Abstract
With all of the fundus lenses available today for biomicroscopy, which one is the best for you? Considering factors such as image quality, magnification and field of view, it is important to understand the benefits of each lens. In this hands-on workshop, attendees will become familiar with various options of lenses for biomicroscopy and their uses in clinical practice. Patient preparation, procedure and interpretation of the fundus examination will be covered. Participants will have the opportunity to gain experience with a variety of non-contact and contact fundus lenses. Attendees will be provided with dilated subjects for this workshop. Standards of care are addressed and clinical pearls provided.

Learning Objectives
At the conclusion of this workshop, attendees will:

1. Enhance fundus examination skills with the use of fundus lenses.
2. Gain familiarity with various types of non-contact fundus lenses.
3. Gain familiarity with various types of contact fundus lenses.
4. Recognize the clinical situations in which a particular fundus lens is more useful.
5. Understand ways to maximize a particular view of the retina.
6. Become familiar with the disinfection of fundus contact lenses using the glutaraldehyde high-level disinfection system.

Outline
I. Introduction
   A. Description of the various types of fundus lenses available and the clinical situations in which particular lenses would be beneficial

II. Procedures
   A. Attendees will be divided into small groups of 2-4, each assigned to a slit lamp with a teaching tube, and a dilated patient
      1. The benefit of teaching tubes and/or video recording and display of procedures will be available for group analysis and interpretation
2. Each attendee will have a hands-on experience with a variety of non-contact and contact fundus lenses, featured below, and will be able to compare their views with that of a traditional 60D, 78D, and/or 90D lens.

III. Stations 1-3: Non-contact Fundus Lenses

A. Purpose and Indications
1. Perform a standard dilated fundus examination using a pre-corneal lens that enhances your magnification, resolution, and/or field of view
   1. Use a particular pre-corneal lens in order to optimize your view of an area in question
   2. Maximize your fundus examination through an undilated pupil for situations that do not allow for pupillary dilation

B. Instrumentation and Procedure
1. Slit Lamp
2. Teaching tube and/or video recording and display of procedure
3. One of the listed pre-corneal fundus lenses (below)
4. Patient with complete pupillary dilation
5. Patient with undilated pupil (for comparison)

C. Interpretation
1. The image provided in each of the above lenses is inverted and laterally reversed

D. Clinical Pearls
1. Patient’s gaze can be altered in order to maximize view of given area
2. Each lens has its own unique working distance to allow for maximal performance
### E. High magnification lenses (Manufacturer’s Featured Lens Specifications)

<table>
<thead>
<tr>
<th>Lens</th>
<th>Magnification</th>
<th>Field of View (Static/Dynamic)</th>
<th>View</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volk 60D</td>
<td>1.15x</td>
<td>68°/81°</td>
<td>indirect</td>
<td>13mm working distance; high mag ideal for detailed ONH and macula</td>
</tr>
<tr>
<td>Volk Digital High Mag®</td>
<td>1.30x</td>
<td>57°/70°</td>
<td>indirect</td>
<td>13mm working distance; high resolution, high magnification imaging of the central retina</td>
</tr>
<tr>
<td>Volk Digital 1.0x Imaging Lens®</td>
<td>1.0x</td>
<td>60°/72°</td>
<td>indirect</td>
<td>12mm working distance; ideal for optic disc measurements and slit lamp photography</td>
</tr>
<tr>
<td>Ocular Instruments MaxField® 66</td>
<td>0.91x</td>
<td>91°/144°</td>
<td>indirect</td>
<td>7.8mm working distance; larger field of view than standard 60D lens</td>
</tr>
<tr>
<td>Volk Super 66</td>
<td>1.0x</td>
<td>80°/96°</td>
<td>indirect</td>
<td>11mm working distance; high magnification optic disc and macular viewing; 1.0x ideal for disc measurements</td>
</tr>
<tr>
<td>Katena Diamond series 60D</td>
<td>0.96x</td>
<td>68°</td>
<td>indirect</td>
<td>12mm working distance; Ultra-lightweight and silicone grip</td>
</tr>
</tbody>
</table>
### F. Lenses providing optimal balance between magnification and field of view
(Manufacturer’s Featured Lens Specifications)

<table>
<thead>
<tr>
<th>Lens</th>
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<tbody>
<tr>
<td>Volk 78D</td>
<td>0.93x</td>
<td>81°/97°</td>
<td>indirect</td>
<td>8mm working distance; good compromise b/w FOV and mag</td>
</tr>
<tr>
<td>Volk Digital Wide Field®</td>
<td>0.72x</td>
<td>103°/124°</td>
<td>indirect</td>
<td>4-5mm working distance; high resolution with a wide field of view (past vortex)</td>
</tr>
<tr>
<td>Ocular Instruments MaxField® High Mag 78D</td>
<td>0.98x</td>
<td>88°/154°</td>
<td>indirect</td>
<td>10mm working distance; wider field of view compared to a classic 78D lens</td>
</tr>
<tr>
<td>Ocular Instruments Osher MaxField® 78D</td>
<td>0.77x</td>
<td>98°/155°</td>
<td>indirect</td>
<td>7mm working distance; wider field of view compared to a classic 78D lens</td>
</tr>
<tr>
<td>Katena Diamond series 78D</td>
<td>0.77x</td>
<td>80°</td>
<td>indirect</td>
<td>7mm working distance; Ultra-lightweight and silicone grip</td>
</tr>
</tbody>
</table>
## G. Lenses with small pupil capability and wide viewing field

