia - this is due to anterior placement of lens

4.9.1.2Optical condition

In myopia, the parallel rays of light fall in front of the retina and cause a blurred image to fall on retina. So the distanct object appears blurred. In order to see clearly the object is brought closer and the divergent rays come to focus on the retina. This makes the far point in the myopic eye at a finite distance. This distance decreases with the increase in the degree of myopia. Therefore the near object is focused without an effort of accommodation. For these reason myopes can suffer from convergence insufficiency and exophoria.

4.9.1.3Clinical types of myopia

Congenital myopia: It is present at birth and may be unilateral or bilateral. Bilateral congenital myopia

Simple myopia: It is the most common type of myopia, results from the normal biological variation in the development of the eye. The power of glasses increases, usually during the years of study in schools and colleges and then remains steady. This type of myopia is not associated with any degenerative change in the eye.

Pathological myopia: In this condition, the myopia rapidly progresses and subnormal visual acuity persists even with correction and there are degenerative changes in the retina. Near-sightedness affects males and females equally, and those with a family history of nearsightedness are more likely to develop it. Most eyes with nearsightedness are entirely healthy, but a small number of people with myopia develop a form of retinal degeneration.

Acquired myopia: This occurs due to exposure to various pharmaceuticals, increase in glucose level, nuclear sclerosis, and increase in curvature of the cornea in conditions such as corneal ectasias. The other types of acquired myopia are:

Pseudo myopia: This type of myopia is called as false appearance of myopia that occurs due to excessive accommodation and spasms of accommodation.This type of myopia usually manifest the execessive amount of myopia and decreased amount of hypermetropia.It could cause severe headache with asthenopic complaints.

Night myopia: In night myopia, the eye has difficulty seeing in low illumination even though the daytime vision is normal. This occurs due to increase in sensitivity to the shorter wavelengths of light. Younger people are affected more than the elderly.

Space myopia: This type of myopia occurs when the individual has no stimulation for distance fixation.

Symptoms

4.9.1.4Symptoms

- Blurred vision or difficulty in seeing distant objects (Children often cannot read the blackboard, but easily read a book).They tends to go near the objects to see clearly
- Eye strain
- Headaches (uncommon)
- Squinting tendency
- Close working habits

4.9.1.5 Tests

A general eye examination or standard ophthalmic exam may include:

1. Visual acuity, both at a distance (Snellen's), and close up (Jaeger)
2. Refraction test to determine the refractive power accurately
3. Cycloplegic refraction may be required in few conditions to confirm the final prescription
4. Color vision test to exclude color defect.
5. Muscle balance test
6. Slit lamp examination of the eyes
7. Measurement of the intra ocular pressure of the eyes

8. Retinal examination

Complications

4.9.1.6Complications

1. If a person with nearsightedness has flashing of lights, floating spots, or a sudden loss of any part of the field of vision, it may be a retinal detachment.
2. Retinal atrophy patches in the macula cause loss in central vision.

4.9.1.7 Expectations (prognosis)

Early diagnosis of myopia is important, since a person can suffer socially and educationally by not being able to see well at a distance. Any degree of myopia that is occurring in a child under the age of 4 requires immediate observation. In high degree of myopia the prognosis is always guarded. It is usually based on the appearance of fundus and the acuity of vision after correction.

4.9.1.8 Management

Myopia is easily corrected by concave lens for eyeglasses or contact lenses. The lens diverge the incoming light rays, so that they will be properly focused on the retina.

Surgical treatment

There are also a number of techniques available for reshaping the cornea (the front surface of the eye), in order to reduce its power and thus correct the myopia. One technique (known as orthokeratology or 'Ortho-K') uses rigid contact lenses to change the shape of the cornea. Other techniques use surgery to remove tissue from the cornea, leaving it with a flat surface.

There are several surgical procedures that reshape the cornea, shifting the focus point from in front of the retina to on to the retina.

Radial keratotomy is a surgical procedure popular in recent past. Now it is almost completely replaced by LASIK, in which an excimer laser is used to reshape the cornea. Refractive surgeries are recommended for persons aged between 20 and 40 years. **Hypermetropia**

Definition

4.9.2Hypermetropia

Hypermetropia is an error of refraction in which parallel rays of light from infinity come to a focus behind the retina, when accommodation is at rest.

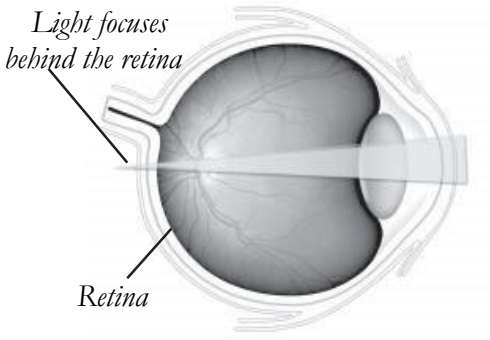


Fig. Hypermetropia

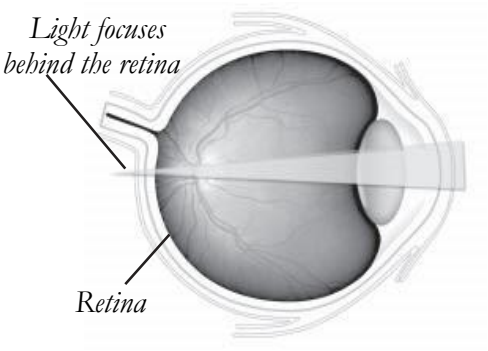


Fig. Hypermetropia

4.9.2.1 Optical condition

Whether the hypermetropia is due to a decrease in the length of the eye ball or decrease of curvature of cornea or due to change in refractive index, the optical effect is the same, parallel rays from infinity come to focus behind the retina, and the diffusion circles which are formed on the retina result in a blurred and indistinct image.

Accommodation eye

Parallel rays are brought to focus on the retina, by the normal lens in the eye becoming more complex. This is called accommodation.

Hypermetropic eye

Parallel rays of light are brought to focus upon the retina, by increasing the refractivity with a convexspectacle lens. The degree of hypermetropia is given by the power of the correcting lens.

4.9.2.2 Types of hypermetropia

- Axial hypermetropia
- Curvature hypermetropia
- Index hypermetropia

Axial hypermetropia : When the anterior / posterior length of the eyeball is shorter than normal. (Normal axial length is 24mm). A decrease of 1mm in axial length produces a hypermetropia of 3.0D.

Curvature hypermetropia : When the curvature of the cornea or lens is flatter than normal. An increase of 1mm in its radius of curvature produces a hypermetropia of 6.OD.

Index hypermetropia : When the refractive index of the media is less than normal - Corneal refractive index - 1.37

- Refractive index of the cortex of lens - 1.38
- Refractive index of the nucleus of lens - 1.40

4.9.2.3Clinical types of hypermetropia

1. Congenital hypermetropia
2. Simple or developmental hypermetropia
3. Acquired hypermetropia

Congenital hypermetropia

This is rare. It is usually associated with other congenital anomalies of the eyeball like microopthalmas.

Simple or development hypermetropia

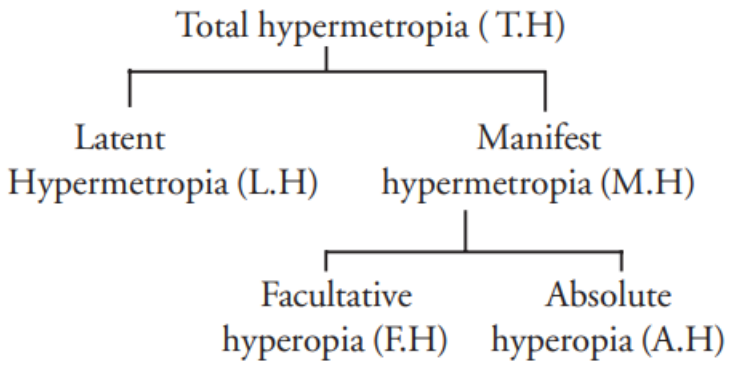
It is the most common type. A newborn baby is hypermetropic but with age, the eye ball grows in size and the hypermetropia is gradually diminished. If the growth of the eyeball is retarded then hypermetropia persists.

Acquired hypermetropia

This is found in aphakic conditions, commonly following extraction of the lens. This hypermetropia is usually high about + 10.0 D.

4.9.2.4 Effect of accommodation on Hypermetropia

4.9.2.4 1Total hypermetropia



TH =MH+LH

MH=FH+AH

TH=Total hypermetropia

LH=Latent hypermetropia

MH=Manifest hypermetropia

FH=Facultative hypermetropia

AH =Absolute hypermetropia

The hypermetropia which is seen after complete paralysis of accommodation, after the application of atropine

TH=MH+LH

4.9.2.4 2 Latent hypermetropia

It is the amount of hypermetropia which is corrected by normal physiological tone of the ciliary muscle. It is strong in young age and slowly declines with age.

4.9.2.4 3 Manifest hypermetropia

The remaining portion which is not corrected by the normal physiological tone of the ciliary muscle, is called manifest hypermetropia. It is the hypermetropia that remains uncorrected in normal circumstance. That is when accommodation is not being actively used, or, in other words it is the total hypermetropia minus the latent hypermetropia. This manifest hypermetropia is again made of two components.

1. Facultative hypermetropia
2. Absolute hypermetropia

   Facultative hypermetropia: It is the part of hypermetropia, which can be corrected by an additional effort of accommodation or excessive strain of the ciliary muscle.

Absolute hypermetropia : It is the part of hypermetropia which cannot be overcome by active exertion of accommodation.

4.9.2.5 Symptoms of hypermetropia

1. Head ache
2. Eye strain
3. Distance blurred vision
4. Difficulty in doing prolonged close work

4.9.2.6 Treatment of hypermetropia

1. By prescribing correct convex lenses
2. Contact lenses
3. Lasik

4.9.2.7Complication of hypermetropia

Uncorrected hypermetropia leads to esophoria, which later on may develop into esotropia.

Hypermetropia with esophoria - To give full correction

Hyperopia with exophoria - To give under correction

Hypermetropic individuals often have shallow anterior chamber. They have increased predisposition to develop narrow angle glaucoma.

4.9.3 Astigmatism

Astigmatism is a type of refractive error where the refraction varies in different meridians. Consequently the rays of light entering in the eye cannot converge on a focus point, but form focal lines.

Aetiology

4.9.3.1Aetiology

1. Corneal astigmatism is the result of abnormalities of curvature of the cornea.
2. Lenticular astigmatism is rare. It may be: -
   - Curvature due to abnormalities of curvature of lens as seen in lenticonus.
   - Positional due to tilting, or oblique placement of lens as seen in subluxation.
   - Index astigmatism occurs rarely due to variable refractive index of lens in different meridian.
3. Retinal astigmatism, due to the oblique placement of macula, is seen occasionally.

Types

4.9.3.2Types

Broadly, there are two types of astigmatism,

- Regular astigmatism
- Irregular astigmatism

4.9.3.2.1 Regular astigmatism

The astigmatism is regular when the refractive power changes uniformly from one meridian to another. Depending upon the axis and

the angle between the two-principle meridians, regular astigmatism can be classified into the following three types.

4.9.3.2.1.1 1Horizonto-vertical astigmatism

In this type the two principal meridians are placed at right angles to one another and those are in the horizontal (180 +/- 20) and vertical planes (90+/20). It is of further two types

With the rule astigmatism: When the vertical meridian is more curved than the horizontal meridian, this is known as with the rule astigmatism. Sometimes it is physiological due to pressure of the eyelid on the cornea. Up to 0.50D we can ignore the error, as it does not cause many symptoms.

This can be corrected either by a – (minus) cylinder x 180 or + (plus) cylinder x 90.

Against the rule astigmatism: The horizontal meridian is more curved than the vertical meridian. This is known as inverse astigmatism or against the rule astigmatism. It cause more symptoms and should be corrected for minimal error.

This can be corrected either by – (minus) cylinder x 90 or + (plus) cylinder x 180.

4.9.3.2.1 2 Oblique astigmatism

When principle meridians are at right angles, but are not vertical and horizontal.

4.9.3.2.1 3 Bi-oblique astigmatism

When principle meridians are not at right angles but crossed obliquely.

4.9.3.2.1 4 Refractive types of regular astigmatism

Depending upon the position of the focal lines in relation to the retina, regular astigmatism is further classified into three types,

Simple astigmatism

Here the rays are focused on the retina in one meridian and in front or behind the retina on the other meridian, as in simple hypermetropic or simple myopic astigmatism.

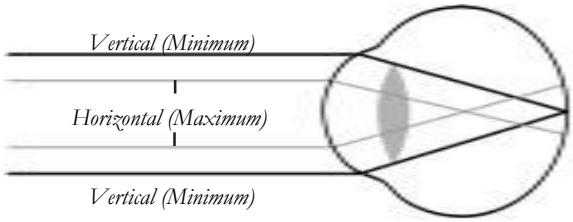


Fig Simple myopic astigmatism

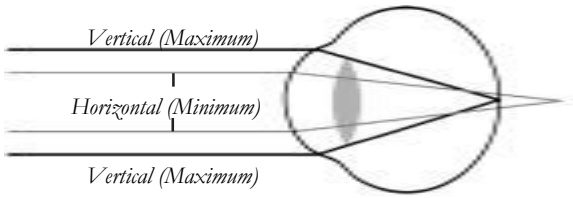


Fig. Simple hypermetropic astigmatism

Compound astigmatism

Here neither of the two foci lies upon the retina but are placed in front or behind it. The former is known as compound myopic, the later as compound hypermetropic astigmatism.

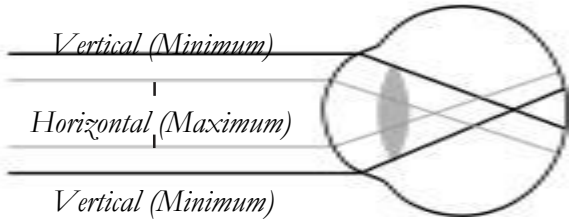


Fig Compound myopic astigmatism

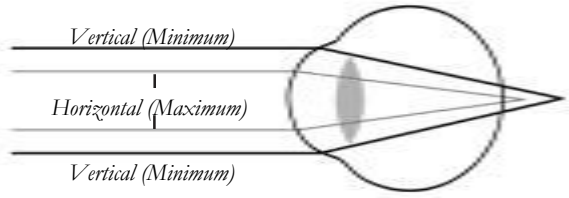
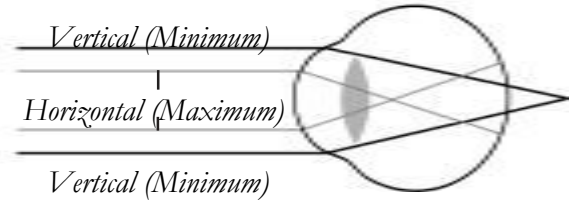


Fig. Compound hypermetropic astigmatism

Mixed astigmatism

One focus is in front of and the other behind the retina, so that the refraction is hypermetropic in one direction and myopic in



the other

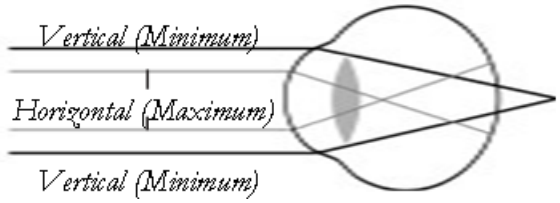
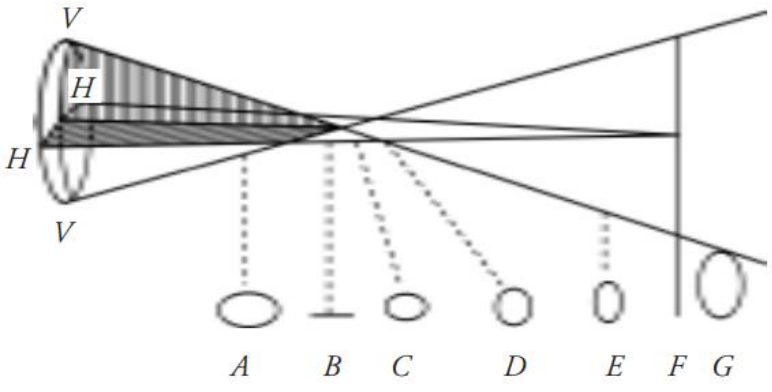


Fig. - Mixed astigmatism

4.9.3.2.1 5 Appearance of image in astigmatism Sturm's conoid

Sturm's conoid is a series of images formed by astigmatic surface, which have two meridians of different curvature. The more curved meridian refracts rays greater than the less curved meridian. Rays refracted by more curved meridian come to focus earlier than those refracted by less curved meridian. It forms two focal lines (B and F). Distance between these two focal lines is known as focal interval (BE). Circle of least diffusion is formed when rays refracted by both meridians have equal and opposite tendencies. At this point the most clear image is formed. Images in between and beyond the focal lines are blurred and elliptical



H

Fig - Sturm's conoid

4.9.3.2.2 Irregular astigmatism

Irregularities in the curvature of the cornea cause Irregular Astigmatism. The principal meridians are not at right angles. Every meridian in the cornea has a separate type of refraction; we can never correct the error by spectacles. This type of astigmatism is called irregular astigmatism

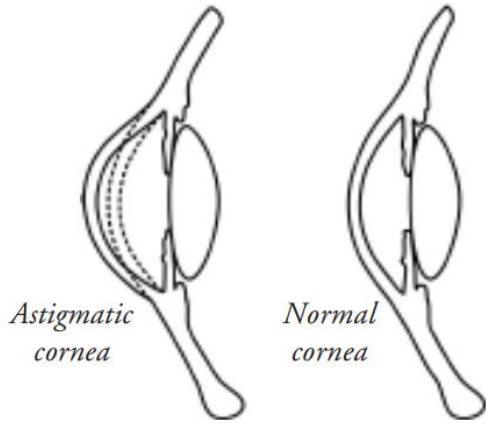


Fig. Irregular astigmatism

Symptoms

4.9.3.3Symptoms

- Defective vision.
- When they look at a straight line either it is blurred or the line can be tailed off at the end
- Headache is an important complaint
- Giddiness
- Torticollis - permanent tilting of head

4.9.3.4 Tools used in evaluation of astigmatism - Keratoscopic examination by placidos disc.

- Retinoscopy by concave mirror/streak
- Use of astigmatic fan or Maddox rod
- Stenopaeic slit or pinhole
- Keratometry
- Jackson cross cylinder.

4.9.3.5 Treatment

4.9.3.5 1Regular astigmatism

Optical correction

- Spectacle (concave – convex cylinder lens)
- Contact lens (toric lens - prism balastic lens)

Surgical

- Keratomiluesis
- Excimer laser

4.9.3.5 2Irregular astigmatism

Hard/semi-soft contact lens

- Keratoplasty in central area of conical cornea
- Excision of scar + replacement by graft

4.9.3.5 3Key points to remember –

Minimum cylinder, maximum comfort.

- Give minus cylinder for more comfort.
- For high cylinder, it is better to do keratometry
- Refine axis and power before finalizing prescription
- Check binocular comfort subjectively

4.9.4 Presbyopia

Presbyopia is an age related progressive loss of the focusing power of the lens. This results in difficulty in reading and seeing near objects.

4.9.4 1 Causes, incidents, and risk factors

- The focusing power of the eye, which depends upon the inherent elasticity of the lens, gradually decreases in old age.
- This causes inability to read at normal reading distance (33 cm to 40cm)
- People usually notice the condition around age 40; after they realise that they need to hold reading materials further away in order to focus.

4.9.4 2 Signs and tests

A general eye examination will be performed including measurements to determine a prescription for glasses or contact lenses.

Tests may include:-

- Visual acuity
- Refraction
- Muscle integrity
- Slit lamp
- Retinal examination

Symptoms

4.9.4 3Symptoms

- Inability to focus near objects
- Likes to read in brilliant illumination when the pupil will be forced to constrict
- Eye strain
- Headache

4.9.4 4 Factors affecting close work

1. Pupil size - Smaller pupils increase the pinhole effect, which increases the depth of focus
2. Lighting - Small print is easier to read in bright light. The contrast is improved and the reflected light may constrict the pupil, improving the depth of field
3. Print size and print distance - large print is easier to read
4. Task requirements - An accountant will need better near vision than a garbage worker
5. Secondary task considerations - A person wants to increase the near working distance in one pair of glasses rather than buy two pairs of glasses
6. Body type and position - some people, particularly those with long arms, like to hold reading materials further away than others do. In this case the add power will be less
7. Previous correction - Many people don't tolerate an increase in add power greater than 0.75D at any one time
8. Low ametropia - Uncorrected low hypermetropes complain of reading difficulty at an earlier age than uncorrected low myopes.
9. Health and medications - Diabetics typically need near correction at an earlier age and need stronger add power than is normal for their age group.

4.9.4 5 Age Expected add power

38 yrs + 0.75 DS
40 yrs +1.0 DS
45 yrs + 1.50 DS
50 yrs + 2.0 DS
55 yrs +2.5 DS
60 yrs and above +3.0 DS

4.9.4 6 Variations of accommodation with age

Amplitude of Accommodation	Age			
	Early Age	36 Yrs	45 yrs	60 yrs
	14 D	7 D	4 D	1D
Near point	7 cm	14 cm	25m	1m

Evaluation of presbyopia

4.9.4 7 Treatment

Presbyopia can be corrected with appropriate lenses, so that his accommodation is reinforced and the near point is brought within the useful working distance.

- Know the working distance of the patient for proper addition
- Refraction
- Determine the amplitude of accommodation
- Supplement this by lens - allowing him a sufficient reserve of accommodation

4.9.4 8 Key points to remember

- Presbyopic spectacle should never be prescribed mechanically based on age
- Lenses must be comfortable
- Vision for the particular work for which their spectacle is intended must be kept in mind.
- Start with an addition of +0.75D
- Better to under correct than over correct
- Lenses that bring the near point closer than 28cm are rarely tolerated.
- Demand for higher correction than convergence should be added with base in prism
- Patient with early cataract can read with +3.50 D or + 4.0D addition
- Usual discomfort for presbyopic optical correction is due to over correction

4.9.4 9 Types of corrective spectacle for presbyopia

1. Single vision reading glasses
2. Bifocals - where glasses are given for near and distance
3. Trifocals - where glasses are given for distance, intermediate and near vision
4. Varifocals - progressive addition lens
5. Monovision correction- one eye is corrected for distance and the other eye for near.

Answer the following

1. Define myopia.
2. What are the causes of myopia?
3. What are the clinical types of myopia?
4. Explain the optical condition in myopia.
5. Explain the treatment modalities.
6. What is astigmatism? What are the possible causes of astigmatism?
7. What do you understand by ‘with the rule’ and ‘against the rule’ astigmatism?
8. What are the refractive types of astigmatism?
9. What is JCC? Write its uses.
10. What are the possible ways to correct astigmatism?
11. Define presbyopia.
12. What are the symptoms of presbyopia?
13. Describe the treatment for presbyopia
14. Mention the important points to be noted while prescribing spectacles for presbyopia
15. What are the types of spectacles that could be prescribed for presbyopia?

4.10 Anisometropia

Anisometropia is one of the binocular optical defects. Anisometropia arises because of the difference in refractive error between two eyes. A small degree of anisometropia occurs commonly when there is a small amount of astigmatic error. Each diopter difference between the refraction of the two eyes causes 2% difference between the two retinal images.

4.10.1 Aetiology

Congenital and development anisometropia

This occurs due to differential growth of the two eyeballs.

Acquired anisometropia

1. Uniocular aphakia occurs after cataractous lens removal
2. From trauma to the eye
3. Due to inadvertent surgical treatment of refractive error

4.10.2 Vision status in anisometropia

Binocular vision: Binocular vision is present in small degrees of anisometropia. An anisometropia of about 1.5 D to 3 D is tolerated depending upon the individual.

Alternate vision: Alternating of vision occurs when one eye is emmetropic or moderately hypermetropic and the other eye is myopic. The emmetropic or moderately hypermetropic eye is used for distance vision and the myopic eye is used for near vision. These patients are usually comfortable and never have to make an effort of either accommodation or convergence.

Uniocular vision: When the refractive error is high in one eye compared to the other, then the high degree refractive error eye receives continuously blurred images compared to the other eye. Due to this the eye receiving blurred image is suppressed and develops amblyopia. This type of amblyopia is called anisometropic amblyopia.

4.10.3 Clinical types

Simple anisometropia

In simple anisometropia one eye is emmetropic and the other eye is either myopic or hypermetropic.

Compound anisometropia

In compound anisometropia both eyes have refractive error. The refractive error may be hypermetropic or myopic, but one has a higher refractive error than the other.

Mixed anisometropia

When the refractive error of one eye is hypermetropic and other eye is myopic it is mixed anisometropia. This is also termed antimetropia.

Simple astigmatic anisometropia

When one eye is normal and the other has simple myopic or hypermetropic astigmatism it is termed simple anisometropic astigmatism.

Compound astigmatic anisometropia

When both eyes are astigmatic but of unequal degree, it is called compound astigmatic anisometropia.

Mixed astigmatic anisometropia When one eye has hypermetropic astigmatism and the other eye has myopic astigmatism.

4.10.4 Clinical test

The visual status is assessed by using either FRIEND test or Worth's Four Dot test.

FRIEND test

An illuminated word FRIEND is present in the Snellen's vision box. The alternate letters in the word FRIEND are illuminated with green and red colour. The letters F, I, N are in green and R, E, D in red colour. Red and green goggles are placed in front of the eye such that red is placed over the right eye and green is placed over the left eye. The patient sees only red letters through the right eye and green letters through the left eye. From the patient's response we can determine whether the patient is using both eyes or not.

