

Lecture 2 & 3
Slit lamp Biomicroscope

Slit lamp is an instrument which allows magnified inspection of interior aspect of patients eyes

Features

- Illumination system
- Magnification via binocular microscope



Slit lamp is used to evaluate the health of the anterior segment of the eye. It also, in conjunction with auxiliary lenses, is used to view the anterior chamber and retina.

Basic components of slit lamp

1- illumination arm contains the illumination system and the angle can be changed from 0-90°

It has

A- slit controls to control the light width and orientation

B- click stop to change the position of the reflecting mirror to change the angle of the beam with respect to the viewing system

C- filters used to change the appearance of the beam like cobalt blue filter, green or red free filter

Basic Components: illumination



- Bulb
- Filters
- Slit height control
- Slit rotator
- Mirror
- Slit width control

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Filters

1. Unfiltered
2. Heat absorbing
3. 10% Grey
4. Red free
5. Cobalt blue

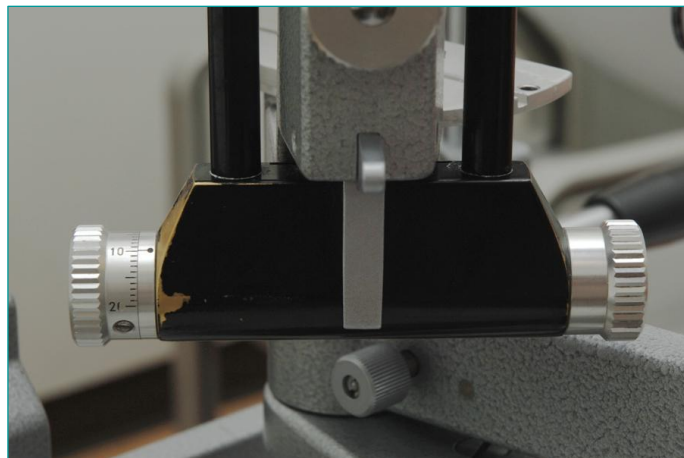


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Table 6.1 Filters available on most slit-lamp biomicroscopes.

Filter	Typical symbol	Use
Cobalt blue	Blue filled circle	Enhances the view of fluorescein dye in the tear film of the eye. Typically used for fluorescein staining and Goldmann tonometry.
Red free	Green filled circle	Used to enhance the view of blood vessels and haemorrhages
Neutral density	Circle with hashed lines	Decreases maximum brightness for photosensitive patients
Heat absorbing	Built into most slit-lamps	Decreases patient discomfort
Grey	Circle with thick line	Decreases maximum brightness for photosensitive patients
Yellow filter	Yellow filled circle Located in the observation system	For good contrast enhancement when using fluorescein and the cobalt blue filter
Diffuser	May be a flip-up filter placed on the illumination source	Used for general overall observations of the eye and adnexa

Width



Microscope arm

A- oculars : it can adjust to the examiner refractive error the distance between them can be adjust as the examiner IPD

B- magnification changer

Slit lamp position controls

- Joystick (elevation knops) to control the movement of the slit lamp forward and right – left movement to have sharp focus

Basic Components: magnification

- Eye pieces
- Magnification changer
- Joy stick
- Lock
- Base



Magnification

Most slit lamps have:

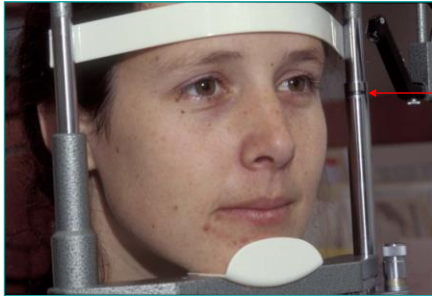
- 2 objective settings (1 and 1.6)
- 2 eye piece options (10x and 16x)
- Total magnification ranges thus from 10x-25x

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Use of the Slit Lamp



- Seat patient comfortably
- Adjust table, chair
- Position patient's head

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Focus Patient's Eye



- Microscope straight
- Light column 20-30 degrees from side
- Microscope moves via joystick
- Move laterally
- Move in and out

