DISCLOSURE STATEMENT
Speaker for VSP

Course Title:  Slit Lamp Learning Lab

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Slit Lamp Learning Lab

Roya Attar, OD, MBA, FAAO
The science of examination with a slit lamp is called **Biomicroscopy** as it allows in vivo study of living tissues at high magnification.
BIOMICROSCOPY

• Modern slit-lamps

Figure: Modern slit-lamp
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- The two (2) basic parts of the slit lamp biomicroscope are:
  - The slit lamp (illumination system)
  - The biomicroscope

- The illumination system can be:
  - Of the Zeiss type
  - Of the Haag-Streit Type

- The compound microscope system can be:
  - The Genrough Type
  - The Galilean Type
1. Zeiss type

In the Zeiss type the illumination comes from below
2. Haag-streit type

In the Haag Streit type the illumination comes from above
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A. The Grenough type

Flip lever to change magnification
B. The Galilean changer type

Knob to change magnification (3 or 5 step)
SLIT LAMP BIOMICROSCOPY:

Parts of the Slit Lamp
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3 Main Components

1. Mechanical system
2. Illumination system
3. Biomicroscope /Observation system

Associated instruments:

• Applanation Tonometer
• Gonioscopic Lens
• Fundoscopy Lens
• Micrometer Eyepieces
• Image archiving device
• Laser delivery system
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Mechanical System

3 basic parts:
1. Motorized table (Base)
2. Patient positioning frame
3. Joystick

Responsible for:
- Positioning & adjustment of patient and observer
- Maneuvering the illumination and microscope system together with joystick
- Providing base to other parts
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Parts of mechanical system:

- Fixation target
- Chin rest adjustment knob
- Joystick
- Power switch
- Table height adjustment
- Forehead band
- Canthus alignment
- Chin rest
- Hand grip for patient
- Lock for slit lamp base
- Low friction plate
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Illumination System

• Provides a bright, evenly illuminated, finely focused, and adjustable slit of light at the eye
• The beam of light can be changed in intensity, height, width, direction or angle

Contains the following components:
  o Light source
  o Condenser lens system
  o Slit and other diaphragms
  o Filters
  o Projection lens
  o Reflecting mirror or prisms
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Parts of illumination system:

- Scale for slit height
- Slit height control
- Inclined mirror
- Latch to tilt light column
- Light source
- Filter control
- Centering screw
- Slit width control
Observation System

- Composed of 2 lenses
  - Objective lens: consists of 2 plano-convex lenses providing a composite power of +22D
  - Eyepiece lens: +10D
- Magnification: Most slit lamps provide a range of magnification, from 6x – 40x
  - Prism: to overcome inverted image produced by compounded microscope
- Provides a larger working distance in front of microscope for manipulation on patient’s eye
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Parts of observation system:

- Eyepiece
- Marked ring for adjustment of examiner’s refractive error
- Prism housing
- Knob to change magnification
- Objective lens
Observation System

- **Magnifications:**
  - Low (7-10x) when scanning large areas
  - Medium (16x) to evaluate details
  - High (>16X) to magnify small details

- **Relationship:**
  - High magnification: decreased FOV
  - Low magnification: increased FOV
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Associated instruments:

- Co-observation Tube
- Gonioscopic Lens
- Digital Archiving Devices
- Fundoscopy Lenses
- Micrometre Eyepieces
- Applanation Tonometer
- Laser
SLIT LAMP BIOMICROSCOPY:
Clinical Procedure
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Setup:

• Explain purpose to patient
• Clean the forehead band
• Change paper strip from chinrest
• Adjust patient in comfortable sitting position
• Position patient properly
  o Alignment – black line positioned at lateral canthus
  o Fixation target
• Adjust eyepieces to correct for examiner’s refractive error and interpupillary distance
• Children may need to stand, sit on their knees, or they can sit on parent’s lap
• Practice turning on and using

Fig. Correct positioning at the slit lamp
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Illumination techniques:

• Slit Width control knob

Narrow to fully open slit illumination achieved by rotating this knob
Illumination techniques:

Slit height control knob:

Short to long slit illumination achieved by rotating this knob.
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Illumination techniques:

Slit angle rotation
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Illumination techniques:

- Tilting light column
  Illumination column can be tilted 5 - 20° with vertical axis which gives extra plane and minimize reflection during posterior segment examination with condensing lens
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Illumination Methods

- **Direct illumination**
  - Direct diffuse illumination
  - Direct focal illumination
    i. Parallelepiped
    ii. Optic section
    iii. Conical beam

- **Specular reflection**

- **Tangential illumination**

- **Indirect illumination**

- **Retro-illumination**
  - Direct retro-illumination
  - Indirect retro-illumination
    o Iris transillumination

- **Sclerotic scatter**

- **Oscillatory illumination**
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Direct diffuse illumination