Responses

1. If the patient reads FRIEND at once the patient has binocular vision
2. If patient reads either FIN or RED, the patient has Uniocular vision with the eye which has the corresponding glass
3. If the patient first reads FIN and then RED, then he has alternating vision

Worth four dot test

This test is similar to the FRIEND test. This test has four dots. Of these four dots, one dot is red in colour, two are green and one is white. The patient wears the red and green goggles, red in front of the right eye and green in front of the left eye and views the box with four lights.

Results

1. When all four lights are seen they have normal binocular single vision
2. When all the four lights are seen with the presence of a manifest squint then they have abnormal retinal correspondence
3. When they see only two red lights, it indicates left eye suppression. If they see only three green lights, it indicates they have right eye suppression
4. If they see two red lights, alternating with three green lights it indicates presence of alternating suppression
5. If they see five lights (two red lights and three green lights) it indicates diplopia

4.10.5 Treatment

Optical

- Contact lens is the best choice for anisometropia
- In children with anisometropic amblyopia and refractive error correction, occlusion therapy should also be given

- Anisometropic spectacles were given for the correction of anisometropia but these spectacles are obsolete now

Surgery

- Implanting intraocular lens for unilateral aphakia
- Removal of crystalline lens for unilateral high myopia
- Refractive corneal surgeries for unilateral myopia, astigmatism and hypermetropia

4.11 Aniseikonia

Aniseikonia is one of the binocular optical defects. Aniseikonia (A = not + iso = equal+ konia = image) is a condition in which the size and shape of images of the two eyes are unequal. Aniseikonia of 3% or more becomes clinically significant.

4.11.1 Aetiology

Optical aniseikonia: This occurs due to inherent or acquired anisometropia of high degree.

Retinal aniseikonia: Retinal aniseikonia may develop due to:

- Widely separated arrangements of the visual elements
- Any retinal oedema causing separation of retinal elements

4.11.2 Clinical types

The difference in the images can be classified as:

1. **Symmetrical**: It is the difference in the image size perceived in each eye
   a) Overall - the difference is the same in all dimensions
   b) Meridional - the difference is greater in onemeridian compared to the other
2. **Asymmetrical aniseikonia**: it is the difference in the image shape perceived in each eye
   a) Regular: progressive increase or decrease in size across the visual field

4.11.3 Symptoms

- Headache
- Asthenopia
- Photophobia
- Reading difficulty
- Nausea
- Vertigo
- Diplopia
- Distorted space perception

4.11.4Testing of aniseikonia

Space eikonometer

The degree of aniseikonia is exactly measured using space eikonometer. This instrument is expensive.

Rule of thumb

- If aniseikonia is associated with anisometropia which is of refractive then the difference in image size will be about 1.5% per diopter of anisometropia

- If anisometropia is due to axial then the difference in image size will be about 1% per diopter

4.11.5 Treatment

Optical aniseikonia

These treatments are available for aniseikonia which arises due to anisometropia

- Contact lenses
- Implanting IOL for unilateral aphakia
- Refractive corneal surgery
- Aniseikonic spectacles - these are expensive and difficult to make

Retinal aniseikonia

- Due to any causative disease, treating the cause corrects the aniseikonia

4.12 Amblyopia

Amblyopia means reduced vision in a normal anatomical eye. No organic cause can be detected for amblyopia.

Amblyopia develops during early childhood. Children under nine years of age whose vision is still developing are at high risk for amblyopia. Generally the younger the child, the greater the risk.

4.12 1 Aetiology

There are many reasons for amblyopia and they are as follows:

- Squint/strabismus
- Large difference in the power of each eye
- Cataract
- Severe ptosis
- Premature birth
- Heredity
- Any disease that affects the eye

Amblyopia develops because one eye is turned as in squint, and two different pictures are sent to the brain. In a young child, the brain learns to ignore the image of the deviated eye and see only the image of the better eye. Similarly when there is difference in refractive error of each eye the blurred or defocused image formed by the eye with more refractive error is ignored by the brain.

For the retina to capture the images, it needs adequate light and visual stimulus. This being absent due to cataract, either in one eye or both, results in amblyopia.

Amblyopia can often be reversed if detected and treated early.

As soon as amblyopia is detected, active measures should be taken to treat it. Cooperation of the patient and parents is required to achieve good results. If left untreated or not treated properly the reduced vision becomes permanent and cannot be improved by any means.

4.12 2 Mechanism of amblyopia

- Abnormal binocular interaction
- Vision deprivation

4.12 3 Characteristics of an amblyopic eye

- Reduction in visual acuity

- Eccentric fixation
- Crowding phenomenon
- Visual acuity is better when the test letters are viewed singularly rather than in a series

4.12 4 Types of amblyopia

- Strabismic amblyopia
- Anisometropic amblyopia
- Ametropic amblyopia
- Stimulus deprivation amblyopia
- Meridional amblyopia

Strabismic amblyopia

Strabismic amblyopia is seen in patients having squint since birth, unilateral constant squint, who strongly use one eye for fixation. It is more common in esotropes.

Example: A patient has right esotropia

Vision: Right eye: 2/60

Left eye : 6/6

In this case the patient will prefer only the left eye for fixation.

Anisometropic amblyopia

Anisometropic amblyopia occurs in an eye having a higher degree of refractive error than the other eye. It's occurs more in hyperopes than in myopes.

Hypermetropic amblyopia - More than 2-3 Diopters

Myopic amblyopia - More than 5 Diopters

Ametropic amblyopia

Occurs in patients with bilateral uncorrected high refractive error.

Hyperopia of more than + 5.0D

Myopia of more than - 10.0D

Example 1: Right eye 5/60 with + 7.0Dsph 6/36 nip

Left eye 4/60 with + 8.0Dsph 6/36p nip Example 2: Right eye 6/60 with - 11.0Dsph 6/18

Left eye 2/60 with - 12.0Dsph 6/18/ nip

Stimulus deprivation amblyopia

It is caused by an eye being deprived of visual stimulus. It is important to alleviate the cause as soon possible.

Example 1. Ptosis (Drooping of upper eyelid)

2. Corneal opacity
3. Cataract

Meridional amblyopia

Occurs in patients with uncorrected astigmatic refractive error. It can be bilateral.

Example : Right eye 6/12 with - 1.0 X 180 6/6

Left eye 6/60 with -4.0 X 180 6/18 nip

(Left eye meridional amblyopia)

4.12 5 4.12 6 Treatment of amblyopia

The earlier the intervention, the better the prognosis for amblyopia. Patients have a better prognosis when treated before 5 years of age.

After 8 years of age, however the chance of significantly improving the vision in amblyopia is small.

4.12 6.1CorrectionVisual development and amblyopia

1. Critical period - One week to 3 - 4 months of age
2. Visual plasticity - Birth to 7 year of age
3. Extended plasticity - more than 10 years of age

Treatment

If any refractive error is present give new correction

- Occlusion
- Atropine therapy (penalisation)

Correction **of refractive error**

If there is any refractive error we have to give full cycloplegic correction before starting treatment.

4.12 6.2 Occlusion

Occlusion refers to closure of the normal eye with patch or ground glass, thus forcing the child to use the amblyopic eye to stimulate visual development. It can be either occlusion of light or both light and forms.

Total occlusion

With the help of direct patching of the eye both light and form occlusion is done.

Partial occlusion

With the help of cello tape or ground glass over the normal eye, only the form of objects are not seen, but the light is seen.

Full time occlusion

The ratio adapted is 3:1. Three days occlusion to normal eye and 1 day occlusion to amblyopic eye.

This type of patient uses ground glass (or) cello tape.

Part time occlusion

Patient does patching for a few hours only 6hrs/day to normal eye.

Occlusion is done from a few hours to full time depending upon the age of the patient and type and severity of the amblyopia.

Follow up

Patients who are patching their eyes need periodic follow up. Duration of treatment may extend from months to years. If the patient is not coming for follow up, but continuously patching, then normal eye can become amblyopic. Follow up is very important for occlusion patients. Follow up period depends upon the eye and type of occlusion therapy.

4.12 6.3 Atropine therapy (Penalisation)

Topical atropine 1% is used to dilate pupil and paralyse accommodation. This is used to blur the normal eye. Atropine therapy (penalisation) is used to selected cases only.

4.12 6.4 Surgery

In case of stimulus deprivation amblyopia, early surgery is needed.

- Ptosis correction
- Squint correction
- Cataract removal with IOL

Answer the following

1. Define anisometropia.
2. What are the causes and types of anisometropia?
3. What are the different types of tests used for anisometropia?
4. What is the visual status in anisometropia?
5. Explain various treatment modalities for anisometropia.
6. What is aniseikonia?
7. What are the causes for aniseikonia?
8. What are the clinical types of aniseikonia?
9. What is the rule of thumb for testing aniseikonia? 5. What are the treatment modalities of aniseikonia?
10. . What is amblyopia?
11. What are the types of amblyopia?
12. What is meridional amblyopia?
13. What is the treatment for amblyopia?
14. What is occlusion therapy?

Chapter no 6: Clinical Refraction

4.13 Retinoscopy

Retinoscopy is an objective method of measuring the optical power of the eye. A retinoscope is used to illuminate the inside of the eye, and to observe the light that is reflected from the retina. These reflected rays alter as they pass through the optical media of the eye, and by examining just how these emerging rays change, we determine the refractive power of the eye.

We describe retinoscopy as objective because we evaluate the eye as an optical instrument, initially ignoring any information the eye transmits to the brain. Thus retinoscopy does not depend on the patient's vision or judgment.

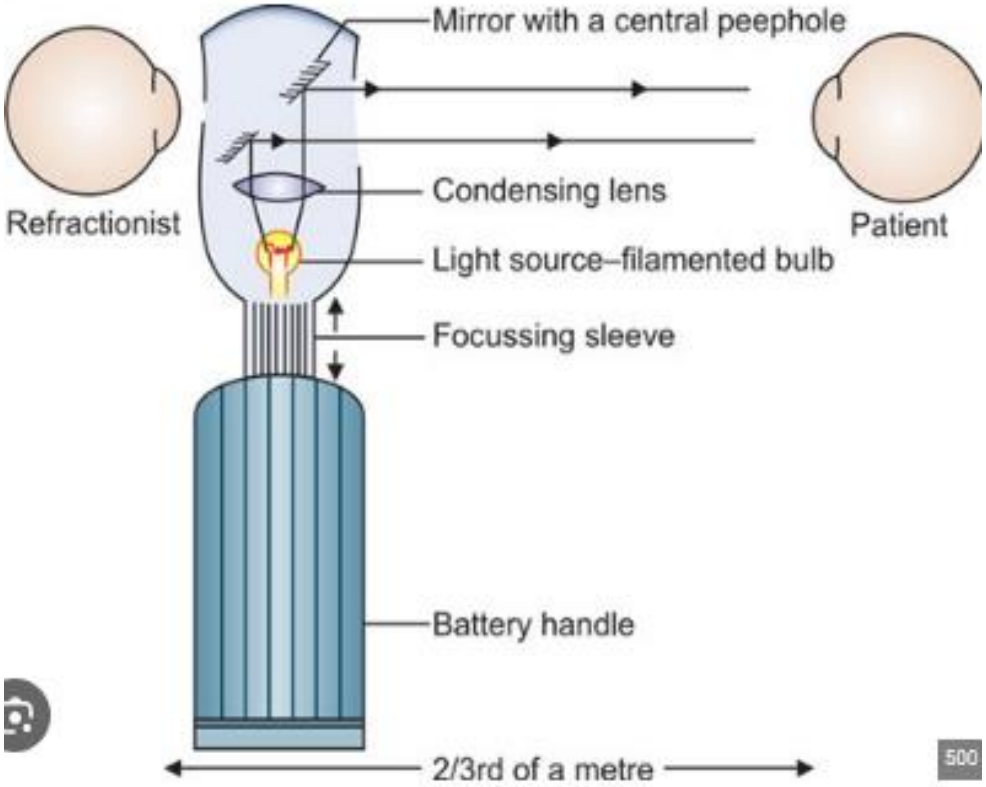
Retinoscopy reduces refraction time and error by quickly determining the appropriate correcting lens, minimising the decisions the patient must make to refine the correction. Retinoscopy proves invaluable when patients cannot cooperate (infants, mentally retarded persons).

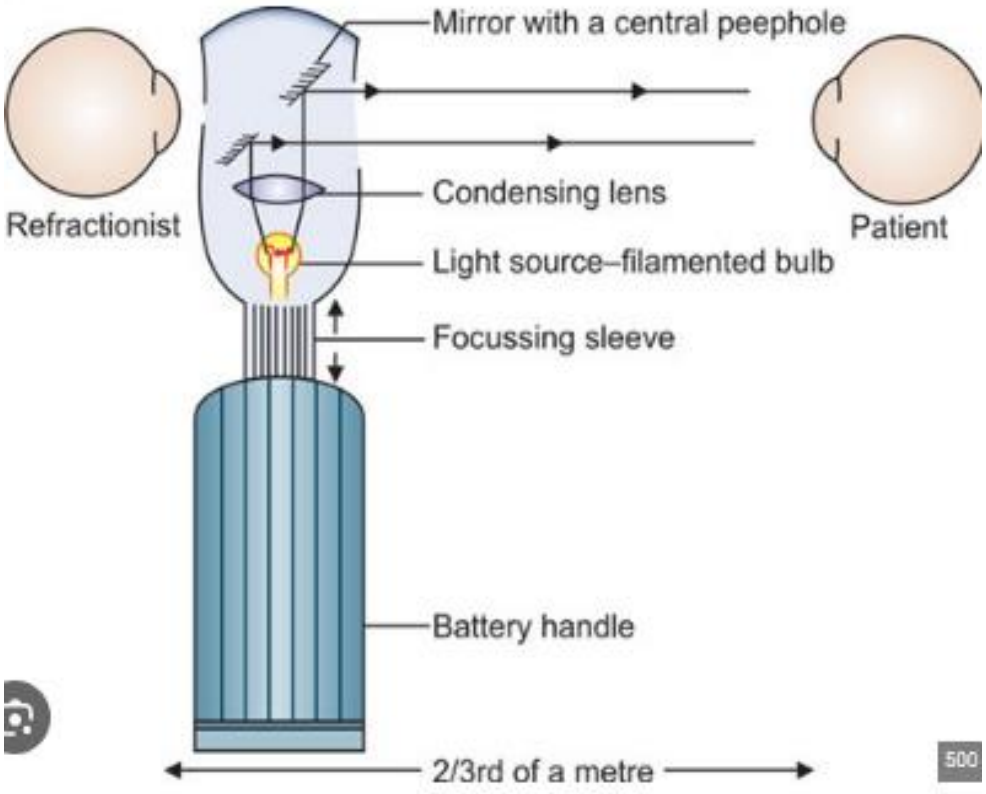
4.13.1 'Far Point' concept

Far point (FP) of an eye is defined as that point in space that is conjugate (corresponding to) with the fovea, when accommodation is relaxed. In retinoscopy retina is illuminated, locating the far point (FP) in space that is conjugate with it. If rays falling on retina come from infinity, it is known as emmetropia (normal vision) - For emmetropia FP is at infinity

- For hypermetropia FP is beyond infinity
- For myopia FP lies somewhere in between infinity and the eye

While correcting refractive errors put the FP point at infinity.


Mirror with a central peephole
Refractionist
Patient
Condensing lens
Light source–filamented bulb
Focussing sleeve
Battery handle
2/3rd of a metre



4.13.2 PRINCIPLE:

Retinoscope illuminates an area of the retina and the image of this area is created at the patient's far point. Observer views rays of light passing from the illuminated retina through patient's pupillary area.

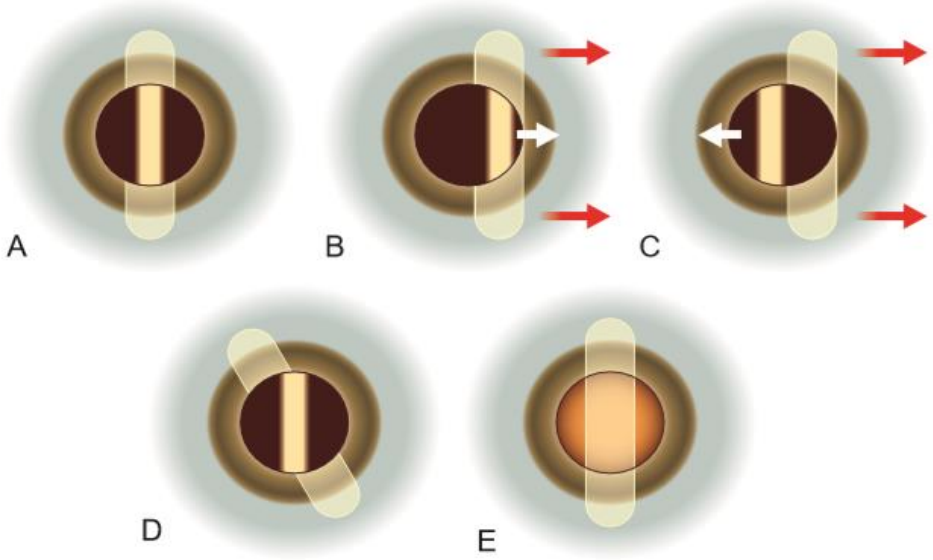
4.13.3 REQUIREMENTS:

- A semi dark room with length of 6 meters
- A trail frame
- A trail set
- Distance vision chart
- Retinoscope

4.13.4 TECHNIQUE:

- Guide the patient and take consent regarding the test

- Sit the patient in semi dark room
- Instruct the patient to fixate at distance target
- The examiner should examine the patient's right eye with retinoscope in right hand and with examiner's right eye and vice versa.
- The examiner should stay close to the visual axis but without obstructing the visual axis.
- Distance between the patient's eye and observer called the working distance is normally 66 cms.
- Carefully examine the vertical and horizontal meridians and carefully notice the reflex.



Reflexes produced by the streak retinoscope. (A) normal. (B) "with" movement. The reflex moves in the same direction as the retinoscope, indicating a hyperopic eye. (C) "against" movement. The reflex moves in the direction opposite to that of the retinoscope, indicating a myopic eye. (D) streak is not uniform in size, speed, or brightness over the entire aperture. The band is more prominent in one meridian, indicating astigmatism. (E) neutralization point. There is no movement of the reflex and the pupil is filled with a red glow.

4.13.5 PROPERTIES OF REFLEX:

- Brightness
  - Dim - Away from neutralization point
  - Bright - Close to neutralization point
- Width
  - Narrow - Away from neutralization point
  - Wide - Close to neutralization point
- Speed
  - Slow - Away from neutralization point
  - Fast - Close to neutralization point
- Movement
  - With - Needs to be corrected with plus lens

- Against - Needs to be corrected with minus lens

4.13.6 INTERPRETATATION:

- With movement indicates that patient is either hypermetropic, emmetropic or myopic of less than the dioptric value of the working distance and is corrected with a plus lens.
- Against movement indicates that the patient is myopic of greater than the dioptric value of the working distance and is corrected with a minus lens.
- No movement indicates point of neutralization.

4.13.7 FINDING ASTIGMATISATION:

- If there is an against movement 90 degrees away from the with movement.
- If there is with movement in both meridians but it differs in speed brightness and width.

4.13.8 CORRECTION FOR WORKING DISTANCE:

- 1 meter: -1 D
- 66 cm: -1.5 D
- 50 cm: -2 D
- 33 cm: -3D

4.13.9 CORRECTION FOR CYCLOPLEGICS:

- Atropine: -1 D
- Cyclopen: -0.75 D
- Homatropin: -0.5 D

4.13.10 SOURCES OF ERROR:

- Media opacities: Cataract corneal scar, Vitreous Hemorrhage, Hyphaema.
- Small pupil.
- Uncontrolled accommodation.
- Inexperienced examiner.
- Improper working distance.
- Defective trail lenses.
- Non-cooperative patient.
- Illuminated room.

4.13.11 THINGS TO REMEMBER:

- Reduce illumination of the streak in case of small/ non-dilating pupil.
- In case of dull reflex, use high plus or minus lenses.
- Use a plus 10 diopter lens in aphakic patients.
- In patients of squint occlude the eye which is not being tested.
- In case of irregular reflex neutralize the central reflex.
- In patients after cataract surgery, there is mostly against the rule astigmatism.

4.13.12 SPHERICAL EQUILVALENT:

Algebraic addition of spherical power and half of cylindrical power.

4.13.13 SIMPLE TRANSPOSITION:

It is transfer of lens power from one form to another so that their meridian values remain same in both forms.

4.13.14 STEPS OF SIMPLE TRANSPOSITION:

- Algebraically add the power of sphere and cylinder to get the new spherical surface power.
- Keep the power of cylinder but reverse the sign.
- Rotate the axis of cylinder through 90 degrees.

4.13.15 USES OF TRANSPOSITION:

- To get the same number in both eyes.
- For comparison of prescription with previous readings.
- For conversion into cylindrical form.
- For conversion into simple form.

4.14 Subjective Refraction:

subjective refraction is a process used by eye care professionals, such as optometrists or ophthalmologists, to fine tune and determine an individual's precise eyeglass prescription based on the patient's subjective responses. unlike objective techniques like retinoscopy, subjective refraction involves the patient actively participating in the process by providing feedback on the clarity and sharpness of images.

here's an overview of the subjective refraction process:

1. Preliminary examination:

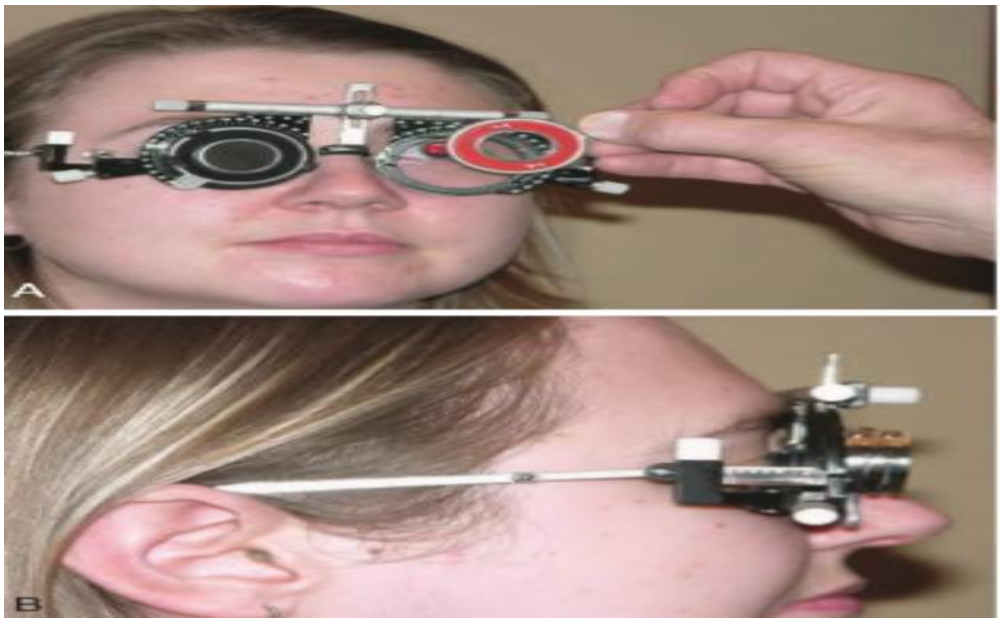
The eye care professional begins with a preliminary examination to assess the patient's overall eye health, visual acuity, and any existing eyeglass prescription.

2. Retinoscopy:

in many cases, the subjective refraction process starts with an objective measurement using retinoscopy to provide an initial estimate of the refractive error.

3. Introduction of lenses:

the eye care professional places a trial frame on the patient's face and introduces different lenses to each eye while asking the patient which lens provides clearer vision. the lenses can be spherical, cylindrical, or a combination of both.



(A) Inserting lenses in a trial frame. (B) Side view of trial frame

4. determining sphere power:
the eye care professional will use lenses with varying spherical power to refine the prescription for myopia (nearsightedness) or hyperopia (farsightedness). the patient is asked to compare the clarity of images with each lens choice.
5. determining cylinder power and axis (if needed):
if astigmatism is present, the eye care professional introduces cylindrical lenses with different axes to determine the correct power and axis. the patient indicates which lens provides sharper vision.
6. binocular balancing:
both eyes are considered together to ensure binocular vision is optimized. the prescription is adjusted to provide clear and comfortable vision for both eyes working together.
7. near vision testing (if needed):
if the patient requires a prescription for reading or other close up tasks (e.g., presbyopia), near vision testing may be conducted using reading charts or other near vision targets.
8. Verification and confirmation:
the eye care professional verifies the final prescription with the patient, ensuring that it provides clear and comfortable vision.
9. Prescription documentation:
the final eyeglass prescription, including sphere, cylinder, axis (if applicable), and any additional parameters, is documented for the patient.

UNIT 5 PRINCIPLES OF OCULAR SURGERY

a. **5.1.Sterilization – Introduction**

Sterilization is the removal of all forms of microorganisms from the surface of an object. It includes both spore and vegetative forms. Here, let's glance at the definition and classification of sterilization notes.

5.2 Classification of Sterilization

Sterilization is achieved by different physical and chemical methods in microbiology. Sterilization is classified into 2 types – physical sterilization and chemical sterilization. Let us discuss them in detail.

5.2.1 Physical Methods of Sterilization

Physical sterilization includes the following methods:

- **5.2.1.1Heat Sterilization**

Heat sterilization is the most effective method of sterilization, where the elimination of microbes is achieved by the destruction of cell constituents and enzymes. It is done by two methods:

A. **Moist Heat Sterilization:** It is one of the best methods of sterilization. Moist heat sterilization is done with the help of an instrument called an autoclave. An autoclave works on the principle of producing steam under pressure. Thus moist heat sterilization is also known as steam sterilization. The water is boiled in an autoclave at 121-134℃ at a pressure of 15psi. This leads to coagulation of proteins in the microorganism, and they are effectively killed.