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Adjust the Illumination



- Brightness: filters
- Width: slit vs broad beam
- Height: long vs pinpoint

Illumination techniques

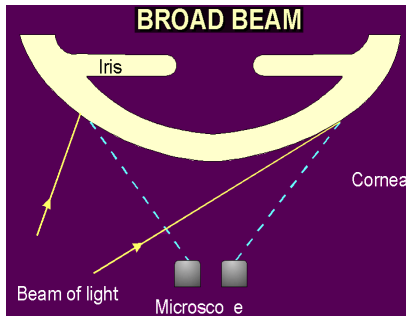
- Diffuse illumination
- Direct illumination
 - Parallelepiped
 - Optic section
 - Conical(pinpoint)
 - Tangential
 - Specular reflection
- Indirect illumination
 - Retro-illumination
 - Sclerotic scatter
 - Transillumination

Diffuse illumination

- Angle between microscope and illumination system should be 30-45 degree.
- Slit width should be widest.
- Filter to be used is diffusing filter.
- Magnification: low to medium
- Illumination: medium to high.

➤ Applications:

- General view of anterior of eye: lids, lashes, sclera, cornea, iris, pupil,
- Gross pathology and media opacities
- Contact lens fitting.
- Assessment of lachrymal reflex.



Optics of diffuse illumination



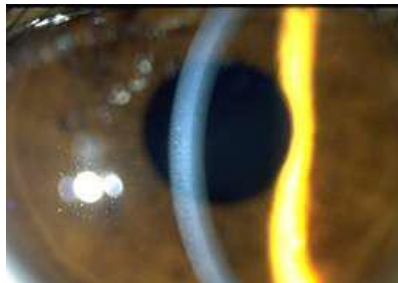
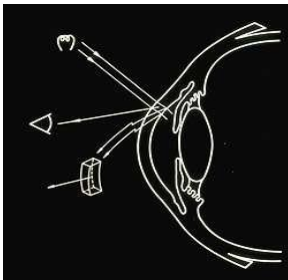
Diffuse illumination with slit beam and background illumination

Direct illumination

- Involves placing the light source at an angle of about 40-50 degree from microscope.
- This arrangement permits both light beam and microscope to be sharply focused on the ocular tissue being observed.
- **Wide beam direct illumination** is commonly used as a preliminary technique to evaluate large area
- it is particularly suitable for assessment of cataracts, scars, nerves, vessels etc.
- It is also of great importance for the determination of stabilization of axis of toric contact lens.
- Parallelepiped:
 - Constructed by narrowing the beam to 1-2mm in width to illuminate a rectangular area of cornea.
 - Microscope is placed directly in front of patients cornea.
 - Light source is approximately 45 degree from straight ahead position.

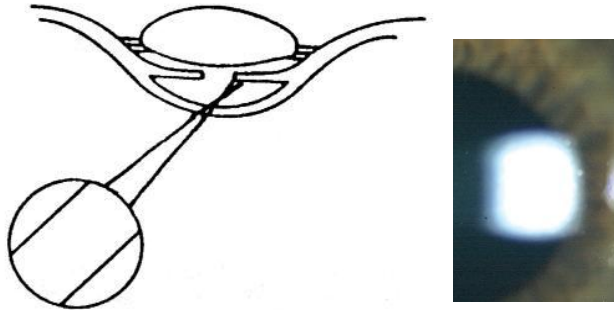
– Applications:

- Used to detect and examine corneal structures and defects.
- Used to detect corneal striae that develop when corneal edema occurs with hydrogel lens wear and in keratoconus.
- Higher magnification than that used with wide beam illumination is preferred to evaluate both depth and extent of corneal, scarring or foreign bodies.



