BIOMICROSCOPY OF THE EYE

The Use of the Biomicroscope in Veterinary Ophthalmology for the Examination of the Anterior Segment

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BIOMICROSCOPY OF THE EYE

History

• Gullstrand in 1911 used a combination of a focused beam of light combined with a diaphragm and examination of the resulting beam of light with a loupe or condensing lens.

• Henker subsequently combined the Gullstrand slit beam with a corneal microscope which became the forerunner of the modern biomicroscope.

Images taken from Berliner’s Text “Biomicroscopy of the Eye” 1943 Volume I
BIOMICROSCOPY OF THE EYE

The Biomicroscope

• **Illuminating System**
  - Source of Illumination
    • Lamp (Halogen bulb today)
  - Condensing Lens
    • 2 plano-convex lens totaling to 22 diopters (with convex surfaces toward each other)
  - Diaphragm
    • Aperture that results in a rectangular beam
  - Koeppe’s Tube
    • Blackened tube between the diaphragm and illuminating lens
BIOMICROSCOPY OF THE EYE

The Biomicroscope

- Illuminating Lens

- Optical Characteristics of the Luminous Beam

- Keep lens surfaces clean to avoid aberrations and false images
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The Biomicroscope Adjustments

- Stereoscopic Microscope
  - Adjustments
    - Ocular Diopters
    - Pupillary Distance
    - Magnification
      - 5x - 20x
  - Take Glasses Off
  - Use Focusing Rod
    - 5 CM distance
The Biomicroscope Adjustments

• **Light Intensity Adjustment**
  - Turn Intensity ALL the way down to lowest when instrument is turned ON.
  - Turn Intensity ALL the way UP for use
  - Turn Intensity ALL the way DOWN before turning instrument OFF

• **ON and OFF Switch**
BIOMICROSCOPY OF THE EYE

METHODS

• Diffuse Illumination
• Sclerotic Scatter
• Direct Focal Illumination
• Retroillumination
• Specular Reflection
• Indirect Illumination
  - proximal or lateral illumination
• Oscillatory Illumination

Drawing taken from Berliner’s Text “Biomicroscopy of the Eye” 1943 Volume I
BIOMICROSCOPY OF THE EYE

TERMS

Relucency
The internal dispersion of light caused by the heterogeneity of the semi-transparent tissues.

Zones of Discontinuity
Reflection of light when a beam of light is incident on an optical surface whose refractive index differs from that through which the light has passed. Such a surface is known optically as a zone of discontinuity. These zones act as mirror surfaces. Examples: Anterior and posterior surfaces of the cornea and lens. In addition zones can be identified within these structures as well.

Zones of Specular Reflection
Regular and irregular zones of specular reflection can be observed at each zone of discontinuity. Regular reflection at the mirrored zone = Specular Reflection can only be seen when the observing eye is placed in the path of the regularly reflected beam. (angle of reflection equalling angle of incidence.)
METHODS

• Adjust tube to be 25 ° to 45 ° temporal to eye being examined (angle between the illuminating beam and the axis of the microscope). The narrower the angle the deeper into the globe the beam penetrates. Ideal angle is 40 °.

• Hold slit lamp close to body and keep elbow of the hand holding the instrument flexed and firmly resting against your chest.

BIOMICROSCOPY OF THE EYE
METHODS

**Diffuse Illumination**

For studying the topography of pathological changes.

Wide Beam - Defocused or *Ground Glass filter*

*New Slit-lamps; just use wide beam and low magnification.*
BIOMICROSCOPY OF THE EYE

METHODS

_**Sclerotic Scatter**_

- Focused beam at the corneo-scleral limbus.
- The marked dispersion and scattering of light which occurs in the perilimbal sclera, produces a crescentic halo of light around the cornea, particularly marked on the opposite side. After internal reflection, the light passes through the cornea.
- Good for identifying faint pathological changes.

Hold light source 90° to the limbus.
BIOMICROSCOPY OF THE EYE

METHODS

Direct Focal Illumination

- Parallelepiped (corneal block)
- Optic Section

Images taken from Berliner’s Text “Biomicroscopy of the Eye” 1943 Volume I
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METHODS

Direct Focal Illumination

Tyndall Effect

- Pencil of light
- Look with pupil as background
- Look with iris as background
- Change angle through ranges of 15 ° to 45°
- Use bright light and high magnification

Images taken from Berliner’s Text “Biomicroscopy of the Eye” 1943 Volume I
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METHODS

Retroillumination

- Examination by means of retro-illumination is the observation of normal or pathologic structures (in transparent or semitransparent media) in light reflected from tissues situated more posteriorly.
- Originally termed Transillumination - but to avoid confusion with internal trans-scleral illumination (diaphanoscopy) the name was changed to Retroillumination.
- Best for cornea and lens.
- Direct and Indirect Retroillumination

Images taken from Berliner's Text "Biomicroscopy of the Eye" 1943 Volume I
BIOMICROSCOPY OF THE EYE

METHODS

Direct Retroillumination

- Look to the side of the corneal block
- Objects viewed may have one color in direct and a different color with retroillumination.

Images taken from Berliner’s Text “Biomicroscopy of the Eye” 1943 Volume I
Retroillumination Methods

Direct Retroillumination

The object (observed structure) is viewed in the direct pathway of the reflected light. The illuminated background is directly behind the observed structure.

Beam

Images taken from Berliner's Text "Biomicroscopy of the Eye" 1943 Volume I
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METHODS

Indirect Retroillumination

Images taken from Berliner’s Text “Biomicroscopy of the Eye” 1943 Volume I
Retro-illumination Methods

In-direct Retro-illumination

The object (observed structure) is not viewed in the direct pathway of the reflected light. The retro-illumination object is viewed against a dark non-illuminated background. The reflecting illuminated surface is to one side of the axis of observation.
**BIOMICROSCOPY OF THE EYE**

**Retroillumination Methods**

**Combination Direct and Indirect Retroillumination and Sclerotic Scatter**

The beam is placed so that it falls partly on the sclera at the limbus and partly on the iris. The result is that an opacity may be viewed by retro-illumination and sclerotic scatter.

*Images taken from Berliner's Text “Biomicroscopy of the Eye” 1943 Volume I*
METHODS

Specular Reflection

- Regular and irregular zones of specular reflection can be observed at each zone of discontinuity.
- Regular reflection at the mirrored zone = Specular Reflection can only be seen when the observing eye is placed in the path of the regularly reflected beam. (angle of reflection equaling angle of incidence.
- Irregular reflection = Irregular diffuse reflection occurs throughout nature and accounts for the visibility of most non-luminous surfaces and objects. The dancing shimmer on the apparently smooth surface of a quiet pool

Images taken from Berliner’s Text “Biomicroscopy of the Eye” 1943 Volume I
BIOMICROSCOPY OF THE EYE

METHODS

Indirect Illumination
(Proximal or Lateral)

Images taken from Berliner's Text "Biomicroscopy of the Eye" 1943 Volume I
METHODS

Oscillatory Illumination
Small lateral or vertical movements are made with the beam so that the point under observation is alternately viewed by direct and indirect light. Such oscillatory movements cause sudden alternate lighting up and darkening of fine details. In a sense it seems as though the details themselves are caused to move, and their presence is seen with greater ease then when observed under stationary illumination.