B. **Dry Heat Sterilization:** This method is used on objects that are sensitive to moisture. Moisture-free heat or dry heat is applied on the surface or objects such that there is denaturation and lysis of proteins which leads to oxidative damage, and ultimately the microbial cell dies out or may even burn. Some methods of dry heat sterilization include incinerators, hot air ovens and flaming techniques.

5.2.1.2. Filtration

This is a mechanical method of sterilization in microbiology. This method uses membranous filters with small pores to filter out the liquid so that all the bigger particles and microbes cannot pass through. The three steps of filtration are sieving, adsorption and trapping.

5.2.1.3 Irradiation

Irradiation is the process of exposing surfaces or objects to different kinds of radiation for sterilization. It is of two types:

A. **Non-ionising Radiation:** Ultraviolet radiation is exposed to the object, which is absorbed by nucleic acids of the microorganisms. This leads to the formation of pyrimidine dimers in the DNA strand, which causes the replicative error, and eventually, the microbe dies.
B. **Ionising Radiation:** Upon exposure to ionising radiations such as gamma rays and X-rays, reactive oxygen species such as hydrogen peroxide and superoxide ions are formed that oxidise the cellular components of the microbe, and they die.

5.2.1.3 Sound Waves Vibration

Sonix sound waves ranging from 20-40 kHz in frequency are applied across the fluid to be sterilized. These ultrasonic waves produce an alternation of compressive and tensile forces forming cavities in the solution. These cavities suddenly collapse, which creates submicroscopic voids and removes microorganisms from the container.

5.2.1.4. Fractional Sterilization

Fractional sterilization or tyndallisation is a method used for media containing gelatin or sugar. Typically, exposure to 100°C for 20 minutes on 3 successive days is required. The principle is that the first exposure kills all spores and vegetative bacteria. If they germinate, they will be killed in the subsequent exposures. However, this method may fail to kill spores of certain thermophiles and anaerobes.

5.2.1.5. Chemical Methods of Sterilization

Chemical methods of sterilization are used in microbiology for biological specimens and plastic equipment. In this method, several chemicals work as bactericidal agents. They can be of two types: gaseous or liquid.

- **5.2.1.6. Gaseous Sterilization**

Gaseous sterilization is the method where the object is exposed to gas in a closed, heated and pressurized chamber. The gaseous chemical agents used for sterilization include ethylene oxide, formaldehyde, nitrogen dioxide and ozone.

- **5.2.1.7. Liquid Sterilization**

Liquid sterilization is the process of immersing the object in a liquid such that it kills all the viable microorganisms and their spores. This method is less effective than gaseous sterilization and is used to remove low levels of contamination. Common liquid chemical agents that are used for sterilization include hydrogen peroxide, glutaraldehyde and hypochlorite solution.

5.2.1.8. Cold Sterilization Definition – It is a process in which sterilization is carried out at low temperatures with the help of chemicals, filters, radiation and all other means excluding high temperatures. It is done for products that contain heat-sensitive ingredients and yet require sterilization.

5.3

Hot Air Oven

5.3.1 Introduction

- An oven provides a temperature higher than atmospheric.
- Temperature range: 50-250°C.
- Used for rapid evaporation, drying, and sterilization by dry heat.

Dry heat sterilization requires longer exposure (1.5 to 3 hours) and higher

5.3.2 Principle

Sterilization by dry heat is achieved by conduction, oxidizing molecules, and destroying essential cell constituents. Temperature maintained for about an hour to kill resistant spores.

5.3.3. Working

Time-temperature relationships:

170°C for 30 minutes

160°C for 60 minutes

150°C for 150 minutes or longer.

Slow cooling after sterilization to prevent glassware cracking.

Used for glassware, forceps, oils, waxes, powders, and swabs.

Quality control using chemical (Browne's tubes) and biological controls.

5.3.4 Advantages

Easy installation and low operating costs.

Penetrates materials.

Nontoxic, noncorrosive.

5.3.5 Disadvantages

Time-consuming.

High temperatures unsuitable for some materials.

5.4 Autoclave

5.4.1 Introduction

Sterilization: destruction of all microorganisms.

Autoclave is a high-temperature, high-pressure chamber using steam for sterilization.

5.4.2 Methods of Sterilization

Steam pressure (Autoclave).

Chemical vapor pressure (Chemiclave).

Dry heat (Dryclave).

Ethylene oxide.

5.4.3 Types of Autoclave

1. Downward Displacement Autoclave

Gravity displacement unit.

Air removal is downwards.2. Vacuum Autoclave

Steam created in a separate chamber.

Steam released in a pressurized blast for air removal.

5.4.4 Sterilization Cycles

N-Type (Downward Displacement): Unwrapped solid instruments.

S-Type (Vacuum): Naked and single-wrapped solid and hollow items.

B-Type (Vacuum): Unwrapped and wrapped solid and hollow instruments, porous loads.

5.4.5 Major Factors for Effective Autoclaving

Pressure: 15 Psi

Temperature: 121°C

Time: 30 mins

5.4.6 Stages of Sterilization

Presoaking

Cleaning

Lubrication

Inspection

Preparation and packing

Sterilization

Storage

Delivery of materials

5.4.7 How to Use the Autoclave

Do not overfill.

Load should not touch chamber walls.

Door should be clear before closing.

Autoclave the load immediately after preparation.

5.2.4.8 How to Check Autoclave Functionality

Biological tests with spore strips (e.g., Geoacillus stearothermophilus).

5.4.9 Potential Risks

Heat burns, steam burns, hot fluid scalds.

Injuries during door closing.

Body injury in case of an explosion.

5.5 Personal Protective Equipment

Heat-insulating gloves

Protective coats

Protective eye equipment

Close-toe shoes

5.6 HEPA filter

(high-efficiency particulate air) filter, also known as high-efficiency particulate absorbing filter and high-efficiency particulate arrestance filter, is an efficiency standard of air filters.

Filters meeting the HEPA standard must satisfy certain levels of efficiency. Common standards require that a HEPA air filter must remove—from the air that passes through—at least 99.95% 99.97% of particles whose diameter is equal to 0.3 μm, with the filtration efficiency increasing for particle diameters both less than and greater than 0.3 μm. HEPA filters capture pollen, dirt, dust, moisture, bacteria (0.2–2.0 μm), virus (0.02–0.3 μm), and submicron liquid aerosol (0.02–0.5 μm).Some microorganisms, for example, Aspergillus niger, Penicillium citrinum, Staphylococcus epidermidis, and Bacillus subtilis are captured by HEPA filters with photocatalytic

oxidation (PCO). A HEPA filter is also able to capture some viruses and bacteria which are ≤0.3 μm. A HEPA filter is also able to capture floor dust which contains bacteroidia, clostridia, and bacilli. HEPA was commercialized in the 1950s, and the original term became a registered trademark and later a generic trademark for highly efficient filters. HEPA filters are used in applications that require contamination control, such as the manufacturing of hard disk drives, medical devices, semiconductors, nuclear, food and pharmaceutical products, as well as in hospitals, homes, and vehicles.

5.6.1 Efficacy and safety

In general terms (and allowing for some variation depending on factors such as the air-flow rate, the physical properties of the particles being filtered, as well as engineering details of the entire filtration-system design and not just the filter-media properties), HEPA filters experience the most difficulty in capturing particles in the size range of 0.15 to 0.2 μm. HEPA filtration works by mechanical means, unlike ionic and ozone treatment technologies, which use negative ions and ozone gas respectively. So, the likelihood of potential triggering of pulmonary side-effects such as asthma and allergies is much lower with HEPA purifiers.

To ensure that a HEPA filter is working efficiently, the filters should be inspected and changed at least every six months in commercial settings. In residential settings, and depending on the general ambient air quality, these filters can be changed every two to three years. Failing to change a HEPA filter in a timely fashion will result in it putting stress on the machine or system and not removing particles from the air properly. Additionally, depending on the gasketing materials chosen in the design of the system, a clogged HEPA filter can result in extensive bypassing of airflow around the f**ilter.**

5.7 Instruments and their uses;

5.7.1 A-Scan Biometry

5.7.1.1 Introduction:

Ophthalmic ultrasound is a special tool that uses sound waves to see inside the eye. One important use of this tool is A-Scan biometry, which helps measure and calculate the power of a lens put in the eye during cataract surgery.

5.7.1.2 Why A-Scan Biometry?

A-Scan is like a special ruler for the eye. It measures how long the eye is and helps figure out the right power for the lens. Even a tiny mistake in this measurement can make a big difference in how well the lens works.

5.7.1.3 How A-Scan Works:

A special device, called a probe, sends sound waves into the eye. These sound waves bounce back, and the machine calculates the time it took for them to travel. This helps find out the distance inside the eye.

5.7.1.4 Different Ways to Use A-Scan:

There are a few ways to use A-Scan:

1. Handheld Method: A small probe held by hand.

   Sometimes, it might press too much on the front part of the eye.

2. Standheld Method: The probe is part of a special microscope.

 This method is more comfortable for the patient.

3. Immersion Technique: The probe sits in a liquid-filled cup on the eye.

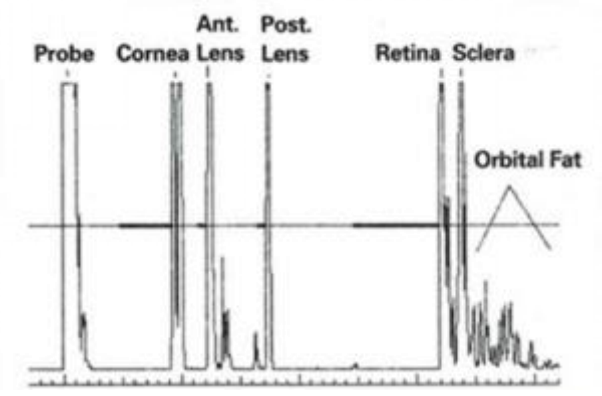
 This method helps avoid pressing on the eye too hard.

5.7.1.5 How the A-Scan is Done:

1. A small probe touches the eye gently.

2. The machine sends adjustable sound waves.

3. The results show up on a screen like spikes.



5.7.1.6 Avoiding Mistakes:

Corneal Compression: Too much pressure on the front part of the eye can give the wrong measurement.

Solution: Using the immersion technique helps avoid this.

5.7.1.7 Where to Point the Probe:

The probe should touch the eye just right and aim towards the center of the back of the eye.

Reading the Results:

The spikes on the screen show different parts inside the eye.

Example: There are spikes for the front part, the lens, and the back.

5.7.1.8Different Eye Conditions:

Phakic Eye: With a natural lens.

Aphakic Eye: Without a natural lens.

Pseudophakic Eye: With a replaced lens.

Taking Care of the A-Scan Machine:

Regular checks and cleaning keep the machine working well.

5.7.1.9 Calculating Lens Power:

The A-Scan helps figure out the right power for the lens.

Importance: This is crucial for clear vision after cataract surgery.

5.7.1.10 Common Mistakes and How to Fix Them:

If the lens power is not right, there are ways to correct it.

Tip: Always check both eyes and repeat scans if needed.

5.7.1.11 Conclusion:

Understanding A-Scan is like using a special tool to measure and calculate the lens power for clear vision. Taking care to avoid mistakes and regularly checking the machine ensures better outcomes for patients.

5.7.2 Keratometry

5.7.2.1 Introduction:

Keratometry is like a magic ruler for eye doctors. It helps measure the roundness of the front part of your eye, called the cornea. Let's dive into the basics of how it works and why it matters.

5.7.2.2How It Works:

Imagine your cornea as a curved mirror.

The more curved it is, the smaller the picture it makes.

Keratometry measures this picture to figure out how curved your cornea is.

5.7.2.3 Why Curvature Matters:

Curvature affects how well you see and if you need glasses or contacts.

5.7.2.4Key Concepts:

The tool uses special mirrors to create two pictures of the cornea.

By adjusting these pictures, we can find out the curvature.

5.7.2.5 Using the Keratometer:

The doctor calibrates the tool, making sure it's super accurate.

Patient sits in front of it, and the doctor adjusts until the pictures look just right.

5.7.2.6 What We See:

For a normal eye, the pictures look like perfect circles.

If cornea has issues, the pictures might look stretched or even doubled.

5.7.2.7Types of Conditions It Helps With:

Spherical Cornea: Perfect circles, no stretching.

Astigmatism: Oval shapes instead of circles.

Keratoconus: Distorted or doubled pictures.

5.7.2.8 Keratometer Types:

Bausch & Lomb: A common one with a range of measurements.

Automated Keratometers: Quick and easy, no need for extra adjustments.

Bausch & Lomb Keratometer

Humphrey Keratometer

Bausch & Lomb Keratometer

Humphrey Keratometer

Why It's Important:

Helps eye doctors prescribe glasses, contacts, or plan surgeries.

Checks if cornea is healthy and shaped just right.

5.7.3 Operating Microscope

5.7.3.1 The Essential Trio: Components of the Operating Microscope:

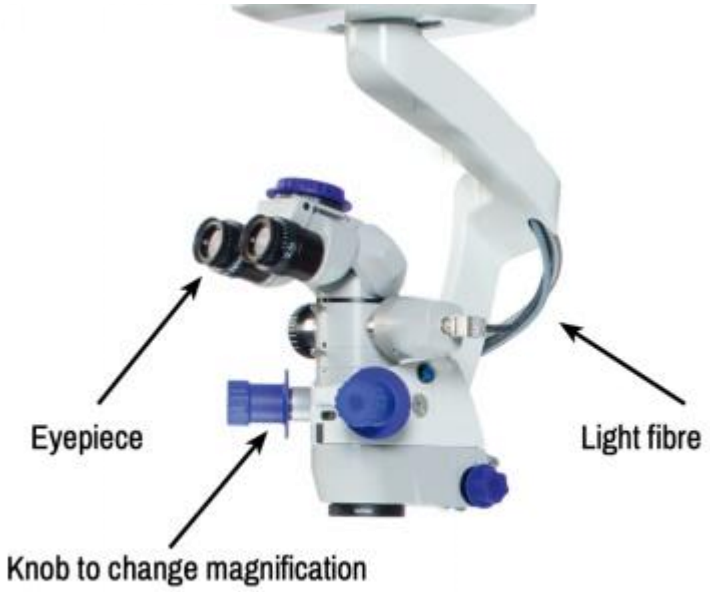
5.7.3.1.1 Observation System:

5.7.3.1.1.1 Eyepieces: Main magnifiers with various magnification options.

5.7.3.1.1.2 Binocular Tubes: Equipped with an inverting prism and a magnification changer for a comfortable and adjustable view.

5.7.3.1.1.3 Objective Lenses: Determines the working distance and is commonly available in focal lengths of 150, 175, and 200 mm.

5.7.3.1.2 Illumination System:



Coaxial light, often Halogen lamps, providing bright and contrast-enhancing illumination.

Fiber optic cables transmit light to the surgical field, reducing shadows.

Halogen lamps, although emitting heat, offer high color temperature, enhancing contrast.

5.7.3.1.3 Mechanical Support System:

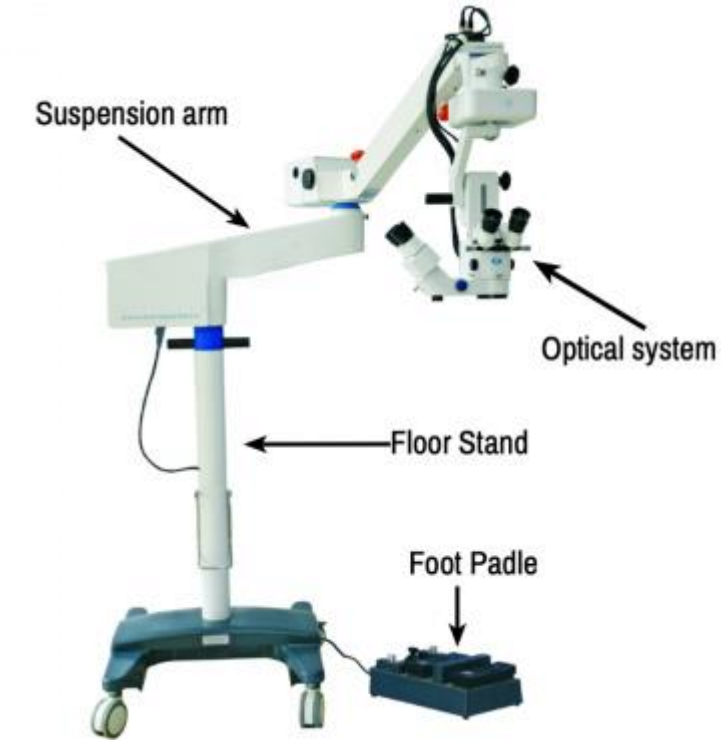
Available in three models: floor, table-mounted, and ceiling.

Foot pedal control for focus, zoom, x-y positioning, and light control.

5.7.3.2 Zooming In: Magnification and Field of View:

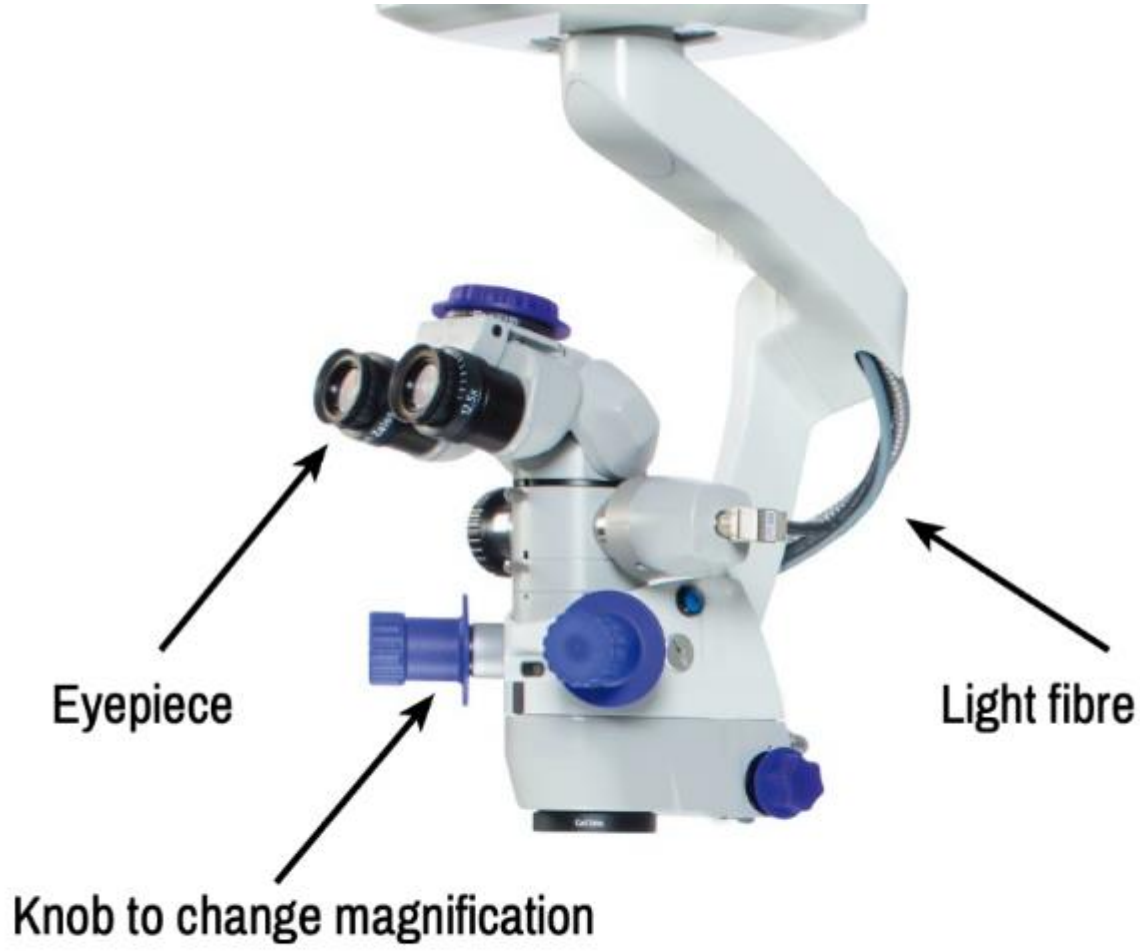
Magnification: Determined by the combination of eyepiece, objective lens, and magnification changer.

Field of View: Decreases with increasing magnification.



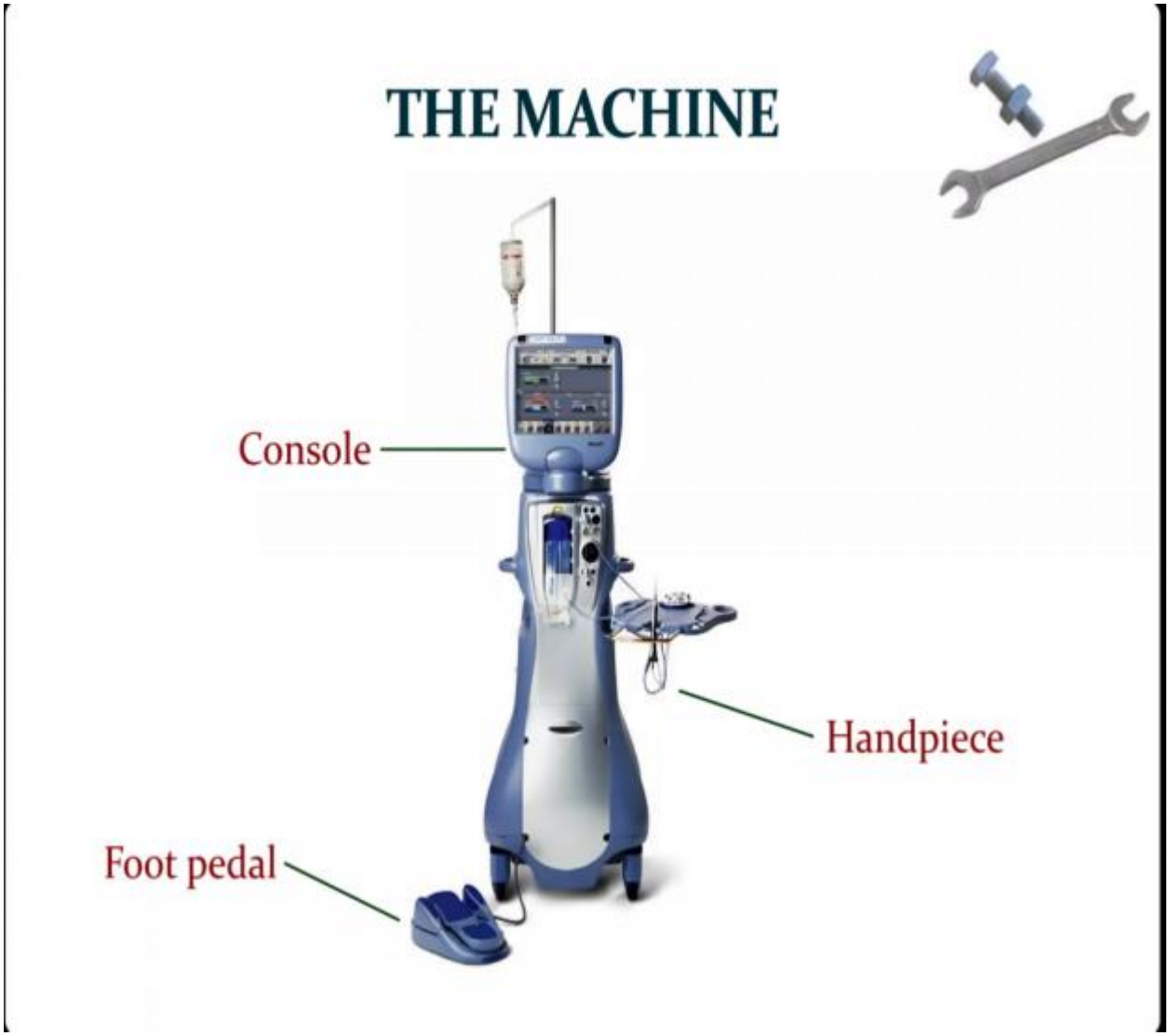
5.7.3.3 Caring for Your Microscope:

- Keep it in a dry, cool place to prevent fungus growth.
- Use a cover to protect from dust when not in use.
- Wipe external surfaces with a damp, soapy cloth.
- Cover the foot pedal to prevent fluid damage.
- Use a voltage stabilizer to ensure constant illumination.
- Test controls before use and check arm stability.
- Avoid kinking or bending fiber optic cables.
- Handle bulbs with care, avoiding fingerprints.
- Allow the microscope to cool before moving.



Understanding and caring for the operating microscope ensures its longevity and reliability in the intricate world of eye surgery.

5.7.4 Phaco Machine



5.7.4.1 Uses of Phaco Machine

Cataract Removal: Phaco machine helps take out cloudy eye lenses using sound waves.

Surgical Precision: Doctors can adjust settings for each person's eye needs.

Minimally Invasive: Small cuts mean faster healing and fewer problems.

Quick Recovery: Patients can see better sooner because the machine works efficiently.

Reduced Astigmatism: It helps to decrease eye shape issues for better vision results.

Customizable Settings: Doctors can use different settings for different eye problems.

High Success Rates: The machine is good at making cataract surgery successful with few issues.

5.7.4.2 Parts of Phaco Machine

5.7.4.2.1 Console

Controls all machine functions.

Manages phaco power delivery, irrigation, and aspiration.

Allows manipulation of parameters such as power, vacuum, and flow rate.

5.7.4.2.2 Hand Piece

Includes Phaco handpiece and Irrigation-Aspiration (I & A) handpiece.

5.7.4.2.2.1 Phaco Handpiece

Functions: Power delivery, irrigation, aspiration.

Phaco power generated by piezoelectric crystals.

Different tip types: Standard, Kelman, Micro, Mackool, Flared, ABS, Micro Flow

5.7.4.2.2.2 Irrigation-Aspiration Handpiece

Types: Co-axial and Bimanual.

Functions: Anterior chamber lavage (outflow), creation of hold for emulsification (vacuum).