Conical beam(pinpoint)

- Produced by narrowing the vertical height of a parallelepiped to produce a small circular or square spot of light.
 - Light source is 45-60 degree temporally and directed into pupil.
 - Biomicroscope: directly in front of eye.
 - Magnification: high(16-25x)
 - Intensity of light source to highest setting.
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- **Focusing:**
 - Beam is focused between cornea and anterior lens surface and dark zone between cornea and anterior lens observed.
 - Principle is same as that of beam of sun light streaming through a room ,illuminating airborne dust particles.
 - Most useful when examining the transparency of anterior chamber for evidence of floating cells and flare seen in anterior uveitis.

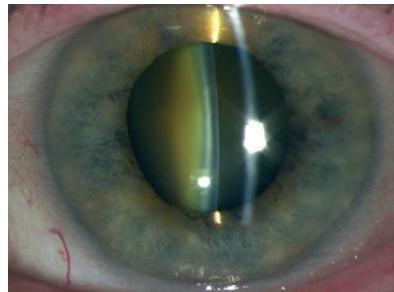
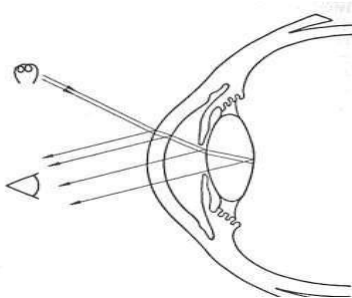


Slit Lamp Illuminator - Pinpoint

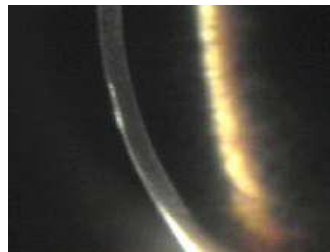
Optic section

- Optic section is a **very thin parallelepiped** and optically cuts a very thin slice of the cornea.
- Axes of illuminating and viewing path intersect in the area of anterior eye media to be examined e.g. the individual corneal layers.
- Angle between illuminating and viewing path is 45 degree.
- Slit length should be kept small to minimize dazzling the patient.

- With narrow slit the depth and portion of different objects (penetration depth of foreign bodies, shape of lens etc) can be resolved more easily.
- With wider slit their extension and shape are visible more clearly.
- Magnification: maximum.
- Examination of AC depth is performed by wider slit width .1-.3mm .
- Used to localize:
 - Nerve fibers
 - Blood vessels
 - Infiltrates
 - Cataracts
 - AC depth.



Optical section of lens



1. Corneal scar with wide beam illumination 2. optical section through scar indicating scar is with in superficial layer of cornea.

Examination methods

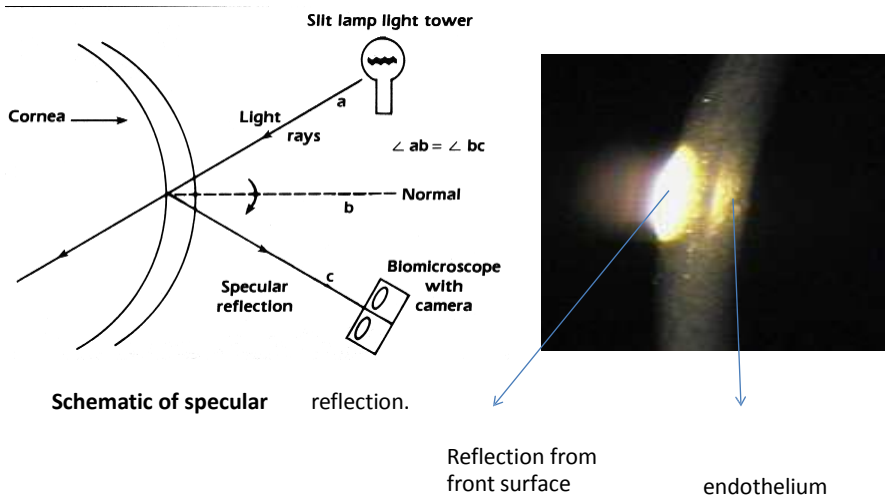
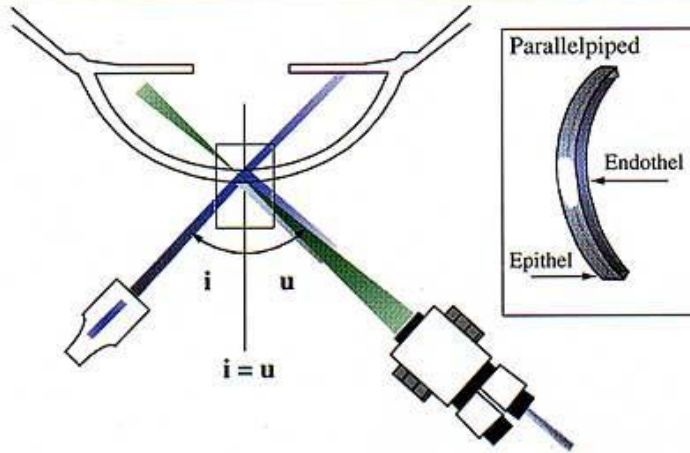
A- direct illumination : angle between the light source and microscope is about 30-50 and both microscope and light will direct to the focusing area , different type of direct illumination can be used