- A wide beam (at least 4 mm)
- Maximum beam height
- Directed obliquely between 30°-45°
- Low magnification 6x to 10x
- Illumination: medium to high
- Filter: Diffuse

Applications:

- General gross scanning overview of eyelids, lashes, conjunctiva, sclera, pattern of redness, iris, pupil, gross pathology and media opacities
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Direct diffuse illumination
**BIOMICROSCOPY**

**Direct focal illumination**
- Illumination and observation are focused on the same area
- Slit width narrow to broad
- Illumination angle 45° to 60°
- Magnification 10x-40x

**Applications:**
- Cornea in detail
- Anterior chamber
- Crystalline lens
- Anterior part of vitreous
- Grading cell and flare in the anterior chamber
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Direct focal illumination
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Direct focal illumination

i. Parallelepiped

• Slit width ~2-4 mm obliquely focusing on the cornea so that a quadrilateral block of light illuminates the cornea

Applications:

• To examine corneal surface, stroma
• To ascertain depth (Ex. Foreign Body)
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Direct focal illumination

ii. Optic section
- Very thin ~1mm or less
- Maximum height
- Illumination angle 45-60° or more
- High illumination & magnification
- Optically cuts a very thin slice of the cornea

Applications:
- van Herick angle estimation
- Used primarily to determining the depth or elevation of a defect of the cornea, conjunctiva or lens
- Corneal depth, layers, scars, infiltrates, vessels, lens opacity
Diffuse Illumination

lids / lashes / conjunctiva
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contact lens  make-up
Iris-transillumination

- Transillumination of the iris by indirect light reflected from the fundus
- Mid dilated pupil (3 to 4mm)
- Illumination and observation at coaxial position

Applications:

- Visualization of defects of the pigment layer of the iris

Fig.: Transillumination in Albinism
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Filters:

<table>
<thead>
<tr>
<th>Filter type</th>
<th>Filter Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobalt Blue</td>
<td>Used with fluorescein dye during assessment of dry eyes, contact lenses, and Goldmann applanation tonometry.</td>
</tr>
<tr>
<td>Neutral density</td>
<td>Reduces the brightness of the illumination and is complemented by the rheostat on the instrument.</td>
</tr>
<tr>
<td>Yellow</td>
<td>Can be used in addition to the Cobalt blue filter to enhance contrast.</td>
</tr>
<tr>
<td>Red free (green)</td>
<td>Enhances the contrast of blood vessels on the corneas of contact lens wearers and haemorrhages seen under the conjunctiva</td>
</tr>
<tr>
<td>Diffuser</td>
<td>Generally used with a wide beam and low magnification with non-directional illumination for gross assessment of the eye.</td>
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Filters:

- **White filter**
  - Overview of ocular surface tissues
  - Examining intraocular structures

- **Cobalt Blue filter**
  - The cornea may also be evaluated using sodium fluorescein and the cobalt blue filter. After NaFl is instilled, use the blue filter to scan the cornea (beam should be widened to approximately 3-4 mm). Any defects in the corneal epithelium will appear bright green.
    - Corneal abrasion, ulcer
    - Goldmann Applanation tonometry
    - Determination of TBUT (Tear Break-Up Time)

- **Red free filter**
  - Rose-bengal staining
Van Herrick’s Technique:

- Used to evaluate anterior chamber angle without gonioscopy
- Narrow slit beam close to limbus with Illumination angle 60°
- Medium magnification

Principle:

- Compare the width of cornea seen by optical section with the dark section seen between anterior surface of iris & back of cornea

Interpretation:

Grade 4 – open anterior chamber angle 1:1 ratio
Grade 3 – open anterior chamber angle 1:2 ratio
Grade 2 – narrow anterior chamber angle 1:4 ratio
Grade 1 – risky narrow anterior chamber angle less than 1:4 ratio
Grade 0 – closed anterior chamber
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Van Herrick’s Technique: to assess anterior chamber angle
Van Herrick’s Technique: to assess anterior chamber angle
If the width of the anterior chamber = corneal thickness, then it is a wide open angle or grade 4.
Associated instruments:

**Applanation Tonometer:**

*The Goldmann Applanation Tonometer* is the most common tonometer that usually mounted on the standard slit-lamp biomicroscope

**Application:**

- Measurement of intraocular pressure (IOP)

**Parts:**

1. Tonometer tip (*biprism*)
2. Metal rod
3. Tonometer housing
4. Force adjustment knob
Troubleshooting:

- Unable to turn on
  - Check all connections and power outlets
- Power on - but no light
  - Slit width closed
  - Slit height too small
  - Bulb burned out
  - Bulb not positioned correctly
Troubleshooting:

- Difficulty moving instrument
  - Unlock
  - Check patient position

- Difficulty focusing
  - Check eye-pieces on correct setting
  - Make sure patient’s head in correct position
  - Adjust joy stick in and out