5.7.4.2.3 Foot Pedal

Four positions: Resting, Irrigation mode, Irrigation Aspiration mode, Irrigation Aspiration Phaco mode.

Foot gradient controls excursion and phaco power delivery.

Sidekick movement functions for reflux control and continuous infusion mode.

5.7.4.3 Phaco Dynamics

5.7.4.3.1 Fluidics

Components: Irrigation system and Aspiration system.

5.7.4.3.1.1 Types of Aspiration Systems

5.7.4.3.1.1.1 Flow Pumps

5.7.4.3.1.1.2 Peristaltic Pumps: Slow vacuum build-up, independent AFR, and vacuum control.

5.7.4.3.1.1.3 Scroll Pumps: Less surge and leakage.

5.7.4.3.1.1.4 Vacuum Pumps

5.7.4.3.1.1.5 Venturi Pump: Compressed gas generates vacuum.

5.7.4.3.1.1.6 Diaphragmatic Pump: Vacuum generated by flexible diaphragm.

5.7.4.3.1.1.7 Rotary Vane Pump: Vacuum created by motor-driven rotor.

5.7.4.3.2 Phaco Power

-**5.7.4.3.2.1** Mechanism of Action

- Direct impact, Chatter, Cavitation, Acoustic wave effect.

- Modes: Continuous, Pulse, Burst, HyperPulse.

- Duty Cycle

- Continuous mode (100%), Pulse mode (50%), Burst mode (< 50%), HyperPulse mode (< 50%).

5.7.4.3.3 Surge

- Surge occurs due to extra fluid aspiration when an occluded phaco tip with built-up vacuum is suddenly dis-occluded.

-**5.7.4.3.3.1** Effects: Anterior chamber collapse, damage to iris and cornea, posterior capsular rupture.

- **5.7.4.3.3.2** Factors: Compliance of tube, high vacuum level, high AFR.

- 5.7.**4.3.3.3Control** measures: Improvisation in the phaco machine and surgeon's measures.

5.7.4.3.3.4 Control of Surge

1. Improvisation in the Phaco Machine

Reduce compliance, Increase inflow, Pressure transducer and logarithmic control, Smaller diameter tubings and phaco tips, ABS tip.

2. Surgeon's Measures

More resistive phaco needle, More resistive tubing set, Augment inflow, Proper wound construction, Increase bottle height, Lower vacuum setting, Decrease AFR, Partial occlusion of tip, Good foot control, Viscoelastic substances.

5.7.5 OPHTHALMIC INSTRUMENTS

Ophthalmic instruments can be classified according to their function and shape as follows:

- Knives.
- Forceps.
- Scissors.
- Holders.
- Cataract surgery instruments.
- Lid surgery instruments.
- Lacrimal sac surgery.
- Squint surgery instruments.
- Miscellaneous

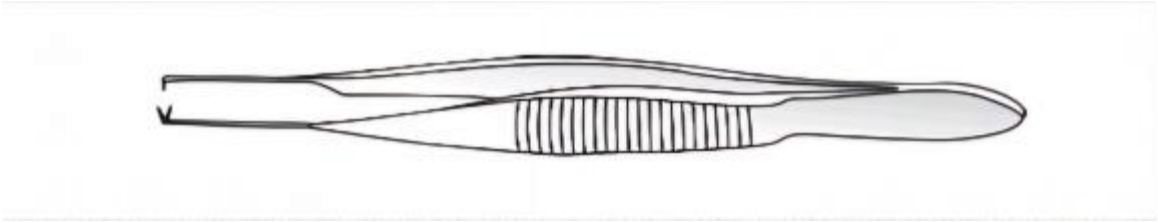
- **5.7.5.1 FORCEPS**

  - Forceps consists of two limbs joined together at one end.

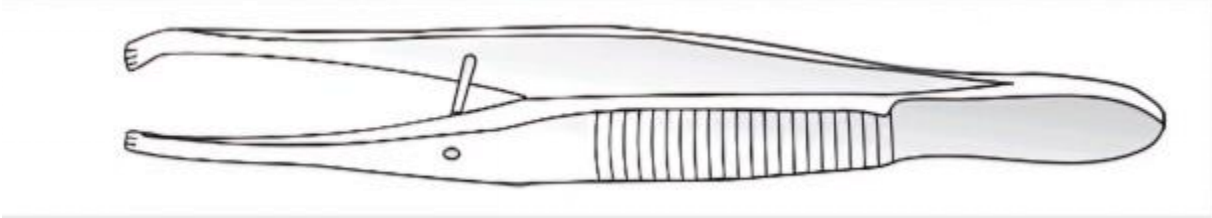
  - **5.7.5.1.1 STRAIGHT FORCEPS**

- **5.7.5.1.1.1 PLANE FORCEPS**
    - It is a simple straight forceps without any teeth.
    - Uses
        - It is used to hold the conjunctiva or skin during blunt dissection.
        - It helps in tying corneoscleral sutures.

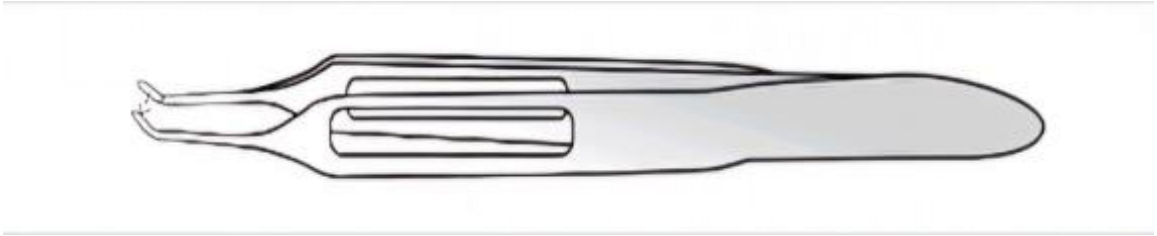
- **5.7.5.1.1.2 CORNEAL OR ONE TOOTH FORCEPS**
    - The corneal forceps has 1 x 2 tiny fine teeth at the narrow pointed tip.
    - Uses:
        - It is used to hold the cornea while passing corneoscleral sutures.
        - It may be also used to lift the cornea during lens delivery by a cryoprobe.



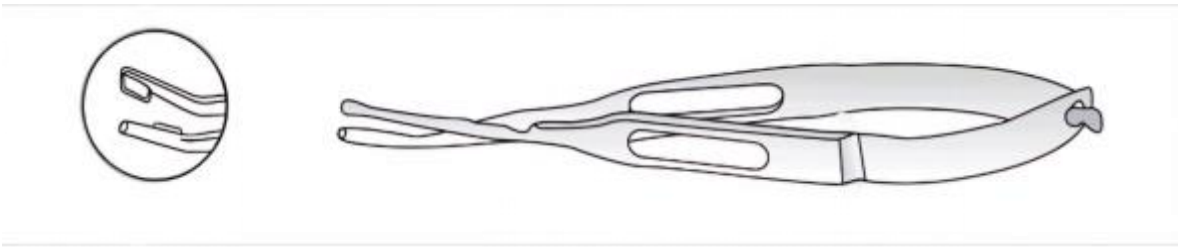
    - **5.7.5.1.1.3 FIXATION FORCEPS**
    - The fixation forceps may have a narrow or wide jaws.There may be 2 x 3 or 4 x 5 teeth at the tip.
    - Uses:
        - It is used to fix the eyeball by holding conjunctiva and episcleral tissue at 6 0'clock position while making corneoscleral incision during cataract surgery.

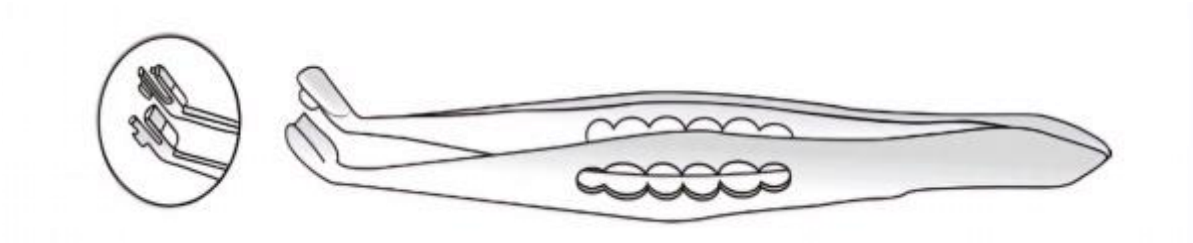


- **<u>5.7.5.1.2 SINGLE CURVE FORCEPS</u>**
    - **5.7.5.1.2.1 MCPHERSEN IRIS FORCEPS**
        - It is a small delicate forceps with fine limbs having 1 x 2 teeth.
        - Uses:
            - It is used to hold the iris while doing iridectomy for glaucoma, cataract surgery or optical purpose.



        - **5.7.5.1.2.2 Lens Holding Forceps for Foldable Intraocular Lenses**
        - They may be direct action or cross action forceps and are used to evenly hold acrylic and silicone.



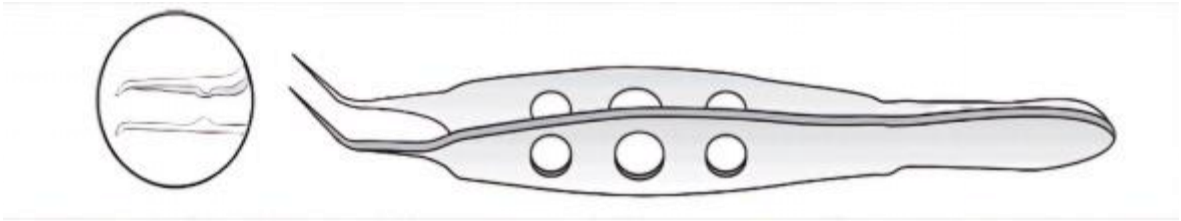


- **5.7.5.1.3 DOUBLE CURVE FORCEPS**

- **5.7.5.1.3.1 Superior Rectus Forceps**
    - It is strong forceps with S- shaped up having 1 x2 teeth.
    - Uses
        - it is used to hold the superior rectus muscle while passing a stay suture to fix the eyeball in downwards gaze in intraocular operations, e.g.cataract and glaucoma surgery, keratoplasty, etc.

- **5.7.5.1.3.2 Iris Forceps**
    - It is a small and delicate forceps with fine limbs having 1 x 2 teeth.
    - Uses
        - It is used to hold the iris while doing iridectomy for glaucoma, cataract surgery or optical purpose.

- **5.7.5.1.3.3 Utrata Capsulorhexis Forceps**
    - It has very delicate grasping tips and extremely thin long straight shanks.
    - Uses
        - It is used for holding the lens capsule after a flap has been raised with a cystitome or bent 26 gauge needle to perform a continuous curvilinear capsulotomy.



5.7.5.2 KNIVES

- These are long, narrow, straight instruments.

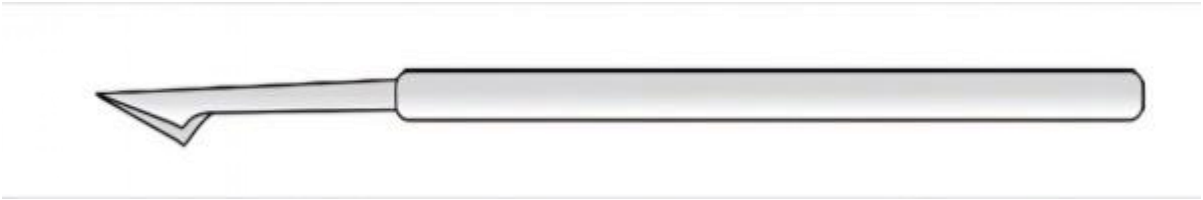
5.7.5.2.1 Keratome

- It has a thin diamond-shaped blade with a sharp apex and two cutting edges. Straight as well as curved keratomes are available in various sizes (2.8 mm, 3 mm, 5.5 mm).
- Uses
  - Keratomes are used to make valvular (self sealing) corneal incisions for entry into the anterior chamber for all modern cataract surgeries like manual small incision cataract surgery (SICS) and phacoemulsification.
  - It is used to make ab-externo corneal incision and for paracentesis.

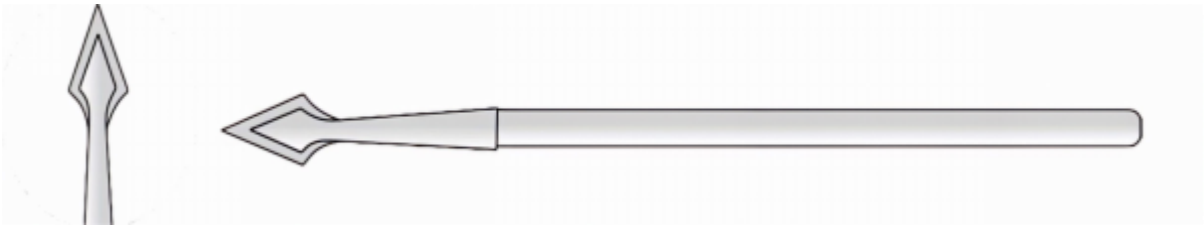
- **5.7.5.2.2 Paracentesis Needle**
  - It is a lancet-shaped needle with sharp cutting edges. It has a guard to prevent injury to deeper structures. It resembles a small keratome.
  - Uses
    - It is used for paracentesis in cases of non-healing corneal ulcer, hyphaema and hypopyon associated with raised intraocular tension.

- **5.7.5.2.3 15° Side Port Entry Blade**
    - It is a fine straight knife with a sharp pointed tip and cutting edge only on one side.
    - Uses

It is used to make a small valvular clear corneal incision (side-port incision) in phacoemulsification,SICS and other intraocular surgeries including pars plana vitrectomy.



    - **5.7.5.2.4 MVR or V Lance Blade**It is a fine straight but triangular knife similar to 15° side port entry blade but with cutting edges on both sides.
    - Uses
        - Its uses are similar to 15 side port entry blade.



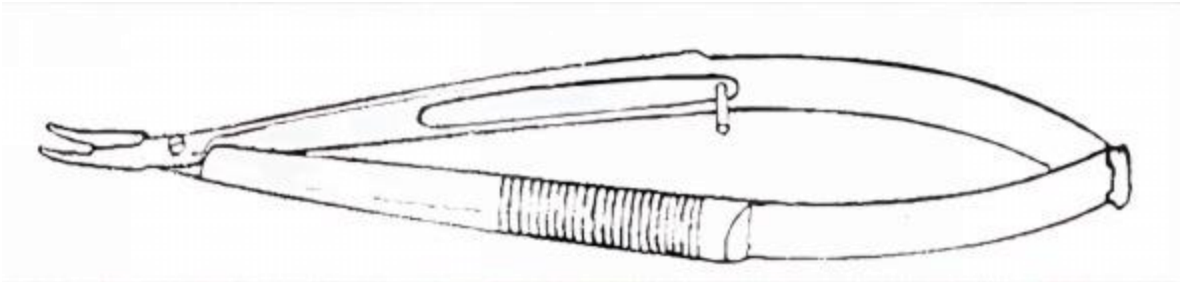
    - **5.7.5.2.5 Crescent Knife**It is a blunt-tipped bevel up knife having cut-splitting action at the tip and both the sides. Its blade is curved and is mounted on a plastic handle (disposable) or fixed to a metallic handle.
    - Uses
        - It is used to make tunnel shaped incision in the sclera and cornea for phacoemulsification, manual SICS and sutureless trabeculectomy.

- **5.7.5.2.6 Iris Repositor**
- It consists of a delicate flat or bent blade with blunt edges and tip attached to a handle. It is curved at an angle of 45° (approximately) to facilitate its intraocular manuering.
- Uses
  - It is used to replace or reposit the iris in the anterior chamber after an iridectomy.
  - It also helps to free the iris from the lips of the section.
  - It is useful in breaking the posterior synechia at the pupillary margin.

5.7.5.3 HOLDERS

- **5.7.5.3.1 Needle Holder**A variety of needle holders are available with or without catch, with straight or curved tips. It holds the needle firmly.
- Uses

It is used for passing sutures in the lids, superior rectus muscle, conjunctiva cornea, sclera or muscle.



- **5.7.5.3.2 Blade Holding Forceps**It is designed to hold the razor blade firmly.

- Uses
  - It is used to make ab-externo incision for cataract surgery.

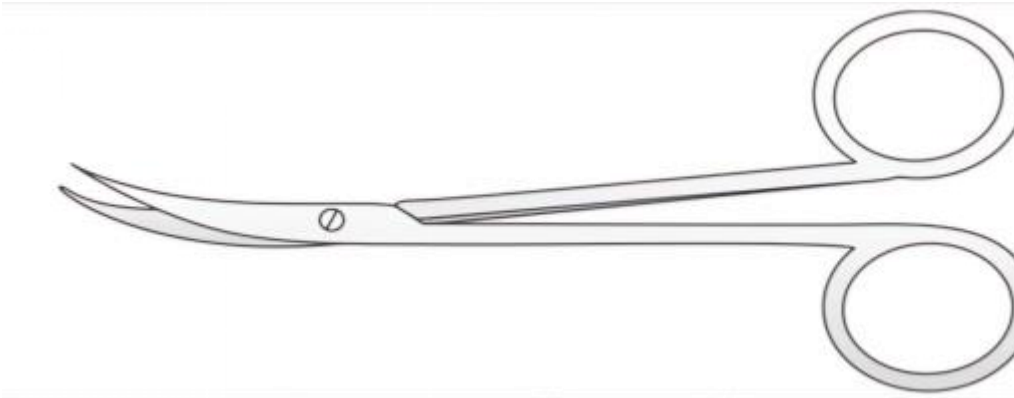
- It is also used for performing trabeculectomy.

5.7.5.4 SCISSORS

- **5.7.5.4.1 Plane Straight Scissors**It is a fine pointed scissor with straight cutting sharp blades.
- Uses
  - It is used to cut the conjunctiva, skin and sutures.

- **5.7.5.4.2 Plane Curved Scissors**It is a fine pointed scissors with curved sharp cutting blades.
- Uses

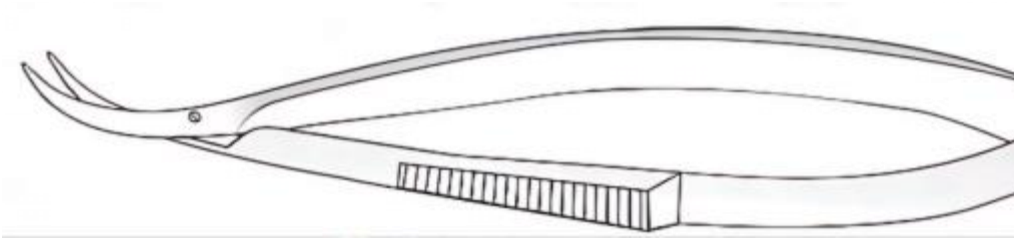
- it is used to cut the conjunctiva while making conjunctival flap in cataract and glaucoma surgery.



5.7.5.4.3 Corneal Scissors or Section Enlarging Scissors It is a very fine a and delicate scissors. The curved cutting blades are kept apart by spring action.

- Uses

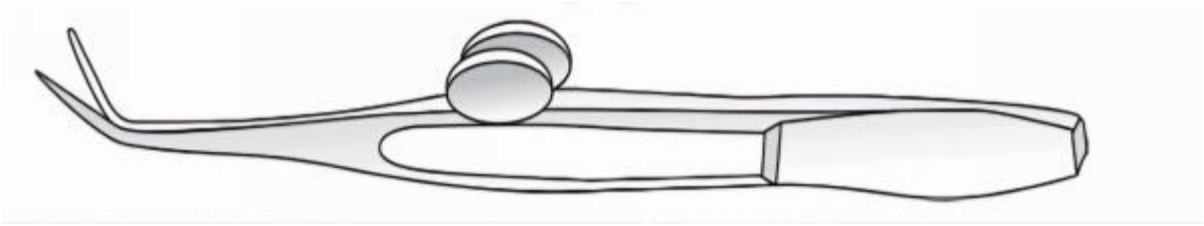
- It is used to enlarge the corneal or corneoscleral section in cataract surgery.



5.7.5.4.4 De-Wecker's Scissors or Iridectomy Scissors

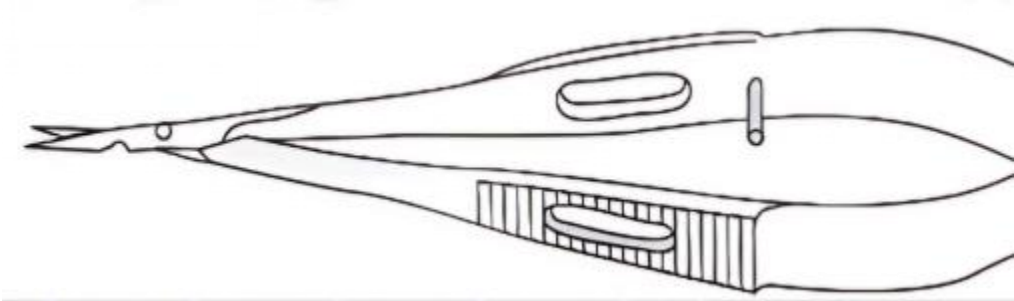
- It is a strong scissors with small V-shaped blades directed at right angles to the arms.
- Uses

It is used to perform peripheral buttonhole iridectomy.



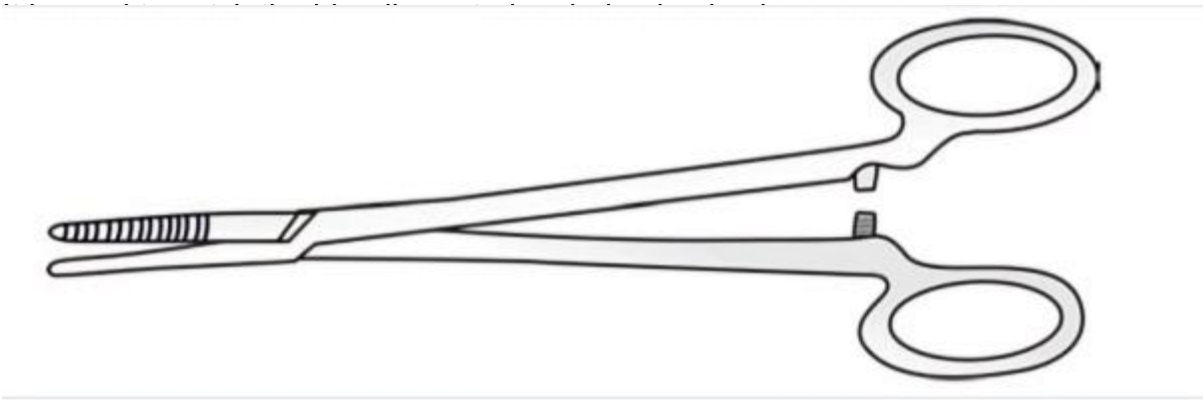
- **5.7.5.4.5 Vannas Scissors**It is a fine delicate scissor with sharp edges.
- Uses

- It is used to cut the vitreous during vitreous prolapse.



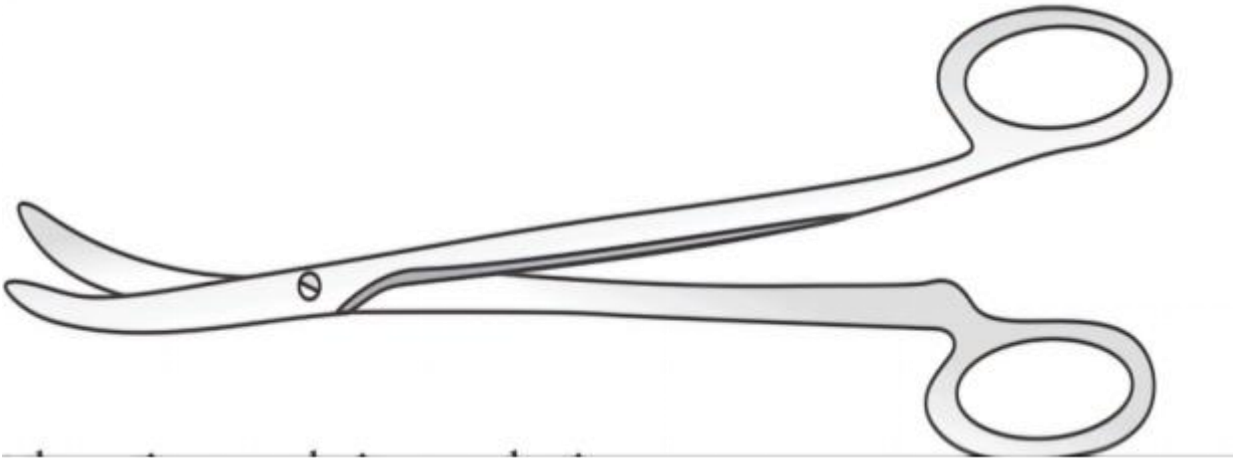
5.7.5.4.6 Artery Forceps It is a blunt forceps which looks like a plane straight scissors. It has multiple straight grooves (at right angle to the limbs) near the tip.

- Uses
  - It is used to hold the skin suture



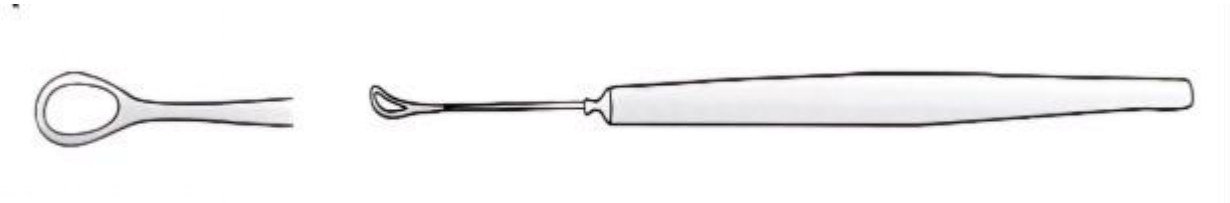
- **5.7.5.4.7Enucleation Scissors**It is a stout strong scissors having curved sharp blades with blunt ends or tips.
- Uses

It is used to cut the optic nerve during enucleation surgery.