- **1- wide-beam direct illumination use**
to evaluate large area
- **2- parallelepiped** it is constructed beam occur by narrowing the beam to 1-2 mm in width use for examined the layered of cornea and lens especially in the depth and extent of the corneal abrasions , scarring and foreign bodies
- **3- optic section** it is when the parallelepiped reduced in width to an extremely thin , it is use for evaluated the layer of cornea and the depth of the foreign body
- **4- conical beam** produce by narrowing the vertical height of a parallelepiped to produce a small circular or square spot of light , used to examined the transparency of the anterior chamber for floating cells

5- Specular reflection

- Established by separating the microscope and slit beam by equal angles from normal to cornea.
- Position of illuminator about 30 degree to one side and the microscope 30 degree to other side.
- Angle of illuminator to microscope must be equal and opposite.
- Angle of light should be moved until a very bright reflex obtained from corneal surface which is called zone of specular reflection.

SPECULAR REFLECTION



- Observe:
 - Anterior and posterior cornea
 - Iris is best viewed without dilation by this method.
 - Anterior lens (especially useful for viewing pseudoexfolation).

Indirect illumination

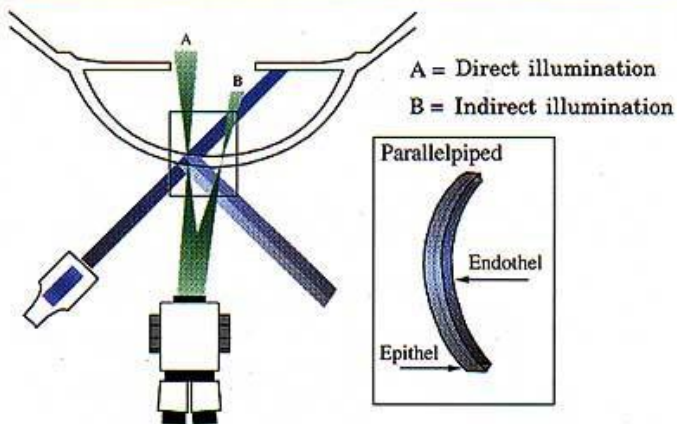
- The beam is focused in an area adjacent to ocular tissue to be observed.
- Main application:
 - Examination of objects in direct vicinity of corneal areas of reduced transparency e.g, infiltrates, corneal scars, deposits, epithelial and stromal defects

Indirect illumination

– Illumination:

- Narrow to medium slit beam
- Decentred beam
- Magnification: approx. $m=12x$ (depending upon object size)

DIRECT / INDIRECT ILLUMINATION



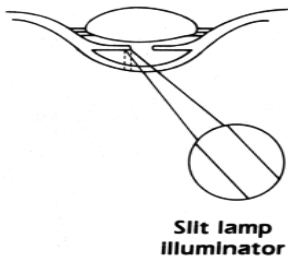
Retroillumination

- Formed by reflecting light of slit beam from a structure more posterior than the structure under observation.
- A vertical slit beam 1-4mm wide can be used.
- Purpose:
 - Place object of regard against a bright background allowing object to appear dark or black.
- Used most often in searching for keratic precipitates and other debris on corneal endothelium.
- The crystalline lens can also be retroilluminated for viewing of water clefts and vacuoles of anterior lens and posterior subcapsular cataract