- **5.7.5.5 CATARACT SURGERY INSTRUMENTS**
- **5.7.5.5.1 Vectis**
- It is a wire loop attached to a metallic handle.
- Uses
  - It is used to remove the dislocated or subluxated lens.

It was used to help in intracapsular lens extraction which is not being done at present.

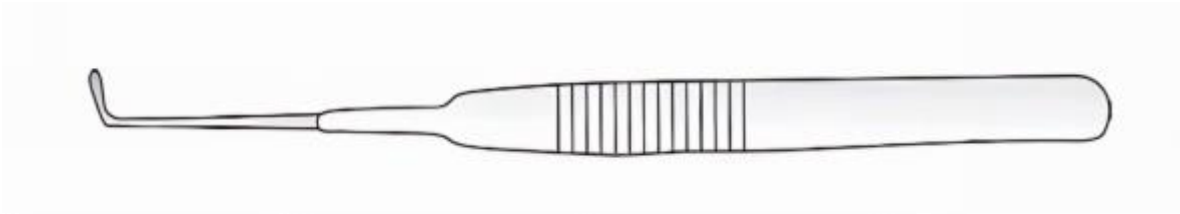


- **5.7.5.5.2 Irrigating Vectis**
- It is a modified vectis with a hollow interior and multiple ports to allow the flow from the leading edge or posterior surface of the vectis. This is attached to an infusion line to assist in hydraulic separation of the nucleus.
- Uses

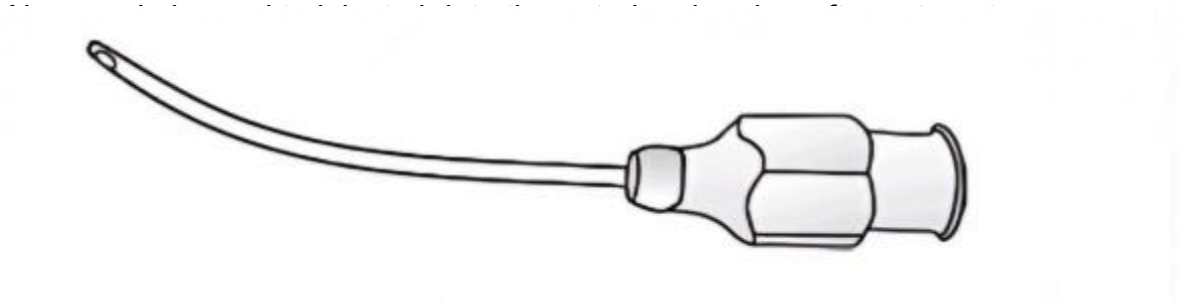
- It facilitates easy nucleus delivery by providing additional hydrostatic pressure to push the nucleus out of the anterior chamber through the surgical iincision.
- 5.
- **5.7.5.5.3 Lens Expressor**
- It is a flat metal handle with rounded curved ends.

- Uses

it was used for intracapsular lens extraction to break the zonule and express the lens,

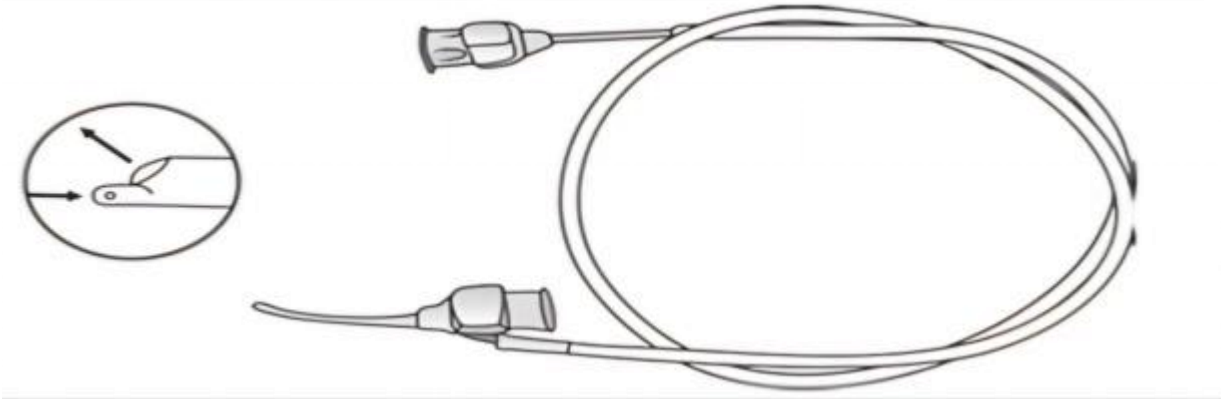


- **5.7.5.5.4 Irrigation Cannula and Air Cannula**It is attached to a syringe with saline or air. The air cannula is thinner than irrigation cannula.
- Uses
  - Irrigation cannula is used in extracapsular lens extraction for irrigating the lens matter present in
  - the anterior chamber.



- **5.7.5.5.5 Suction Irrigation Cannula (Simcoe's Cannula**)It consists of two cannulas and a long rubber tubing
- Uses

It is used for suction and irrigation of lens matter in extracapsular lens extraction.



- **5.7.5.5.6 Sinskey Hook or IOL Dialer**It is a fine but stout instrument with a bent tip. The tip engages the dialing holes of the IOL.
- Uses
  - It is used to dial the PMMA non 'oldable IOL in proper position in the capsular bag or ciliary sulcus.

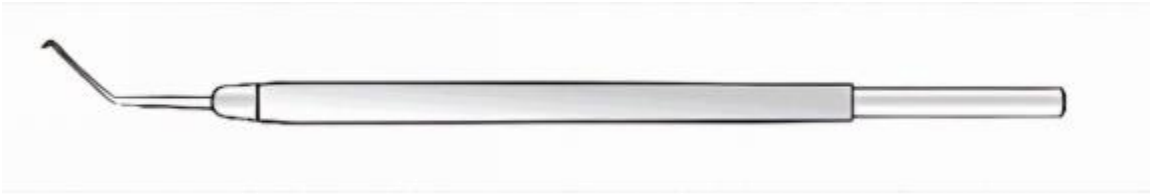
- It can also be used to manipulate nucleus in phacoemulsification and manual SICS by way of nucleus rotation in capsular bag, cracking the nucleus and leading the nuclear fragments into the phaco tip.

a

- **5.7.5.5.7 Chopper**

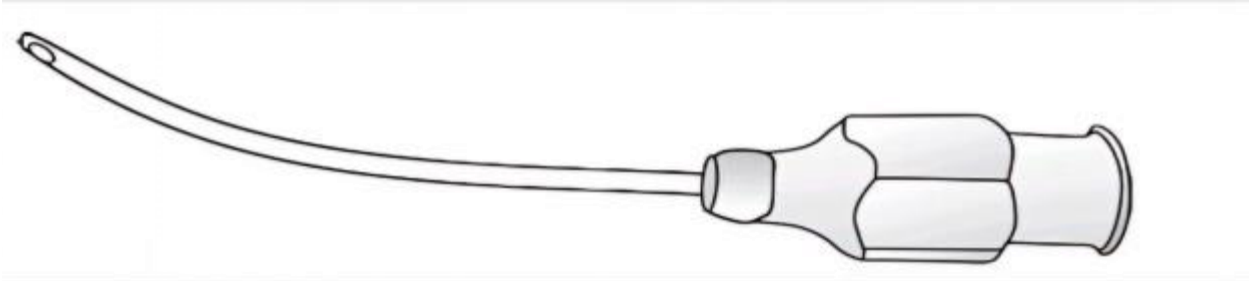
- It's a fine instrument resembling Sinskey hook ing shape. The inner edge of the bent tip is cutting and may have different angles.
- Uses

It is used to split or chop the nucleus into smaller pieces and also for nuclear manipulation in phacoemulsification surgery.



- **5.7.5.5.8 Hydrodissection Cannula**It is a single bore 25 gauge, 27 gauge or 30 gauge cannula with a 45° angulation at about 10-12 mm from the free end. The tip at the free end can be flattened or bevelled. The tip is introduced beneath the anterior capsular margin after capsulorhexis and the fluid is injected to obtain subcapsular dissection.
- Uses

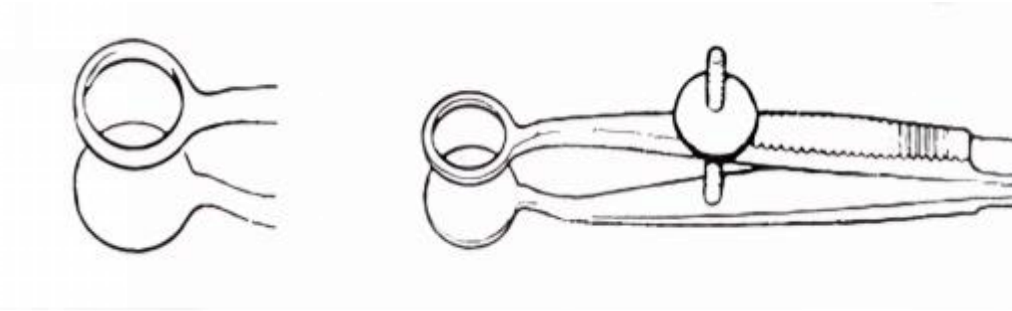
It is used to perform hydrodissection (separation of capsule from the cortex) and hydrodelineation (separation of cortex from the nucleus), in phacoemulsification and manual SICS. It is attached to a syringe carrying irrigating fluid.



5.7.5.6 <u>LID SURGERY INSTRUMENTS</u>

- **5.7.5.6.1 Chalazion Clamp**It is a forceps having a screw in the centre for fixing it tightly. One arm has a round flat disc which is applied on the skin surface. The other arm has a small circular ring which is applied on the conjunctival surface over the chalazion.

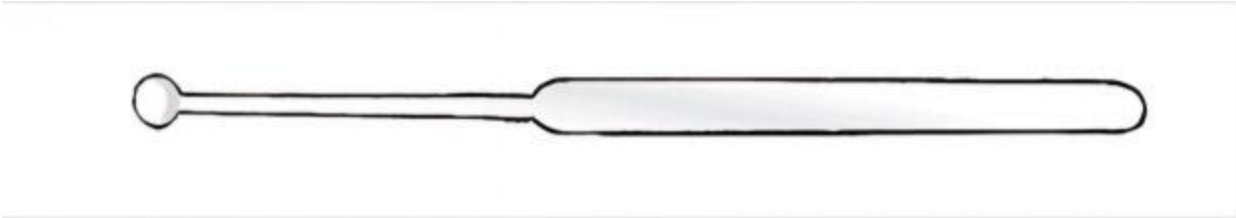
- Uses
- It is used to fix the chalazion during incision and to obtain haemostasis.



5.7.5.6.2 Chalazion Scoop It has a small cup with sharp margins attached to a narrow handle.

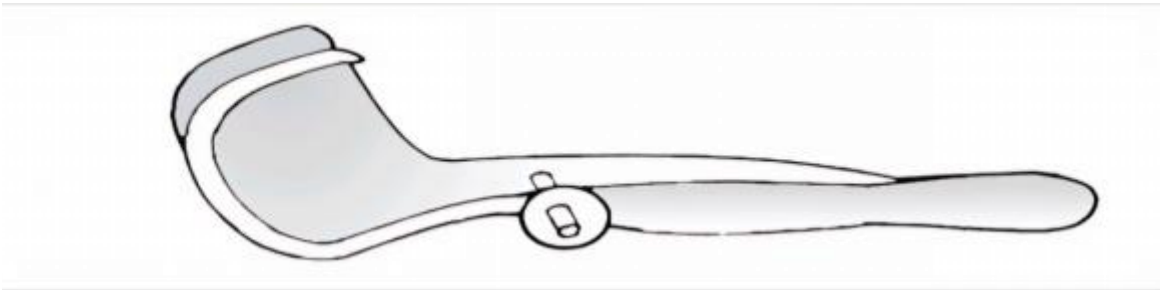
- Uses

It is used to thoroughly scoop out the contents of the chalazion.



- **5.7.5.6.3 Lid Clamp**It consists of a D-shaped plate opposed by arim on the other side. The plate is towards the conjunctival side so it protects the eye during lid surgery on the skin side. 'The screw faces the outer side and the handle is always situated on the temporal side.
- Uses
  - It acts as a hemostat while doing lid surgery.

It protects the underlying eye structures.



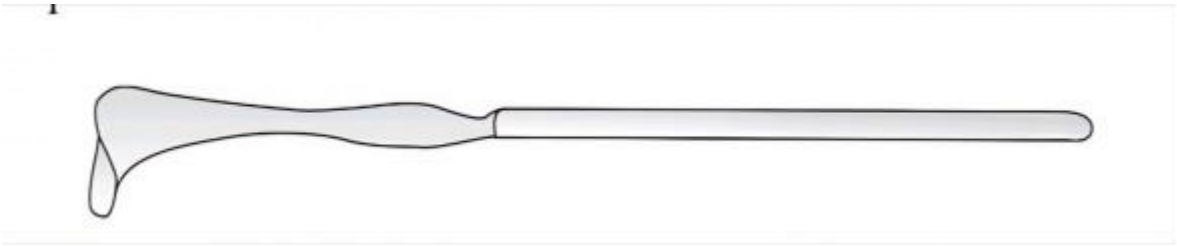
- **5.7.5.6.4 Lid Spatula**It is a plane and simple metal plate having mild convex surfaces on either side.
- Uses

- It is used to support the lid and protect the cornea in

5.7.5.6.5 **Lid Retractor (Desmarres' Retractor**)It is a saddle-shaped instrument folded on itself at one end. It is attached to a metal handle.

- Uses

It is used to examine the eyeball in cases of marked blepharospasm and in children.



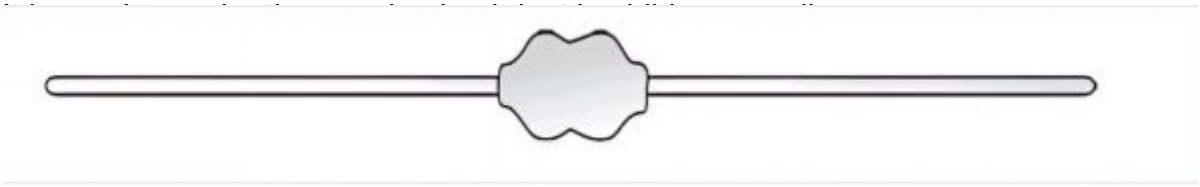
- **5.6.5.7 <u>LACRIMAL SAC SURGERY</u>**

- **5.6.5.7.1 Punctum Dilator (Nettleship's**

- **)**It has a cylindrical metal handle with a conical pointed
- Uses

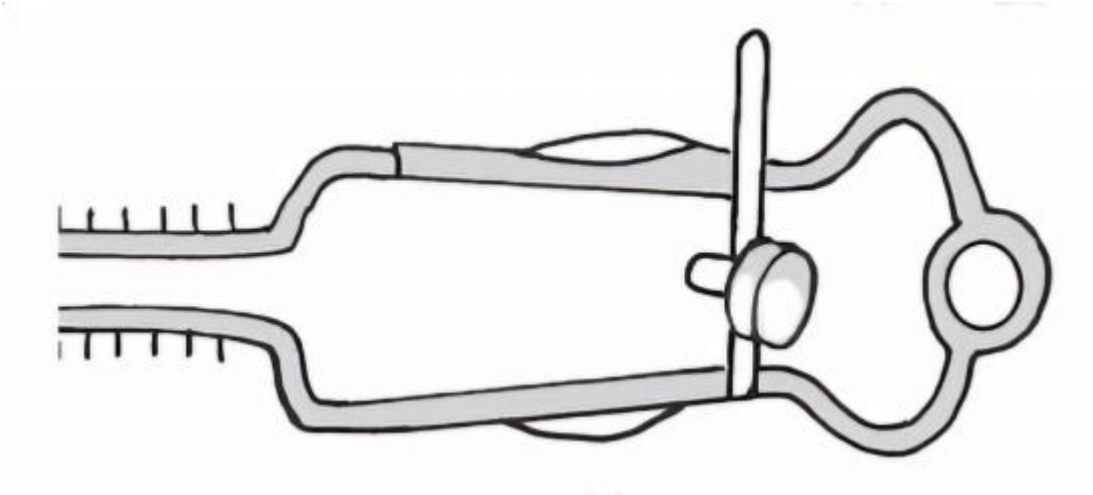
It is used to dilate the lacrimal punctum before syringing or probing.

- **5.6.5.7.2 Lacrimal Probes**
- These are a set of straight metal wires of varying thickness with blunt rounded ends
- Use



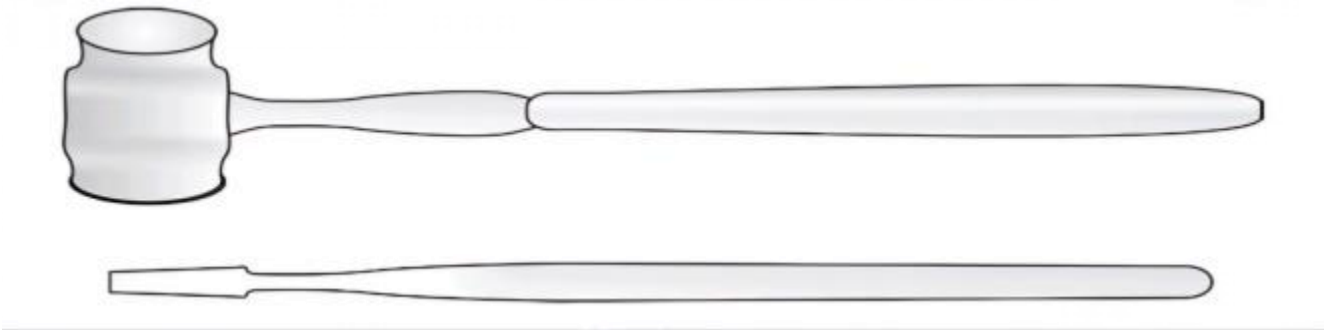
- **5.6.5.7.3 Muller's Skin-Muscle Retractor**It is a self-retaining retractor made up of two limbs with a screw to fix the limbs. Each limb has three curved pins for engaging the edges of skin and muscle.
- Uses
  - It is used during lacrimal sac surgery as a haemostat.

It helps to provide a good field without the help of an assistant.



- **5.6.5.7.4 Chisel and Hammer**Uses

It is used to cut the bone during dacryocystorhinostomy (nasal drainage operation)

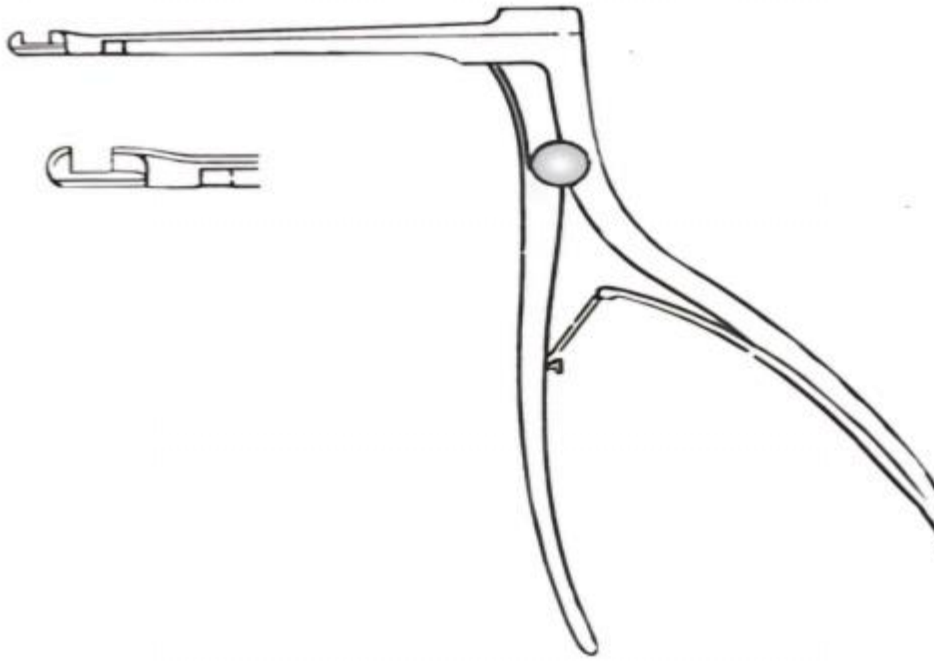


- **5.6.5.7.5 Bone Punch**
- It consists of a spring handle and two blades. The upper blade has a small hole with cutting edges.

- The lower blade has a cup- like depression.
- Uses

it is used to cut the nasal bone during dacryocystorhinostomy.

-



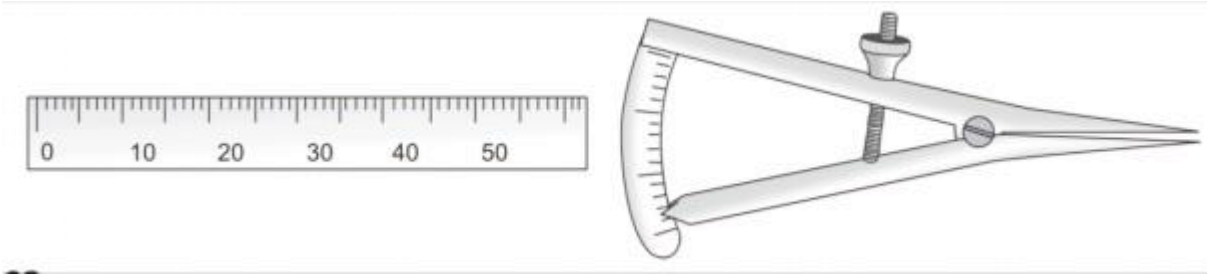
5.6.5.8 SQUINT SURGERY INSTRUMENTS

- **5.6.5.8.1 Muscle Hook or Strabismus Hook**This instrument is like the lens expressor but without the blunt round knob.
- Uses

It is used to engage the muscle during squint surgery, enucleation and retinal detachment surgery

- **5.6.5.8.2Caliper and Rule**It is a divider-like instrument to which a graduated scale is attached to one arm. The other arm can be moved by a screw over the scale.
- Uses
  - It is used to take measurement during squint, ptosis and retinal detachment surgery.

It is also used in localization of the foreign body in X-ray films.

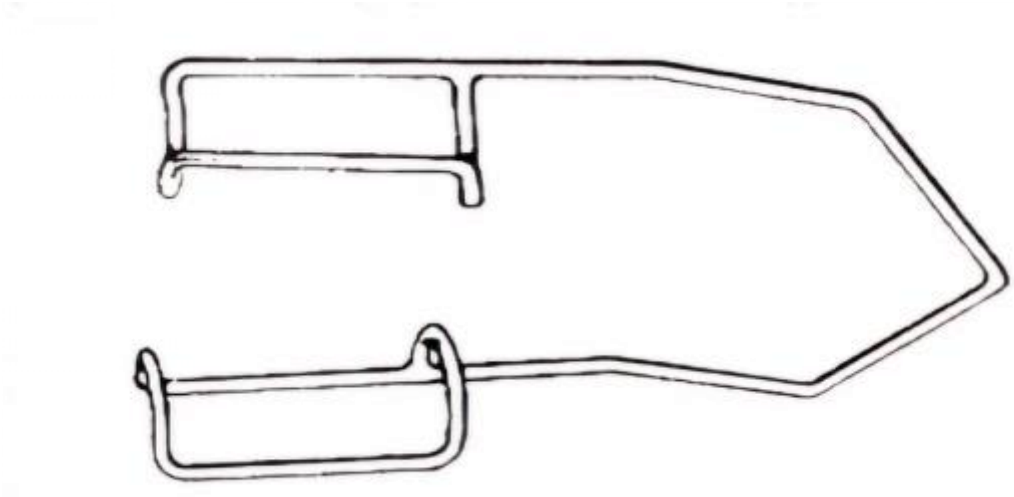


- **5.6.5.8 <u>MISCELLANEOUS</u>**

- **5.6.5.8.1 Wire Speculum**

- It is made up of wire and has two limbs attached at one end.
- Uses
  - It is used to keep the eyelids separate during any operation on the eyeball.

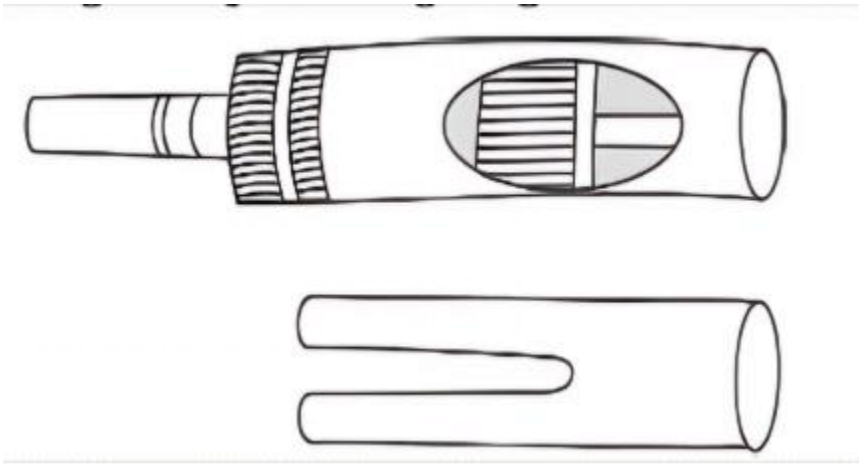
- It protects the underlying eye structures.



5.6.5.8.2 **Trephine**

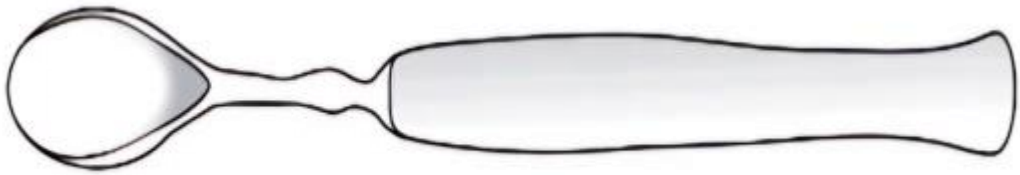
- Trephines are calibrated in various sizes. It has a corrugated metal handle which can be fixed into different sized circular blades having sharp cutting edges.
- Uses

It is used for cutting the corneal disc from the donor's and recipient's cornea in corneal grafting.



- **5.6.5.8.3 Evisceration Scoop**
- It is an oval shallow scoop attached to a thick metallic handle.
- Uses

It is used to scoop out the contents of the eyeball during evisceration.



3.Method of assistantship behavour in operarion theatre

✧ **5.6 Arrangements for the operation**

Following are the duties assigned to ophthalmic assistant or technician.

- It is helpful if the patient is asked beforehand which date is most convenient to schedule the necessary surgery as the patient will be required to take time off from work, school, or homemaking and to make arrangements for someone to fill his or her place in the performance of regular duties.
- prepare the surgical schedule according to the convenience of the surgeon.

- The ophthalmic assistant often may be responsible for obtaining a properly signed consent form. It is important that this be reviewed carefully with the patient and all questions answered.

Three types of operative bookings require special attention,

emergency admission, urgent admission and elective admission.

5.6.1Emergency admission

It is planned in case of trauma and other ocular emergencies.The most common ocular emergencies that require surgical intervention are lacerated globes and eyelids,intraocular foreign bodies, acute glaucoma, and intraocular hemorrhage.

5.6.2Urgent admission

Such a patient requires priority admission because the problem cannot be delayed for an unlimited time. For example, the patient with a retinal detachment is best treated as soon as the detachment is discovered. If, however, the hospital is overcrowded and immediate admission is not possible, the patient should be placed on the urgent list on a day-to-day basis.

Other conditions that may be classified as urgent disorders are chronic glaucoma, orbital tumors, dislocated lenses, uveitis, and temporal arteritis.

5.6.3Elective admission

Slowly progressive diseases and that which donot significantly deteriorate by a delay are admitted on this basis

Examples are strabismus and cataract.

5.7 Operative booking schedule

Knowledge regarding duration of each surgical procedure is necessary.

Infective cases should be put last on list

To save anaesthetist’s time all GA cases should be put together.

Essentials regarding booking schedule are.

• Date of admission

• Type of bed if any required

• Date and time of operation, with type of anesthesia

• Date the patient was notified by telephone

• Date of letter sent requiring confirmation

• Confirmation by the patient

5.8 Consent form

The contents of a proper consent form are

1. Risks of procedure

2. Benefits of procedure

3. Complications

4. Alternative treatments

5. Explanation of procedure

6. Advantages of one procedure over another

7. Significant issues (e.g., bilateral versus sequential)

The patient should carefully review and understand this material. The surgeon should personally review it and permit the patient to ask questions.

SURGERY CONSENT FORM

DO NOT SIGN WITHOUT READING!
I have read, or have had read to me, and understand the following authorization for:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

I authorize Dr.
_____to perform the above
described procedure or treatment.
I have discussed my medical condition, the proposed treatment or procedure,
alternatives to this treatment and the risks associated with them with my physician. I
have been informed that in the performance of any invasive procedure, there is the
potential for damage to my organs, nerves, or blood vessels. There is also the
possibility of an allergic reaction, blood clots, inadvertent puncture, laceration, infection,
consequent hemorrhage, dislodgement or displacement of implanted devices, paralysis,
and very rarely death. I fully understand that it may be

5.9 Preparing child and parent for surgery

Child should be admitted along with mother.if this is not possible then child should be admitted away from adult patients alongwith other admitted children in order to decrease child’s anxiety.

it is important that the child be given some explanation

about the purpose of the visit to the hospital.For preliminary investigations, including a chest x-ray,cbc,ecg and temperature reading,The child should be told that a few simple painless tests will be performed the day before surgery. The

child should be informed by the parent that he or she will go to sleep and, on awakening, will find a bandage over one eye and to not rub eye after surgery.

The parent should be instructed about the time of discharge

and the necessary office visits that may be required

afterwards. A fully informed parent will be a cooperative

parent after surgery.

5.10Preparing an adult for major ocular surgery

For a patient to be in best possible physical and mental health,staff should give patient confidence and coperate with patient.

The patient should be told how to find the admitting department of the hospital and what documents may be required for entry. The patient should leave all valuables

at home.

Alterations in the patient's personal habits may be necessary in the pre- and postoperative periods,like smoking cesation and to stop using aspirin and anticoaagulants 1 week before surgery and post operatively However, patients that are scheduled for routine cataract surgery by phacoemulsification are not required to discontinue these blood thinning medications.

Box 31.3 Guidelines for patients having cataract surgery

- You will be required to have an intraocular lens (IOL) measurement.
- Continue to take all medications prescribed for you.
- Because you will have a topical or local anesthetic, you may eat a light meal.
- Wear a short-sleeved shirt or blouse that buttons in the front with loose-fitting sleeves.
- Do not wear undershirts or long underwear.
- Do not wear pantyhose. Wear socks or knee-highs and loose-fitting pants.
- Do not wear eye makeup or nail polish.
- You must be accompanied by an adult and have transportation home by car or taxi. Please bring a translator if you have difficulty with English.
- You will be asked to arrive early. Your surgery will take approximately 15 to 30 minutes and you will be required to stay for about 30 to 45 minutes after surgery.
- Please start the eyedrops received in your surgical package 1.5 hours before your surgery.
- If you are wearing an eyepatch after surgery, it remains on the eye until the first postoperative visit with the doctor. The drops will start after the patch is removed. Many patients do not have a patch and drops can start on the day of surgery.
- All patients *must* see the doctor for a follow-up visit 1 or 2 days after surgery.

5.11 Maintenance of instruments in operation theatre

Proper care of your surgical instruments will improve their longevity and function. Below are different cleaning, sterilization, and maintenance processes to guide you through your techniques.

.5.11.1 General

Guidelines to extend the life of your surgical instruments:

- Clean and thoroughly dry your instruments as soon as possible after each use, paying special attention to joints, hinges, and anywhere there is metal to metal contact.
- Handle your instruments delicately and with care.
- Use your instruments for their intended purpose.
- Store your instruments with tip protectors, and always place them so that they do not touch each other.

5.11.2 Cleaning

Fine surgical instruments should be cleaned immediately after use. Blood or saline solutions left on instruments for any length of time can quickly start corrosive action. Time, temperature, and agitation play important roles in the cleaning process. Time affects the efficiency of cleaning solutions as most are effective after a certain time period. Higher temperature cleaning solutions result in better cleaning. During manual or ultrasonic cleaning it is helpful to loosen any surgical reminisce. Before any of the below procedures, rinse your instruments under warm running water to remove all blood and tissue. Instruments can be cleaned manually or ultrasonically, but always:

- Use a neutral pH (pH 7) cleaning solution.
- Clean instruments in the open position to ensure a thorough and effective cleaning process.
- Use soft textile or paper cloths, soft plastic brushes made of nylon, or water spray guns.
- Do NOT use steel wool, wire brushes, or scouring pads as these are abrasive to the instruments.

5.11.3 Manual Cleaning

- Make sure all instruments are visibly clean and free from stains, wiping them carefully to remove all blood and tissue matter.
- Rinse instruments thoroughly with distilled water, paying close attention to joints and hinges as these areas can accumulate unwanted material.
- Air dry your instruments completely and use a can of compressed air to blow out any water at the joints and hinges. Then store them only in clean and dry environments.

5.11.4 Ultrasonic Cleaning

Ultrasonic cleaning is the most effective cleaning method. The vibrating sound waves create micron-sized bubbles in the solution that grow with the alternating pressure. When the bubbles reach a particular size, they collapse creating a force that dislodges dirt and particles, even in the smallest of crevices.

- NOT recommended for delicate and micro instruments.
- Follow the manufacturer's guidelines for specific instructions and cleaning cycle times. Instruments should be processed for the full recommended cycle time.
- Place instruments in the open position in the ultrasonic cleaner.
    - Do NOT allow instruments with sharp blades to touch other instruments.
    - Do NOT place dissimilar metals (stainless, copper, chrome plated) in the same cleaning cycle.
    - Make sure all instruments are completely submerged.
- After the ultrasonic cleaning cycle is complete, rinse instruments thoroughly to remove all ultrasonic cleaning solution.
- Dry instruments thoroughly with a clean towel.
- Use a spray lubricant in the hinges to minimize the risk of corrosion and maintain functionality.

5.12 Sterilization

It is important that instruments are free from all traces of organic or other matter prior to sterilization.

5.12.1 Steam Sterilization/Autoclaving

The autoclave process utilizes moist heat (or steam) under pressure for sterilization. The steam used must be from distilled water and free of all impurities.

- Lubricate all instruments that have any metal to metal interaction such as; scissors, rongeurs, needle holders, hemostats, and retractors. Do NOT use WD-40 or other industrial lubricants.
- Instruments may be autoclaved individually or in sets.
    - Individual instruments: Disposable wraps or sterilization pouches are ideal. Make sure the pouch size is sufficient for the instrument to be in an open (unlocked) position.
    - Instrument sets: Open and unlock all instruments. Place the heavier instruments on the bottom of the set when two layers are needed.
- Do NOT lock instruments during autoclaving. This will prevent the steam from reaching and sterilizing the metal to metal surfaces, and heat expansion during autoclaving can cause cracks in the hinge areas.
- Do NOT over load the autoclave chamber as this may hinder steam penetration.
- Place a towel on the bottom of the pan to absorb excess moisture during autoclaving. Make sure the towel has no detergent residue and is pH neutral if immersed in water.
- At the end of the autoclave cycle (before the drying cycle) unlock the autoclave door and open it slightly. Run the dry cycle for the recommended time period by the autoclave manufacturer.

Please note: If the autoclave door is fully opened before the drying cycle, cold air will rush into the chamber, which can cause condensation on the instruments. This will result in water stains on the instruments.

5.12.2 Hot Bead Sterilization

Recommended for speed and convenience when instrument tips or blade sterilization is required. The Hot Bead Sterilizer does not use dangerous gases, flames, or chemicals. Highlights:

- Bench top set up.
- Only 20 seconds of contact required to ensure your instruments are free of pathogens and microbial contaminants.
- Beads reach temperature of 240˚ - 270˚C (464˚ - 518˚F) within 15-20 minutes heating time.

5.12.3Ethylene Oxide (ETO) Sterilization

This method is recommended for instruments that will not tolerate high temperatures or moisture (e.g., catheters, cannulae, etc.). This is a process consisting of 4 primary variables; gas concentration, humidity, temperature and time.

5.13 Storage

Surgical instruments should be properly stored in a clean and dry environment. It is highly recommended to use tip protectors and instrument cases to avoid possible damage to your instruments.

5.14 Oxidation (Rust)

All FST stainless steel surgical instruments are manufactured from medical grade stainless steel under strict European standards. It is very important to properly take care of your instruments to extend their lifespan.

Although stainless steel is corrosive resistant, it can still rust or stain if handled improperly. Under unfavorable conditions instruments may oxidize because stainless steel that is exposed to physical, thermal, or chemical manipulations.

5.Preoperative and post operative care of the ophthalmic patients.

Ophthalmic nursing involves the specialized care and management of patients with eye disorders, providing assistance in diagnostic procedures, surgeries and educating individuals on eye health and post-operative care.

5.15.1 WHO IS AN OPHTHALMIC NURSE?

An ophthalmic nurse is a nursing professional who focuses on assessing and treating patients with a variety of eye diseases and injuries.

With the rapid spread of new kinds of ophthalmic diseases, there is an increase need for more knowledgeable professionals in health care disciplines. One way to address this is through ophthalmic nurses, who can play a crucial part in the sub specialty area of diagnosis and management.

The role of ophthalmic nurses includes:

5.15.2 Ophthalmic surgical assistance: carrying out pre and post management of eye surgeries.

5.15.3 Counseling: ophthalmic nurses are able to counsel and refer patients who are irreversibly blind for rehabilitation.

5.15.4 Eye Health Education: Educating the public and other health workers on primary eye care, including health promotion and prevention of avoidable ophthalmic diseases.

5.15.5 Outreach: Organize and run school health and community outreach programs.

5.16. Manage ocular emergencies

5.16.1 THE NURSE IN THE OUTPATIENT DEPARTMENT

For most of the patients the OPD is basically a portal into hospital or unit and may be the only department they visit. It is therefore important that the nurse working there should be a good advertisement for the whole hospital or unit.

All the patients visiting outpatient department have their visual acuity recorded, this usually being the responsibility of the nurse. Other nursing procedure may include:

Lacrimal sac washout

Epilation of misdirected eye lashes

Removing sutures

Applying eye pads and bandages

Taking conjunctival swabs

Recording blood pressure as hypertension can be associated with retinopathies ,retinal vessels occlusion, the blood pressure will need to be recorded if the patient is to undergo surgery, and for general screening.

Testing urine and/or blood glucose monitoring to ensure that the patient is not diabetic, as diabetes can cause various ophthalmic conditions, and for general screening.

Explain the medications to the patient

conjunctival swab

5.16.2 WARD NURSE

The patients in the ward will require pre-operative and post-operative assessment as most of the patients are admitted for surgery e.g cataract extraction, squint surgery, repair of retinal detachment, drainage surgery for glaucoma.

5.16.3 PRE OPERATIVE CARE

Patients file with a registration number will be made and patient will be given a bed

Blood samples will be taken and sent for investigation.

Patients undergoing general anesthesia surgery will be ensured about NPO.

Instilling mydriatic drops prior to cataract extraction and retinal detachment surgery as the pupil needs to be dilated for better view.

Instilling miotic drops prior to trabeculectomy and keratoplasty

Instilling local anesthetic drops such proparacaine, if the operation is to be performed under a local anesthesia.

5.16.4 POST OPERATIVE CARE

Dressing: eye pads must be placed following surgery

Cleaning the eye /skin wound: eye or skin should be cleaned at least once daily. In case of some oculoplastic procedures, the pad and bandage will remain untouched for prescribed period.

Instillation of drops/ ointment accordingly

Patient must be advised to avoid heavy work for at least 1 week

Patients who underwent surgery under general anesthesia must be observed for 4-6 hrs (vitals ,NPO)

Patient must be advised about eye hygiene.

DISCHARGE

All patients must be given instructions about care and follow up:

Names of drops/ointments and times of instillation /application must be given verbally as well as in written form.

Advise the patient ,if the eye is sticky in the morning s, it should be cleaned with wet cotton wool/ gauze instead of dry as fibers can get into eye causing irritation. Use clean cotton/gauze every time.

Patient must be advised to avoid heavy work that will raise intra ocular pressure such as weight lifting for 1-2 weeks. They should avoid soap getting into eye as it would cause irritation that could result in rubbing.

Patient must be advised to avoid bending (also avoid bending while praying). Patient must also avoid constipation, coughing and sneezing for 2weeks as these can cause increase in pressure leading to broken stitches/open wound.

Patient must wear dark shades to avoid light sensitivity and trauma from any foreign body.

Patient must be advised to avoid rubbing the eye.

Never clean the eye with dirty cloth/towel

Patient can take bath 1 day after surgery but must avoid soap/shampoo getting into the eyes.

Ensure that patient come for follow up after 1 week in OPD.

Some procedures such as vitrectomy may require the patient to ‘posture’ in a certain position to ensure a satisfactory surgical outcome.

In case of any complication immediately come for follow up.

6.Hospital acquired infections and their prevention.
Pathogen Risk and Overview

A. Bloodborne Pathogens (HIV, HBV, HCV)

B. Adenovirus

C. Multi-drug resistant organisms

D. MRSA

III. Basic Infection Prevention Recommendations

A. Employee Health

1. Immunizations

2. Hepatitis B Vaccine

3. Tuberculin Skin Test

4. Employee Illness

5. Pregnant Employees

6. Sharp Injury or Body Fluid Exposure Follow-Up Management

IV. Standard Precautions for Patient Encounters and for Surgical Procedures

A. Hand Hygiene

B. Personal Protective Equipment

C. Respiratory Hygiene/Cough Etiquette

D. Sharps Safety

E. Biomedical Waste Management

F. Single Use Devices

G. Environmental Barriers

H. Supply Storage and Handling

I. Medication, Eye Drops & Solutions Use, Handling & Storage

V. Care of the Environment

A. Toys

B. Patient Care Equipment

C. Computer Equipment

D. Exam/procedure rooms

E. Waiting rooms and bathrooms

F. Laundry

G. Linen-clean storage

VI. Procedure set-up

VII. Instrument Storage and Handling

VIII. Cleaning, Disinfection & Sterilization Procedures (Reprocessing)

Assessment

Question # 1

What is A-Scan Biometry and How it Works? Explain Different Methods to use A-Scan Biometry and Write the Steps to perform A-Scan Biometry?

Question # 2

What is Keratometry and how it works?

How is Keratometry done and What are different types of Keratometer?

Question # 3

What are different Components of Operating Microscope and How to Take care of it?

Question # 4

What is Hot Air Oven and What is its working Principle? What are its advantages and Disadvantages?

Question # 5

What is AUTOCLAVE and What is its Working principle? What are major factors for Effective Sterilization ?

Question # 6

What are different types of Autoclave? Explain different Stages of Sterilization? What are potential hazards associated with Autoclave use and how to protect from them?

Question # 7

What is Phaco Machine and what are its uses?

Question # 8

What are the different Components of Phaco Machine?

Question # 9

What is Surge and how can it be controlled ?

Question # 10

What are different types of Surgical Forceps and explain their uses?

Question # 11

What are different types of Surgical Knives and Explain their uses?

Question # 12

What are different types of Surgical Scissors and Explain their uses?

Question # 13

What are different Instruments used in Cataract Surgery and Explain their Uses?

Question # 14

What are different instruments used in Lacrimal Sac Surgery and explain their uses?

Unit 6 Practical

LIST OF PRACTICALS

6.1. Ocular Surgery

- Preparation of Operation Theatre for common Ocular Surgery
    - CATRACT
    - CHALAZION
    - SYRINGING
    - DACRYOCYSTECTOMY
    - GLAUCOMA
    - EPILATION
    - STRABISMUS
    - Standard Sets

6.2. OPTICS/REFRACTION (Refer to Unti 4)

Practical-I: To diagnose common error of refraction & Management in:-

- MYOPIA
- HYPERMETROPIA
- ASTIGMATISM
- PRESBYOPIA
- ANISOMETROPIA
- EMETROPIA
- COLOURED VISION

Practical-II Retinoscopy

- INDICATION
- APPARATUS
- PROCEDURE
- PRECAUTION

Practical-III: Visual Acuity

- INDICATION
- APPARATUS
- PROCEDURE
- PRECAUTION

Optics

1. To verify the laws of reflection
2. To verify the laws of refraction.
3. To find the position of an image when the position of an object from

specific mirror is given.

4. To find the different position of the image of object from a convex lens.
5. To determine the position of an object from a lens, by adjusting the position of a lens.

6.3.Surgery and OPD

1. O.T. Instruments (Refer to Unit 5)

Speculum
ii. Eorueal Scissors
iii. Needle Holders
iv. Hooks
v. Conjunctival Scissors
vi. Cautry
vii. Knife with blades
viii. Iris Reponters
ix. Stiches 10,80, silk 40
x. SIMCOR Cannula
xi. IOLs
xii. Visco Elasties
xiii. Muscles retractors
xiv. Care of Microscopes & bulbs.

2. **OPD (Refer to unit 4)**

a. Measurement of Vision
b. Snellen's test charts for distant vision and for near vision
c. Color Vision Charts

3. **Glaucoma Tests**

- Field of Vision
- Schiotz Tonometer

4. **Dressing and Bandages**

- How to put drops.
- How to apply eye bandage
- How to care FBs in eye.

PRACTICALS

6.1 Ocular Surgery

The general OT preparation measures are the same as mentioned in the section On Sterilization. Specific details and additional instruments tailerd to each surgical procedures are mentioned below:

6.1.1 CATARACT :

Pre-operative management of cataract patients

• Includes anaesthesia, antiseptic wash and dilating drops.

• The patient should be reminded of the importance of holding still during surgery..

• It is important to monitor the patient's vital signs during surgery.

Post-operative management of cataract patients

• Provide instructions on the post-operative drop regimen (usually consisting of a topical steroid and antibiotic), eye protection (including eye patch and shield), and signs and symptoms to report especially worsening pain and redness.

Implant — IOL

• Make sure the correct IOL is confirmed during Sign-In and Time-Out.

Medications/solutions

Check with the surgeon before administering (note: label all syringes on the surgical table, and always handle and pass the syringe in a safe manner):

• topical dilating drops

• capsular dyes (for example, trypan blue)

• topical antibiotic drops

• topical steroid drops and possible non-steroidal antiinflammatory drops (NSAIDs)

• injectable antibiotic and dexamethasone at the end of the procedure

• viscoelastic or Ophthalmic Viscoelastic Device (OVD)

• balanced salt intraocular irrigating solution (e.g. BSS, lactated Ringers)

• injectable miotic solution (e.g. Miochol/miostat) to constrict the pupil.

Scrub nurse duties

• Participate in the SSS check – including IOL and biometry checks.

• Prep and drape the patient and ensure that a sterile technique is maintained.

• Keeping the cornea surface well lubricated so that the surgeon has a clear view –

• Ensure there is a sterile anterior vitrectomy cutter on standby.

6.1.1.1SICS Technique

Full name: Small Incision Cataract Surgery with Posterior Chamber IOL Implant (SICS + PC IOL) (also known as Manual small incision cataract surgery — MSICS).

Surgical technique

A self-sealing corneoscleral tunnel incision (wound) — is created with either a superior or temporal approach. A separate side-port (paracentesis) incision(s) is often created. The AC is 227inimize227i with viscoelastic. The anterior lens capsule is opened using a bent 25 or 27 gauge needle or capsule forceps by linear, V, canopener capsulotomy or continuous curvilinear capsulorhexis (CCC). The cortex and the nucleus (central portion of the lens) are then

separated by hydrodissection. The nucleus is removed through the tunnel using one of several techniques. The cortical material is then aspirated using the Simcoe cannula and the balanced salt intraocular solution. Simultaneous irrigation and aspiration maintains the AC and protects both PC and the corneal endothelium from damage.

The aspirating tip of the cannula must face uppermost. A Posterior Chamber (PC) IOL is then inserted into the capsular bag with viscoelastic maintaining the AC. The viscoelastic is then removed, and the wound self-seals without sutures. The surgeon may choose to insert one or more sutures. Antibiotics are injected, usually into the AC, but at times subconjunctival and often with steroids. The final stage involves checking for any wound leakage and confirming that the AC is deep with a round pupil and centred IOL. Duration of procedure: 30 minutes

6.1.1.2 ECCE Technique

Full name: Extracapsular Cataract Extraction with Posterior Chamber Intraocular Lens Implant (ECCE + PC IOL).

Surgical technique:

A wide corneal or scleral incision is made. Viscoelastic is injected into the AC. The anterior lens capsule is opened, by using a bent 25 or 27 gauge needle to complete a linear, V-shaped, can-opener capsulotomy or continuous curvilinear capsulorhexis (CCC). The cortex and the nucleus are separated

from each other by hydrodissection. The nucleus is expressed first. The cortical material is then aspirated using the Simcoe cannula. Simultaneous irrigation and aspiration maintain the AC and protect both the PC and the corneal endothelium from damage. The aspirating tip of the cannula must face uppermost. A PC IOL is then inserted into the capsular bag and the wound sutured. Antibiotics are injected and a final inspection is made of the wound, checking for leakage, and of the AC to confirm it is deep with a round pupil.Duration of procedure: 30 minutes.

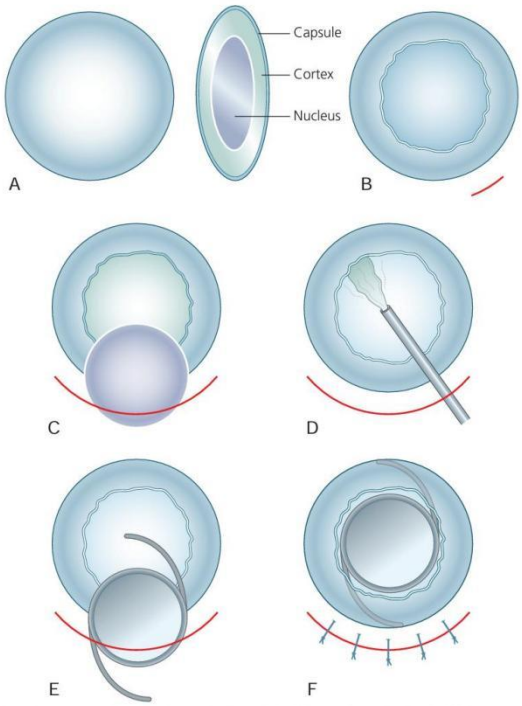


Fig. 32.15 Extracapsular cataract extraction. (A) Cataract. (B) Small incision and capsulorrhexis. (C) Phacoemulsification of lens. (D) Cortex aspiration. (E) Insertion of folded lens. (F) Rotation of lens in capsule.

6.1.1.3 ICCE Technique

Full name: Intracapsular Cataract Extraction (ICCE)

Surgical technique

ICCE refers to the removal of the entire lens, within its capsular bag, by cryoextraction, manual expression or forceps.

Duration of procedure: 30 minutes, but any complication will lengthen the time of surgery.