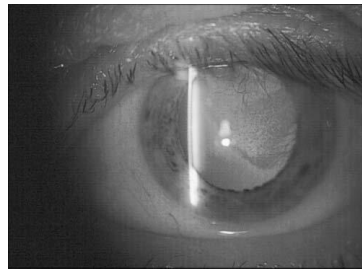


Slitlamp photo shows keratic precipitates inside the eye. These opacities are collections of inflammatory cells that collect on the inner surface of the cornea.

- Direct retroillumination from iris:
 - Used to view corneal pathology.
 - A moderately wide slit beam is aimed towards the iris directly behind the corneal anomaly.
 - Use magnification of 16x to 25x and direct the light from 45 degree.
 - Microscope is directed straight ahead .



Schematic of
direct retroillumination from
the iris.



direct retroillumination from the iris.

Sclerotic scatter

- It is formed by focusing a bright but narrow slit beam on the limbus and using microscope on low magnification.
- Such an illumination technique causes cornea to take on total internal reflection.
- The slit beam should be placed approximately 40-60 degree from the microscope.

When properly positioned this technique will produce halo glow of light around the limbus as the light is transmitted around the cornea.

Corneal changes or abnormalities can be visualized by reflecting the scattered light.

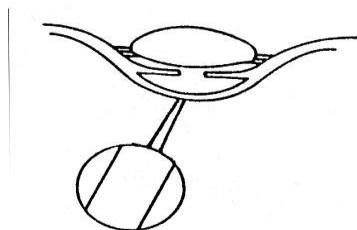
Used to observe:

Central corneal epithelial edema

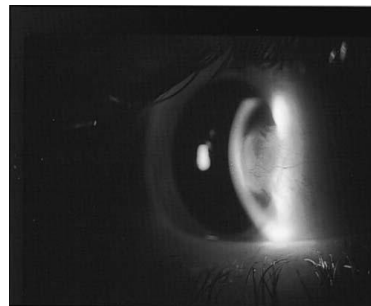
Corneal abrasions

Corneal nebulae and maculae.

- Depending on the density of the abnormality, the light from behind may reflect through, allowing detailed examination of the internal structure of the pathology.
- *Observe: corneal opacities (edema, infiltrates, vessels, foreign bodies), lens, iris*



Slit Lamp Illuminator - Proximal



Procedure:

- Patient will be examined without glasses
- Room illumination is dim
- Adjust the height of the slit lamp table to the comfortable position for patient and examiner
- Instruct the patient to place his chin on chin rest and his forehead against forehead rest
- Adjust the chin rest to align the patient's canthus
- Set the magnification in low setting, remove all filters
- Open both eyes of you (examiner) and set the IPD
- Use one hand to use the joystick and the other hand to control the angle between the microscope and light

Fluorescein staining:

Fluorescein is an orange colored dye, it is instilled into the eye and a fine film over the corneal surface, it will appear by using ultra – violet light as green color, it is used to detect F.B and corneal abrasion

Ocular structure	Type of slit lamp beam	Angle of illumination arm	magnification
Lids / lashes	diffuse	30	low
conjunctiva	parallelepiped	30	low
cornea	Narrow parallelepiped	30 - 45	medium
Anterior chamber	Optic section	60	medium
Angle depth – aqueous	Conical beam	30	high
Iris	Wide parallelepiped	30 - 45	medium
Lens	Narrow parallelepiped	20 - 30	medium

How to recording ?

- Each eye must be recorded separately
- List each structure evaluated and record your observations for each
- Record any abnormalities
- Illustrations are recommended

Example :

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OS

Clear	lids	clear
Clear	lashes	clear
Clear	conjunctiva	clear
Small opacity	cornea	
Anterior iris clear	flat clear	flat lens