6.1.1.4 Phaco Technique

Full name: Phacoemulsification

Surgical technique

The term phacoemulsification (‘phaco’) refers to the removal of the lens using ultrasound. A small corneal or corneoscleral incision allows the phaco hand-piece instrument to enter the AC and simultaneously emulsify and remove the lens material from the eye. A phaco machine requires a single use changeable bag/cartridge system. Once the lens has been emulsified and completely removed, the surgeon places a foldable PCIOL into the eye. While this technique is more costly, it is a small sutureless (self-sealing wound) technique which allows for a quicker recovery from surgery.

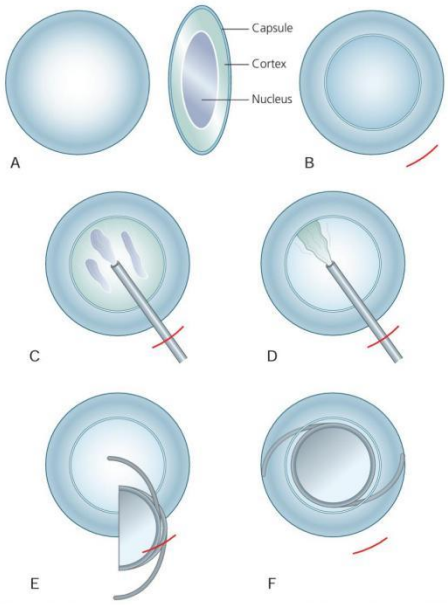


Fig. 32.6 Phacoemulsification. (A) Cataract. (B) Continuous curve capsulotomy. (C) Removal of nucleus. (D) Cortex aspiration and enlargement of incision. (E) Insertion of intraocular lens. (F) Wound closure.

Set-up items specific to PhacoMachines

• **Phaco** — Ensure the phaco machine is properly maintained and the hand-piece has been sterilized. It is important that the entire team are aware of the surgeon's preferences for machine parameters, for each step of the procedure. Often, these parameters can be set for different "modes" or steps in the procedure and profiles can be made for different surgeons using the same machine.

• Bipolar cautery — sometimes used when scleral incisions are made.

Consumables

• Phaco packs – which include the tubing and tips that need to be connected to the machine and the phaco hand-piece. Every machine has a unique pack.

• Phaco tips and sleeves- Each machine has a variety of tips and sleeves to place onto the Phaco hand-piece. The nurse needs to check that the correct ones have been selected for the operating surgeon (i.e. a 45 degree tip, a bevelled tip etc.).

• Foldable PC IOL with injection cartridge and injector/or PC IOL folding and insertion forceps.

• Viscoelastic/Ophthalmic Viscoelastic Device (OVD).

• Balanced salt irrigating solution (e.g. BSS, Lactated Ringers).

• Automated anterior vitrector should be available on standby should a posterior capsular rupture occur.

Instruments

• keratome knife(s) (sometimes a diamond knife)

• Capsulorhexis Forceps

• cystitome 27G pre-curved

• iris retractors

• nucleus rotator and/or Sinskey hook

• phaco chopper instrument

• bi-manual or coaxial irrigation and aspiration system.

6.1.6 Incision and curettage of chalazion

A chalazion is a chronic, sterile, granulomatous inflammatory lesion caused by retained secretion leaking from Meibomian glands. Draining the glands is the only way to provide relief from this condition.

Causes and risk factors

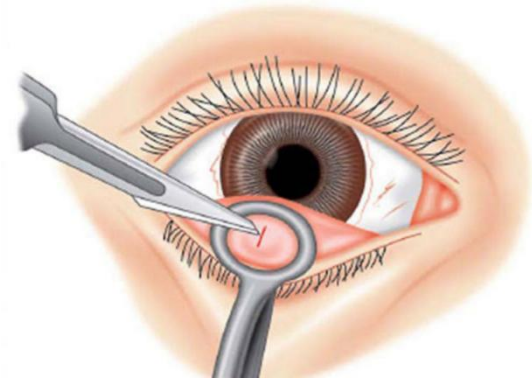
• blepharitis
• dry eyes
• dry/dirty work conditions
• make-up.

Surgical technique

This procedure is considered a minor-procedure.

• Complete SSS check and protect eye
• administer local anaesthetic
• apply chalazion clamp over lesion
• evert eyelid using clamp
• use a No 11 Blade to incise the lesion vertically
• curette the contents of the chalazion and excise the fibrotic sac
• remove clamp
• pad for 2 hours post-op.

Duration of the procedure: 10 minutes



Equipment

• chalazion clamp
• No 11 blade and handle
• curettes of various sizes
• pad/lanolin dressing
• 0.2 toothed forceps and Westcott scissors for the sac.

Nursing considerations

• provide analgesia, if ordered, for pain
• monitor for bleeding, pain and swelling. If padded, alert the surgeon to excess pain and swelling, in case they need to remove the pad and examine prior to discharge
• use aseptic techniques, hand-hygiene and clean gloves at all times

• provide patient education, especially cleanliness, monitoring for bleeding/swelling under the skin and how to administer any topical antibiotics
• provide considered psychological support
• educate patient on the need for good hygiene – especially with regard to removal of make-up from around the eyes.

6.1.3.Syringing/Dacryocystorhinostomy (DCR)

This is a procedure to create a new epithelium lined passage-way for tears to flow into the nasal cavity, via the lacrimal sac, when the nasolacrimal duct does not function. This can be performed
endoscopically in some circumstances.

Indications

• acquired nasolacrimal duct obstruction
• watering due to primary acquired nasolacrimal duct obstruction
• prevention of infection due to lacrimal duct obstruction before intraocular surgeries
• mucocele of lacrimal sac
• chronic dacryocystitis
• discharge and conjunctivitis in older patients due to lacrimal sac obstruction
• incomplete obstruction with significant impairment of tear flow causing annoying epiphora
• congenital nasolacrimal duct obstruction that cannot be cured by probing.

Pre-operative preparation

Lacrimal function will need to be tested. A differential diagnosis of complete nasolacrimal obstruction will need to be concluded via direct syringing, such as a negative sac-washout procedure is one
whereby all the fluid is regurgitated. This process requires a syringe filled with saline that is injected, using a blunt-tipped lacrimal cannula — via the upper and lower eyelid punctae.

Anaesthesia

• general anaesthesia (optional)
• intravenous sedation
• regional anaesthesia
• subcutaneous injection in surgical site
• infratrochlear nerve injection
• peri-infratrochlear nerve injection
• topical proparacaine drops to eye
• topical nasal xylocaine spray/jelly to nose.

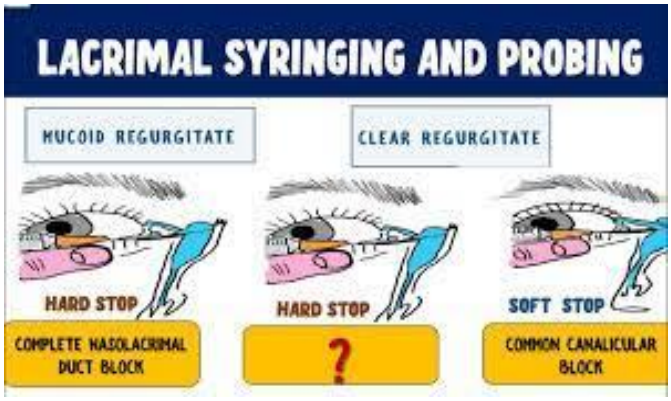
NLD PROBING AND SYRINGING.

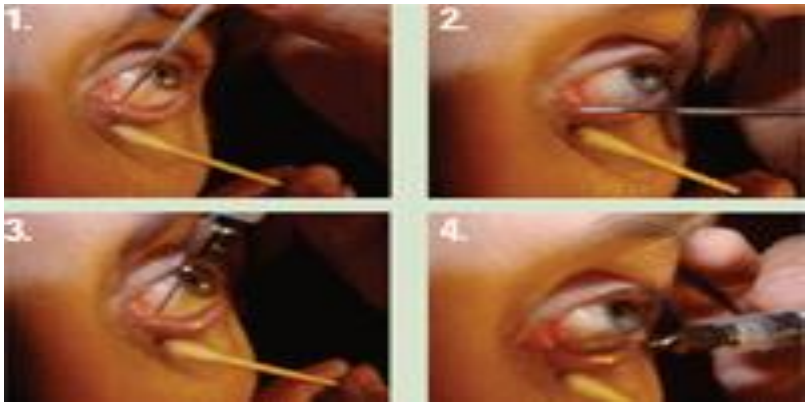
Probing of the nasolacrimal duct is performed through the punctums under general anesthesia. Great care is taken to avoid injury to the walls of the duct as it may cause fibrosis or infection.

Primary treatment of nasolacrimal duct obstruction consists of nasolacrimal duct probing. In this procedure a probe ranging in size from 0.70 to 1.10 mm in diameter is passed through either the upper or lower punctum following

dilation of the punctum. The probe is advance along the canaliculus while exerting gentle lateral traction on the lid until it reaches the nasal bone. Then the probe is rotated 90 degrees and gently introduced into the nasolacrimal duct and advanced into the nose.

A small bolus of saline can be irrigated through the duct. If the infant is awake, the bolus will illicit a swallowing reflex. If the child is anesthetized the saline (colored with 233inimize233in typically) can be aspirated with suction.





Surgical technique

• Nasal packing for decongestion.

• A straight vertical incision is made 10 mm medial to the inner canthus, avoiding the angular vein using a No 15 surgical blade.

• The anterior lacrimal crest is exposed by blunt dissection and the superficial portion of the medial palpebral ligament is identified and divided.

• The periosteum is divided from the spine on the anterior lacrimal crest to the fundus of the sac and reflected forwards using Freer's periosteal elevator.

• The suture line between thick maxilla and thin lacrimal bone is identified. A Freer's elevator is used to gently break the suture line and bone behind it a small bone drill may be used in thick bone).

• The anterior lacrimal crest and the bone from the lacrimal fossa are removed using Kerrison's bone nibbling rongeurs (punch).

• A probe is introduced into the lacrimal sac through the lower canaliculus and the sac is incised in an 'H-shaped' manner to create anterior and posterior sac flaps.

• Similar incision is made in the nasal mucosa to create anterior and posterior nasal flaps.

• Silicone intubation may be performed in selected cases like failed DCR, paediatric DCR, common canalicular obstruction and post traumatic cases.
• The anterior flaps are sutured using 6-0 vicyrl, posterior flaps are resected out. Flaps can be tented up by suturing to periosteum/muscle (anchoring suture).
• Skin incision is closed with interrupted sutures (6-0 Vicryl or Silk or Prolene).
• Nasal packing may be used to 234inimize nasal bleeding.
Duration of the procedure: 20-40 minutes

Equipment

• No 15 Blade and handle
• packing materials
• toothed forceps/Westcott scissors
• periosteal elevator
• bone punch (laminectomy/Kerrison/Rongeurs)
• diathermy/swabs
• sutures to close flaps (5/0 Vicryl) and cutaneous closure
• gauze and cotton tips.

Dacryocystectomy (DCT)

This is a simpler, and minor lacrimal sac surgery in which the entire lacrimal sac is excised along with the nasolacrimal duct.
Indications
• old and debilitated patients
• systemic contraindications for DCR
• lacrimal sac tunerculosis/sarcoidosis
• lacrimal sac malignancies
• rhinosporidiosis of the lacrimal sac
• infection and sequelae of infection.

6.1.4.Glaucoma (Trabeculectomy)

Definition

Glaucoma refers to a series of conditions which consist of increased pressure within the eye (Intraocular pressure or IOP), abnormal visual fields, and optic nerve damage. While an increased IOP is one of the hallmarks of glaucoma, there are cases where IOP is within the theoretical range of normal, but it is still too high to maintain a healthy nerve. Such cases are known as low tension glaucoma. If left untreated, glaucoma can lead to severe visual disability and even complete blindness. Glaucoma is often called the ‘sneak thief of sight’ because it is undetectable in the early stages. Therefore, regular eye examinations can help to manage the condition or prevent it from progressing. Glaucoma, which is also passed on through families can be treated at the clinic level through the
prescription of eye drops to prevent the pressure build up. The general procedure is therefore a Trabeculectomy – meaning removal (ectomy) of a part of the trabecular meshwork, by literally
punching a hole through it.

Pre-operative preparation

• constrict the pupil.

Surgical technique/description

The aim of a Trabeculetomy is to establish aqueous flow from the anterior chamber (AC) to the sub-conjunctival space. This is achieved by making a conjunctival flap (flap) which may be either limbus based or fornix based, depending on the preference of the surgeon. This is followed by a partial thickness, scleral flap, similar to a trap door, and then punching through the trabecular meshwork

with a punch (i.e. a Kelly's Punch). In more specific detail, the technique is:

• Complete Time-Out and prep the patient.

• Make a limbus based or fornix based conjunctival flap.

• Dissect the episcleral and Tenon's membranes to expose bare sclera. Blood vessels are carefully cauterized.

• If needed, antimetabolite (cytotoxics) can be used (i.e. Mitomycin-C at a concentration of 0.4mg per ml or as per the surgeon's request). To use this, place the antimetabolite onto a small sponge(s) and place over a wider area of sclera for 2-3minutes. Remove and thoroughly wash away.

• Raise a half thickness triangular or rectangular scleral flap, and dissect forward about 1mm into the cornea with a No.15 BP blade. The flap is then folded forwards.

• Make a side-port using a 30G needle — to help decompress the eye and help form the chamber at the end of the procedure.

• Make an entry into the AC with a 3.2 Keratome (or size as per the surgeon's requirements).

• Excise a rectangular block of sclera tissue — including the trabecular meshwork, from the posterior cornel lip (of scleral tissue) overlying the surgical limbus, using a Kelly's punch.

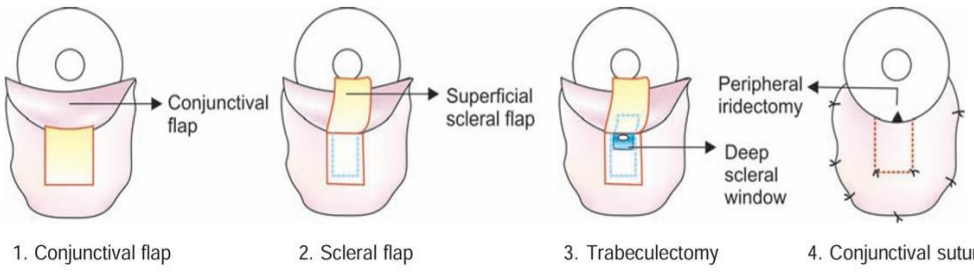
• Hold the peripheral iris tissue with an Iris forceps, and a surgical iridectomy is performed using Vannas scissors — thus allowing free flow of aqueous from the AC to sub—conjunctival space.

• Secure the flap angles with three 10-0 nylon sutures to create a bleb, with one fixed apical and two side sutures.

• Ensure (the nurses) have completed the Sign-Out surgical count, prior to the final wound closure.

• Close the conjunctiva with 8-0 vicryl suture or 10-0. Nylon suture, depending on surgeon preference

• Wound is checked prior to removing drape and arranging dressing.



Post-operatively all patients receive a tapering dose of an antibiotic, steroid and a homide twice daily for one week (or as per surgeon preference). All anti-glaucoma medications are stopped after

Trabeculetomy and patients are reviewed at 2 weeks, 4 weeks and 8 weeks, with close monitoring of their IOP. By digital massage, loose sutures are also removed and/or bleb needling occurs until

an adequate IOP control is achieved. Duration of procedure: 35 minutes (plus additional time if valves

are used).

Valves

While not universal – possibly due to resource limitations, a valve system can be used to assist patients who do not benefit from a traditional Trabeculetomy. The valve is a manufactured device

which contains a drainage tube and a one-way valve system. It is implanted into the eye to allow the fluid to drain-out (but not to allow anything else to go into the eye). It is sutured into place. There are a variety of devices available, both for children and adults.

Nursing considerations

• Depending on the procedure and access to resources, the valve can be surgically covered over with a small scleral tissue patch or manufactured patch.

• The valve, manufactured patch and/or scleral tissue patch, needs to be checked during Sign-Out and Time-Out, and documented/logged as an implant in nursing and surgeon notes. Additional care of the scleral tissue is also needed

6.1.5.Strabismus (squint) surgery

Definition: Misalignment of the eyes. This may be of one eye or both (unilateral/bilateral). This procedure is mostly performed on children but from time-to-time adults may elect to undergo

alignment surgery. The surgery is conducted to try and align the eyes so that they are straight and moving together. The goal is to realign the eyes and improve binocularity. This is done by the surgical manipulation of the muscles around the eye. Which muscles the surgeon chooses to weaken, strengthen, etc. depends on the severity and type of the misalignment. Therefore, the nursing teams need to be aware of each patient's needs. This will help the nurse to determine what they need, i.e. how many sutures they will need.

Instruments

• lid speculum

• handheld high-temperature cautery

• muscle hooks (Steven's, Jameson, Greene hooks)

• muscle clamp/straight haemostat

• 6-0 Double-armed Vicryl suture on spatulated needle (e.g. S-14, helpful if the suture is dyed)

• 8-0 Vicryl suture (e.g. Ethicon TG140-8)

• Westcott scissors

• needle drivers
• toothed forceps x 2
• tying forceps x 2
• Moody-locking forceps x 2
• sterile cotton tipped applicators
• calipers or a Scott measuring device with millimetre markings
• phenylephrine 2.5 % eye drops.

6.1.6 Electrolysis/Epilation

Indications :

Trichiasis, distichiasis, entropion etc

Anesthesia:

Same as that for other eyelid procedures, inj.lignocaine + bupivacaine close to the lid margins

Technique :

Bipolar cautery is used to electrolyse the hair follicles after local anesthesia, the dislodged lashes are then simply removed from the field with a plain forceps.

Instruments :

Bipolar Cautery
Plain Forceps/Tooth Forceps

6.1.7 STANDARD INSTRUMENT SETS

6.1.7.1 Intracapsular Cataract Extraction (ICCE) set

• wire speculum, Barraquer
• squint hook, Graefe
• cautery ball, Wordsworth, electric cautery or glass rods
• blade handle Nº 3 Bard Parker, Nº 15 blade vectis loop, Snellen
• iris repositor, Nettleship
• forceps: Landolts, superior rectus, Hoskins, grooved with tying platform forceps, Moorfields, toothed, Moorfields, nontoothed, cilia, suture tying, Arruga, non-toothed, Mosquito,
curved and straight, Westcotts, conjunctival, universal, corneal, Barraquer, angled on flat, right and left cutting, De Wecker, iridectomy, Vannas or iridectomy
• needle holder, i.e. Silcock, Castroviejo, towel clip, cross action
• cannula, i.e. Rycroft 30 gauge, Southampton or Lang.
• syringes, i.e. 2 ml, 5 ml, 10 ml
• sutures - superior rectus, 5/0 cutting silk, 9/0 spatulated nylon
• other: needles, swabs, dressing and injection drugs.
• +/- cryoprobe.
Additional items (standby)
For ICCE with AC IOL implantation, add: Cannula, Simcoe - with silicone tubing, lens introducing, non-toothed forceps.

6.1.7.2 Extracapsular Cataract Extraction (ECCE) and Small Incision

6.1.7.2 1 Cataract Surgery (SICS) Set

• wire speculum, Barraquer

• squint hook, Graefe
• cautery ball, Wordsworth, electrical cautery, or glass rods
• blade handle Nº 3, Bard Parker and Nº 15 blade
• blade handle, i.e. Troutman and Razor fragment, or blade, slit knife, disposable blade, keratome
• vectis Loop, Snellen
• iris repositor, Nettleship
• forceps, Landolts, superior rectus, Hoskins, grooved, with tying platform or forceps, Calibri, grooved, with tying platform, Moorfields, toothed, Moorfields, non-toothed, cilia, suture tying, Birks, suture tying, Mosquito, curved and straight, Utrata, capsulorhexis.
• scissors, i.e. Westcott, conjunctival, Barraquer's, angled on flat, De Wecker, iridectomy, Vannas,
capsulotomy
• needle holder, i.e. Silcock, Castroviejo, towel clip, cross action
• cannula, i.e. Rycroft 30 gauge, anterior chamber, 23 gauges
• simcoe, irrigating and aspirating, with silicone tubing.
• syringes, i.e. 2 ml, 5 ml, 10 ml
• sutures - superior rectus, 5/0 cutting silk, 9/0 spatulated
nylon
• irrigating solution: Ringer's Lactate, or Balanced Salt Solution
• other: needles, swabs, dressing and injection drugs.

Additional items (standby)

For ECCE with PC IOL implantation, add: lens introducing, nontoothed forceps, callipers, measuring hook, Sinskey dialler cannula, posterior capsule polisher viscoelastic gel.

6.1.7.2.2 Phacoemulsification set

For Phacoemulsification, adapt an ECCE/SICS tray with the addition of:
• guarded speculum
• capsulorhexis forceps
• phacoemulsification machine
• phaco hand piece, tip and accessory pack speculum
• keratome and/or diamond knife
• cystotome 27G
• y-nucleus rotator or iris retractor
• lens manipulator
• chopper
• spatula
• fine iris forceps
• bi-manual/irrigation and aspiration system
• IOL folding forceps or insertion injectors.

6.1.7.3 Trabeculectomy set

• wire speculum, Barraquer
• squint hook, Graefe
• cautery ball, Wordsworth, electric cautery
• blade handle Nº 3, Bard Parker and Nº15 blade Troutman and razor fragment or blade, slit knife, disposable, Tookes
• vectis loop, Snellen
• Kelly's Punch
• iris repositor, Nettleship
• forceps, i.e. Landolts, superior rectus, Hoskins, grooved with tying platform or forceps, Calibri with tying platform, Moorfields, toothed, Moorfields, non-toothed, cilia, suture tying, Mosquito, curved and straight, Westcott, conjunctival
• scissors, i.e. De Wecker, iridectomy, Vannas, iridectomy, micro Westcott, iris, sharp pointed
• needle holders, Silcock, Castroviejo, towel clip, cross action
• cannula, Rycroft 30 gauge, anterior chamber, 23 gauge
• syringes, i.e. 2 ml, 5 ml, 10 ml
• sutures, i.e. superior rectus, 5/0 cutting silk, 9/0 spatulated nylon, 7/0 spatulated vicryl (optional)
• other: needles, swabs, dressing and injection drugs
• +/- cytotoxics.

6.3.1 TYPES OF CAUTERIES

Electrosurgical units

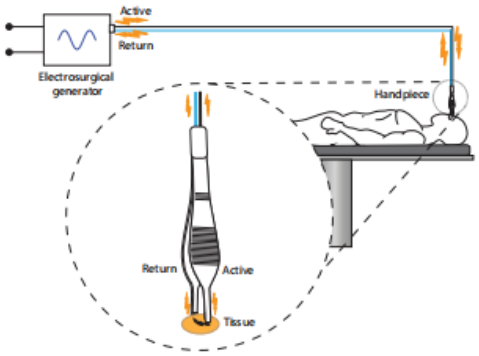
Electrosurgery is used routinely in eye surgery to cut, coagulate, dissect, fulgurate, ablate, and shrink tissue. High frequency (100 kilohertz to 5 megahertz) - alternating electric current at various voltages (200 to 10,000 Volts) is passed through tissue to generate heat. An electrosurgical unit (ESU) consists of a generator and a handpiece with one or more electrodes. The device is controlled using a switch on the handpiece or a foot switch. Electrosurgical generators can produce a variety of electrical waveforms. As these waveforms change, so do the corresponding tissue effects.

By using a constant waveform the surgeon is able to vaporise or cut tissue. This waveform produces heat very rapidly. Using an intermittent waveform causes the generator to modify the waveform so that the duty cycle ("on" time) is reduced. This interrupted waveform will produce less heat. Instead of tissue vaporisation, a coagulum is produced. A "blended current" is a modification of the duty cycle. When going from Blend 1 to Blend 3 the duty cycle is progressively reduced. A lower duty cycle produces less heat. Consequently, Blend 1 is able to vaporise tissue with minimal haemostasis whereas Blend 3 is less effective at cutting but has maximum haemostasis.

BIPOLAR

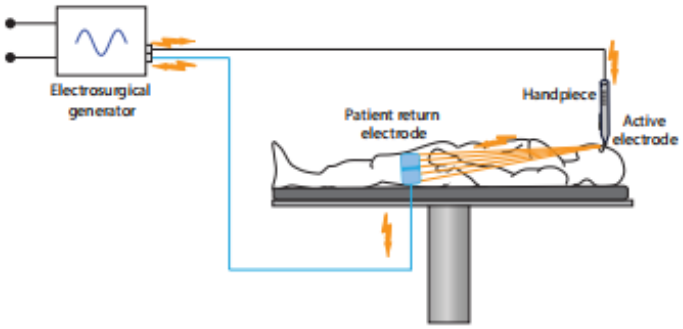
In bipolar electrosurgery(Cautery), both the active electrode and return electrode functions are performed at the site of surgery. The two tips of the

forceps perform the active and return electrode functions. Only the tissue grasped is included in the electrical circuit. Because the return function is performed by one tip of the forceps, no patient return electrode is needed. Bipolar electrosurgery operates regardless of the medium in which it is used, permitting coagulation in a fluid environment. This is a great advantage when attempting to coagulate in a wet field. As a result, **bipolar electrosurgery is often referred to as "wet field" cautery.**



MONOPOLAR

In monopolar electrosurgery), the active electrode is in the surgical site. The patient return electrode is somewhere else on the patient's body. The current passes through the patient as it completes the circuit from the active electrode to patient as it completes the circuit from the active electrode to the patient return electrode. The function of the patient return electrode is to safely remove the
current from the patient. A return electrode burn will occur if the heat produced, over time, is not safely dissipated by the size or conductivity of the patient return electrode.



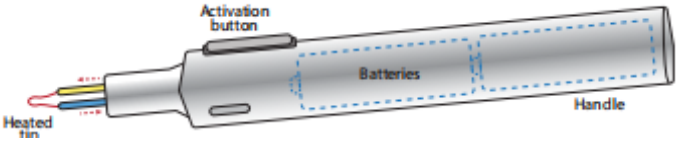
Modern electrosurgical machines have one or both of the following built in safety features to prevent burns from occurring (due to poor contact between the patient and the return electrode) when using
the monopolar mode:

- **Return Electrode Monitor (REM)** – A circuit that measures the impedance of the return electrode. If the impedance is greater than 30 ohms, an alarm will activate and the ESU will not operate. A REM monitor uses a special type of return electrode, which has two separated surface areas.

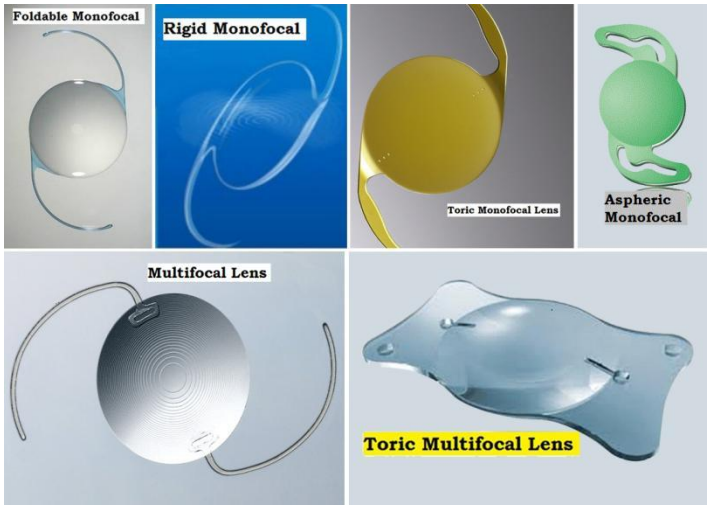
• **Return Fault Monitor** – A circuit that measures the current leaving and returning from and to the ESU. If all the current leaving does not return, the alarm activates and the ESU will not operate.

ELECTROSURGERY VS. ELECTROCAUTERY

Often the term “electrocautery” is incorrectly used to describe electrosurgery. Electrocautery refers to direct current (electrons flowing in one direction) whereas electrosurgery uses alternating
current. In electrosurgery, the patient is included in the circuit and current enters the patient’s body. During electrocautery, the current does not enter the patient’s body. Instead, in the current
flows through a heating element, which burns the tissue by direct transfer of heat. Electrocautery or, more precisely, thermocautery units) are usually portable battery powered devices that can be either disposable or reusable.



6.3.2 TYPES OF INTRAOCULAR LENSES



Scleral Fixation IOL AC IOL

6.3.3 DIFFERENT SUTURE MATERIALS AND NEEDLES

Brand Name	Aurosilk	Aurolon	Aurobond	Aurolene	Polycryl
Sutue Material	**Silk**	**Nylon**	**Polyester**	**Polypropylene**	**Polyglycolic Acid**
					
Available Sizes	8-0, 6-0, 4-0	10-0, 9-0, 8-0	4-0,5-0	10-0,9-0	10-0,8-0,7-0,6-0
Applications in Ophthalmic Industry	8-0 - Cataract Surgery - ECCE, SICS(If Reqd) 6-0 -Orbit & Oculoplasty 4- 0 - Orbit & Oculoplasty (Taper Point Needle) Rectus retraction in SICS (Conventional cutting)	Cataract Surgeries - ECCE, SICS (If req) Corneal transplant Surgery Keratoplasty	Scleral buckling surgery	Scleral Fixation surgery	10-0 ECCI, SICS (if reqd) Preferrably for pediatric cataract surgery; 8-0 Glaucoma Surgery, Orbit & Oculoplasty; 7-0 Retinal surgery, Glaucoma, Orbit & Oculoplasty, 6-0 Corneal, Pterigium, Orbit & Oculoplasty,
Model Nos.	8-0 - 8481S, 8482S, 8481VS, 8482VS, 8482VSB	10-0 - 6401N, 6402N,6601N, 6602N,8401N, 8402N, N0204	5-0 - E5101, E5102, 4-0 -E4101	10-0 - 6002PP,60602PP 9-0 - 6092PP, 60692PP	6-0 -A6108 ;7-0 - A7102; 8-0 -A8104; 10-0 - A0101
	6-0 - B6105, B6106 4-0 - B4401, B4203	9-0 - 6491N, 6492N, 6692N, 8491N, 8492N 8- 0 - 8481N, 8482N			
Packaging	Pack of 12 foils per box	Pack of 12 foils per box	Pack of 12 foils per box	Pack of 12 foils per box	Pack of 12 foils per box
Carton Box					
Suture Needle (Medical graded stainless steel)	Spatulated Needle	Taper point Needle	Conventional cutting needle	Reverse cutting needle	
			 	 	

6.3.3 VISCOELASTICS (OVDS)

Viscoelastics, also referred to as OVDs (ophthalmic visco-surgical devices), are viscous substances that allow us to make phacoemulsification easier and safer.

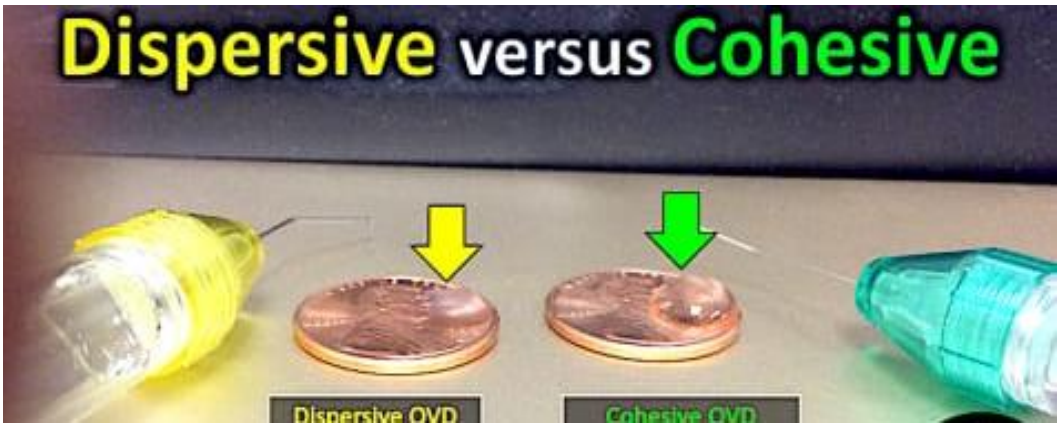
While there are many viscoelastics available on the market, there are two main classes: dispersive and cohesive.

CLASSIFICATION

There are two main classes of viscoelastics, dispersive and cohesive, and they behave differently. There are also combination OVDs and visco-adaptive OVDs, but their use is not as common for routine cataract cases.

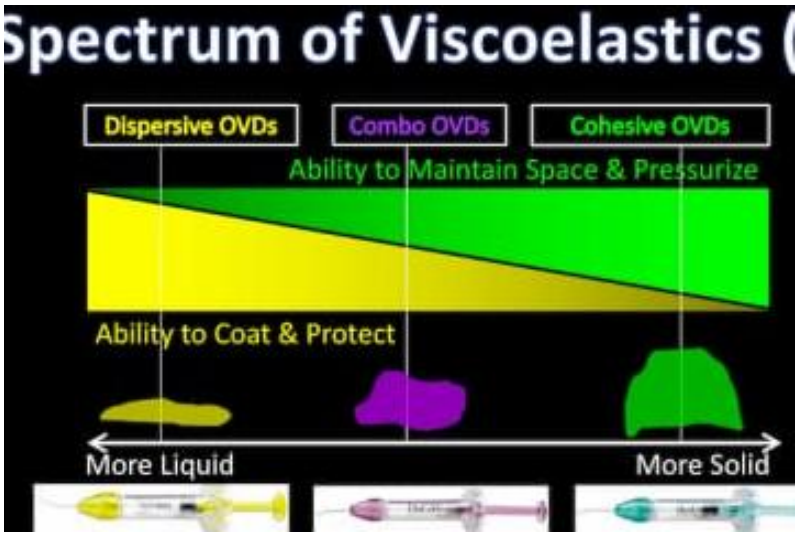
Dispersive OVDs have the consistency of honey, syrup, or molasses, and they are able to flow like thick liquids. This gives dispersive OVDs the ability to coat ocular structures well, and this coating is not easily washed away by the flow of balanced salt solution during surgery. This coating of dispersive OVD is helpful to **protect the corneal endothelium** from the ultrasonic waves during surgery. Since it is more liquid than solid, it is also a good choice for lubricating the lens injector cartridge. The downside to a dispersive OVD is that it is not as good at maintaining a space within the eye and it is more difficult to remove at the end of the case. Examples of dispersive OVDs include: VisCoat (Alcon), EndoCoat (AMO/J&J), and OcuCoat (B&L) — note that these **all have the word "Coat" in the name** since dispersive viscoelastics coat the eye like honey.

Cohesive OVDs are more solid than liquid, and they have the consistency of gelatin, which means that they cannot coat or flow as well. However, because they are much thicker, they are able to maintain space and pressurize the eye quite well. This is useful **to keep the anterior chamber formed**, to keep the anterior capsule flat during capsulorrhexis creation, to move and manipulate iris or other tissues and **to keep the empty capsular bag open for IOL insertion.** These agents are easier to remove from the eye at the end of surgery because the entire bolus of OVD is cohesive and once part of it is pulled from the eye via the suction tip, the rest tends to follow. Examples of cohesive OVDs include: Pro**Visc** (Alcon), Healon / Healon GV (AMO/J&J), and AmVisc (B&L)



Dispersive is like honey - it coats because it is more liquid.

Cohesive is like gelatin-holds space because it is more solid.



6.3.4 CARING FOR THE OPERATING MICROSCOPE

It is essential that all facilities develop protocols for performing microscope checks. Microscope optics should be inspected and cleaned on a weekly basis, or earlier if dirty. The entire microscope should be checked by a biomedical equipment technician at least once every six months.

• Keep the microscope in a dry, cool and well-ventilated place to prevent fungus growth on the optics (lenses).

• Every week, clean the optics according to the optical cleaning instructions.

• Fungus and mould growth are a particular and difficult problem with microscopes, and are mainly related to above average humidity. The risk varies greatly, but the effect of fungus and mould growth on lenses and prisms can cause irreversible damage. Fungicidal pellets are available from several microscope suppliers. A good supply is advised although they last several years. Some microscopes are manufactured with fungicidal pellets already in place. This is indicated on the supplier’s instructions.

• Microscopes and loupes are protected from fungi and mould if the following environment can be assured:

• DRY, LOW HUMIDITY

• LOW TEMPERATURE

• GOOD VENTILATION

• LENS SURFACES FREE OF DEBRIS

• CLEANED APPROPRIATELY

• WEEKLY EXPOSURE TO SUNLIGHT.

• Protect it from dust when not in use with a dust cover. Vinyl coverings are preferred because they do not shed lint (like cloth covers do). However, their use should be avoided in humid environments since they can trap moisture, which increases the risk of fungal growth.

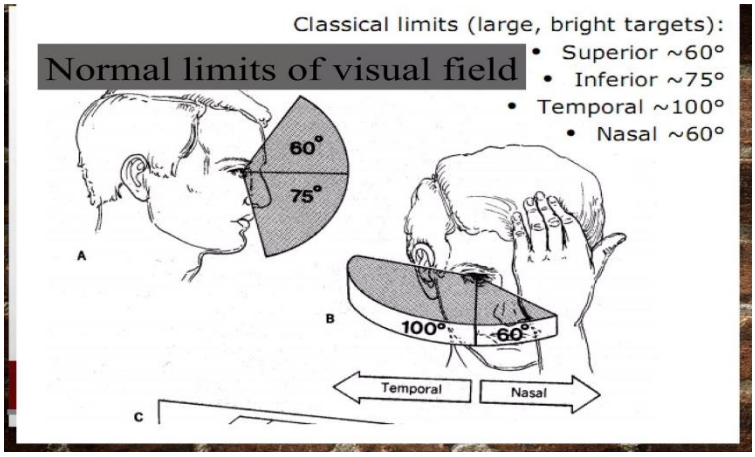
• Wipe down the external surfaces with a damp cloth soaked in hot, soapy water.
• Cover the foot pedal with a clear plastic bag to prevent surgical and cleaning fluids from entering and damaging the electronics.
• Lift the foot pedal off the floor when washing the floor.
• Use a voltage stabiliser with the microscope. This will prevent sudden increases in voltage from destroying the bulbs and will ensure that the illumination provided remains constant.
• Before using, test the controls of the foot pedal (the x, y movement, zoom, and focus, light on and off).
• Before using, check that the suspension arm can be fixed into position to ensure that it does not fall on the patient.
• Avoid kinking or bending the fibre optic cables.
• When replacing the bulbs, avoid touching them with fingers. This is because oil from fingerprints can be left on the bulb and shorten its life.
• Do not move the microscope while the bulb is still hot because strong vibrations may damage the filament.
• Every six months, clean and oil the wheels and the brakes. Remove any surplus oil when done.
• Rubber control handle covers, which can be sterilized, are available from several microscope manufacturers. Alternatively, they can be made out of cloth

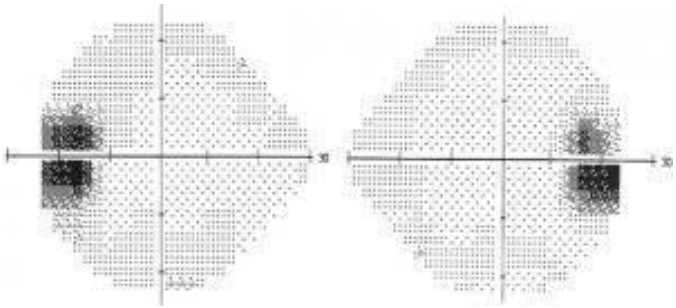
6.5 GLAUCOMA TESTS

6.5.1 Field of vision

The normal visual field is described as **island of vision surrounded by sea of blindness.**

Normal visual field;	**right eye field**	
Upward;60^		60
Inward;60^		
Downward;70^		
Outward;90^	>90	60
00		
	70	





Point of fixation;

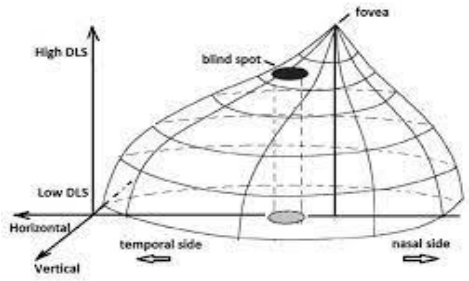
It is area of maximum visual acuity in normal visual field. It corresponds to foveola of retina.

Blind spot;

This is an area of absolute scotoma (non-seeing area) within the boundaries of normal visual field. It is located 15^ temporal to fixation point.

Scotoma;

It is area of depressed visual field (non-seeing) area surrounded by normal normal vision. It is commonly seen in glaucoma, optic neuritis.



6.5.1.1 Perimetry;

It is used to describe various techniques employed to evaluate both central and peripheral visual field using targets of various sizes and colors.

Two types of techniques are used;

6.5.1.1.1 Kinetic perimetry;

In this target is moved across the field to draw the two-dimensional extent of field.in this moving stimulus of known intensity is moved from periphery to center till is perceived by the patient. The point of perception is recorded in

different meridian. These points are joint to plot a field. Following are methods by which kinetic perimetry is done.

1.confrontation method

2.goldmann perimeter

Confrontation method;

It is rough but useful method. It can be done on bedside of patient or in clinic.in this patient field of vision is measured with comparison of examiner' s field of vision.

Method; Examiner stands facing patient at the distance of about 60cm.

Patient covers his one eye (right) and examiner his one eye(left). The examiner moves his hand from periphery towards center, keeping his hand in plane midway between patient and himself. Patient is instructed to tell examiner when he started to see target and tell no. of fingers. All four quadrants are being tested. Same procedure is being repeated with the other eye.

Goldmann perimeter;

It consists of half sphere within which a spot of light can be moved.

Method;

The patient is seated with his chin supported on chin rest.one eye is covered by pad. The eye is fixed on object placed on Centre of arc. The field is recorded fist with a white object 5mm in diameter from periphery to Centre.

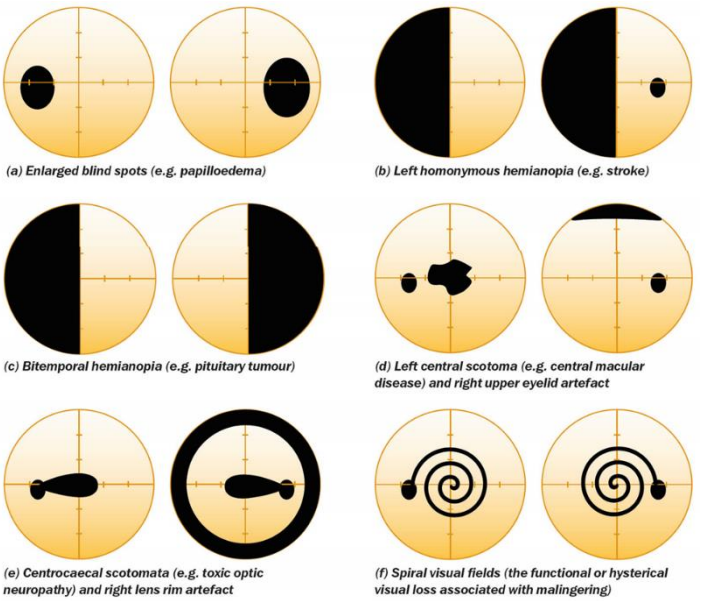
6.5.1.1.2Static perimetry;

It is three-dimensional assessment of height of predetermined area of ‘’hill of vision’’. In this non-moving stimulus of varying intensity are presented in same position to get vertical boundary of visual field.

Uses;

Charting of visual field is used to monitor and progression of following diseases;

1. Glaucoma
2. Retinal diseases i.e., Retinitis pigmentosa
3. Follow up of laser therapy for diabetic retinopathy
4. Neurological disorders, e.g., brain tumors, head injury, multiple sclerosis.



(a) Enlarged blind spots (e.g. papilloedema)

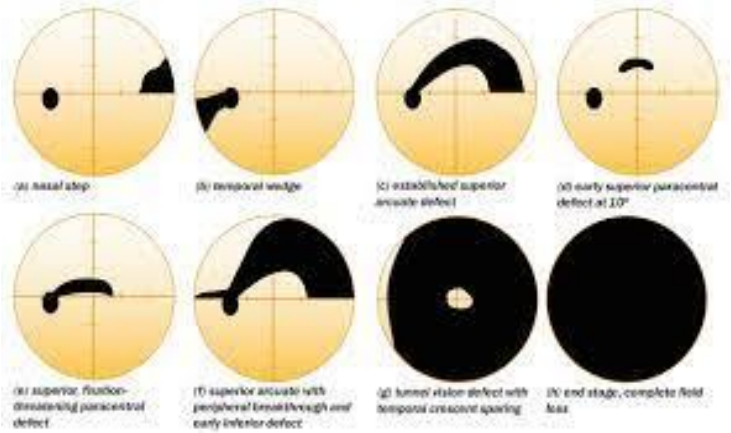
(b) Left homonymous hemianopia (e.g. stroke)

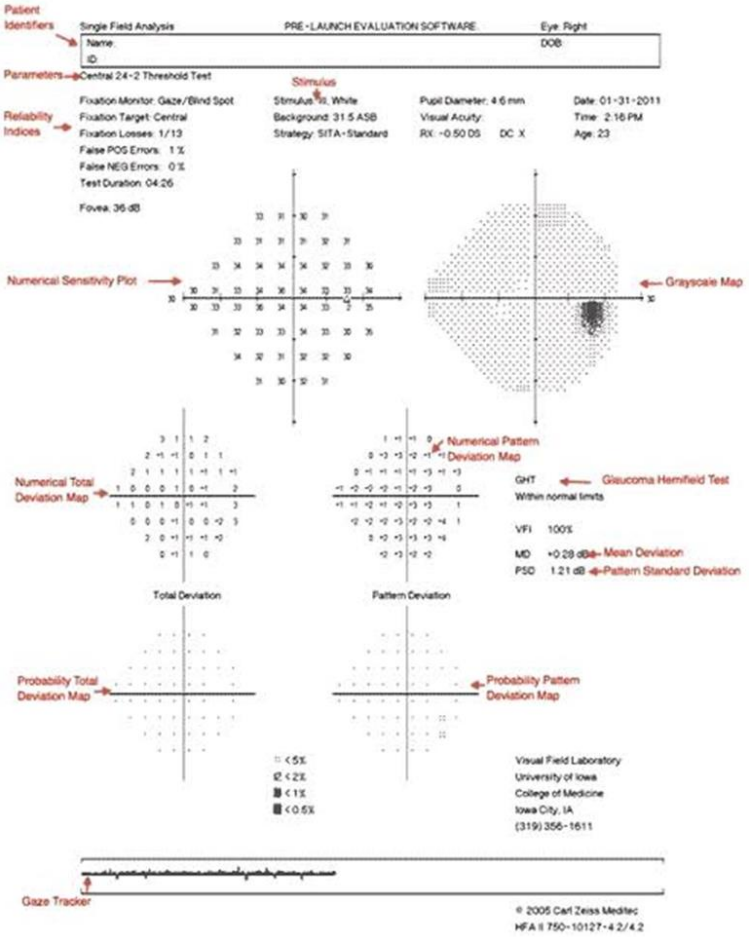
(c) Bitemporal hemianopia (e.g. pituitary tumour)

(d) Left central scotoma (e.g. central macular disease) and right upper eyelid artefact

(e) Centrocaecal scotomata (e.g. toxic optic neuropathy) and right lens rim artefact

(f) Spiral visual fields (the functional or hysterical visual loss associated with malingering)





6.5.2 INTRAOCULAR PRESSURE

Normal intraocular pressure is 10-20 mmHg.

Suspicion of glaucoma/Ocular Hypertension : 20-25mmHg

Ocular Hypertension : above 27 mmHg

6.5.2.1 Digital Tension; It is measured by palpating by fingers. Patient is asked to look down and sclera is palpated through upper lid beyond tarsal plate. The amount of fluctuation gives estimation of tension.

6.5.2.2 Schiotz tonometer

The depth of indentation of cornea is measured.

Advantages—It is easy to use, cheap, convenient to carry and does not need slit lamp.

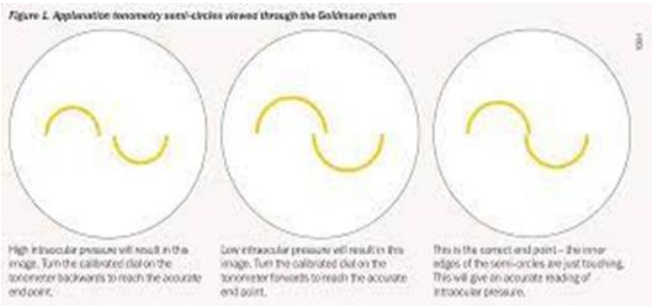
Disadvantage—ocular rigidity can produce error.

6.5.2.3 Applanation tonometer;

It is more accurate method. cornea is flattened by plane surface. The applanation tonometer measures the intraocular pressure by flattening the cornea(rather than indent) over a specific area 3.06mm.this is more accurate because scleral rigidity is ruled out in this.

Method;

7. Patient's eye is anesthetized with local anesthesia and fluorescein drop is put into eye
8. Put the patient's chin onto chin rest and forehead onto support provided.
9. Slit lamp is moved towards patient's eye while patient is looking straight with open wide eyes.
10. Slit lamp is moved till tip of tonometer touches the cornea.
11. By flattening cornea, a just bit, tonometer detect pressure in the eye.
12. Same procedure is repeated for the 2nd eye,



6.6 DRESSING AND BANDAGES

6.6.1 INSTILLING DROPS/OINTMENT

• The eyedropper should not touch patients eye while instilling drops as it can cause trauma and contaminate the remaining medicine.

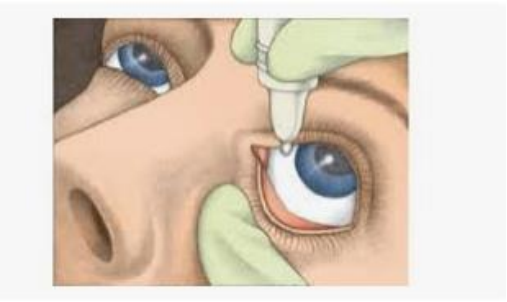
• The drops and ointment should be administered in the correct strength, to the correct patient, into the correct eye, at the correct time and at the appropriate interval.

• The eye drops should also be monitored for discoloration or sedimentation which indicates that the ophthalmic solution is decomposing. In such case a new dose of medicine should be obtained and the affected bottle discarded.

• Always make sure if patient is contraindicated to some medicine.

• Medication that has passed its expiry date must not be used. Any opened drops or ointment must not be used after 28 days.

- An appropriate time interval of approximately 3min is necessary between each drop/ointment in order to prevent dilution and over flow.
- A 5mm strip of ointment should be applied to the inner edge of the lower fornix



6.6.2 Method Of Making And Applying An Eyepad

How to make an eye pad:

Place cotton wool between the two pieces of gauze.

Cut into an oval shape approximately 5 centimetres wide and 6 centimetres long

How To Apply An Eye Pad :

Apply a piece of adhesive tape, about 15 centimetres long, to the eye pad

Ask the patient to close both eyes.

Position the eye pad diagonally over the closed lids of the affected eye and tape firmly, but gently, to the forehead and cheek.

Apply a second and third piece of tape to ensure the pad lies flat.

Extra protection can be given by taping a shield over the pad in the same way. The shield shown is produced commercially and is called a Cartella shield.

References

1. The Ophthalmic Assistant, Raymond M. Stein
2. Comprehensive ophthalmology, Dr. Nasir Chaudhry
3. Parson's Diseases of the Eye