(Manufacturer’s Featured Lens Specifications)

1. Note: patients in this station will have 1 undilated pupil for comparison

<table>
<thead>
<tr>
<th>Lens</th>
<th>Magnification</th>
<th>Field of View (Static/Dynamic)</th>
<th>View</th>
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<tbody>
<tr>
<td>Volk 90D</td>
<td>0.76x</td>
<td>74°/89°</td>
<td>indirect</td>
<td>7mm working distance; ideal for small pupil examination</td>
</tr>
<tr>
<td>Volk SuperPupil® XL</td>
<td>0.45x</td>
<td>103°/124°</td>
<td>indirect</td>
<td>4mm working distance; optimal small pupil capability through a pupil as small as 1 - 2mm</td>
</tr>
<tr>
<td>Volk Super Vitreofundus®</td>
<td>0.57x</td>
<td>103°/124°</td>
<td>indirect</td>
<td>4-5mm working distance; wide field, pan retinal examination and small pupil capability (3-4mm)</td>
</tr>
<tr>
<td>Ocular Instruments MaxField® 120D</td>
<td>0.50x</td>
<td>120°/173°</td>
<td>indirect</td>
<td>4mm working distance; wide field, pan retinal examination and small pupil capability (2mm)</td>
</tr>
<tr>
<td>Katena Diamond series 90D</td>
<td>.64x</td>
<td>75°</td>
<td>indirect</td>
<td>7 mm working distance; Ultra-lightweight and silicone grip; small pupil performance</td>
</tr>
</tbody>
</table>
IV. Stations 4-6: Contact Fundus Lenses:

A. Purpose and Indications
1. Use a particular contact fundus lens in order to optimize your view of an area in question
2. Clinical uses:
   1. Enhancing view of macula
      a. Edema in diabetic, ARMD, or POHS
      b. Epiretinal membrane
      c. Macular hole
      d. Cystoid macular edema
3. Dilated fundus examination in an uncooperative or photophobic patient
4. To obtain a more magnified view of a peripheral retinal lesion noted during BIO

B. Contraindications
1. Severe corneal trauma
2. Penetrating ocular injury
3. Severe anterior segment infection
4. Hyphema

C. Instrumentation
1. Slit Lamp
2. Teaching tube and/or video recording and display of procedure
3. One of above contact fundus lenses
4. Patient with complete pupillary dilation
5. Patient with undilated pupil (for comparison)
6. Buffering solution such as Goniosol, Refresh Celluvisc, or Genteal Gel
7. Anesthetic
8. Glutaraldehyde for high level disinfection (disposable lenses will be available for trial in addition to reusable lenses)

D. Set Up
1. Prepare disinfected lens by cleaning of debris and fingerprints (soap and water, or an RGP cleansing solution can be used)
2. Place 2-3 drops of buffering solution into lens well
   1. Lenses without a flange may require less or no buffering solution
3. Anesthetize patient’s cornea(s)

E. Procedure
1. Instruct patient to look up
2. Obtain lower lid control (may not be necessary if using a lens without a flange)
3. Insert the lower portion of the lens/flange into the patient’s inferior cul-de-sac
4. Push the lens downward and rotate the lens onto the cornea. Upper lid control can be obtained if necessary.
5. Instruct the patient to look at your fixation target (knob, ear, etc)
   1. Patient’s gaze can be altered in order to maximize view of given area
6. Pull back on the slit lamp joystick in order to obtain a focus on the desired target.
7. Lens removal
   1. Carefully break suction between lens and tear interface
   2. Lenses without a flange will have less or no suction and lens can be gently pulled directly away from the eye
8. Lavage if necessary based on buffering solution used
9. Disinfection of used lens with glutaraldehyde high-level disinfection
   1. Some single-use lenses available for demonstration

F. Interpretation
   1. Direct view: view seen is how it appears anatomically
   2. Indirect view: view is inverted and laterally reversed

G. **Lenses for posterior pole/macula viewing** (Manufacturer’s Featured Lens Specifications)
   1. Flange helps with stability of lens

<table>
<thead>
<tr>
<th>Lens</th>
<th>Magnification</th>
<th>Field of View (Static/Dynamic)</th>
<th>View</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volk Fundus 20mm (with flange)</td>
<td>1.44x</td>
<td>25°/30°</td>
<td>direct</td>
<td>Flange helps provide stability of lens on cornea; posterior pole viewing</td>
</tr>
<tr>
<td>Ocular Instruments Yannuzzi Fundus Lens</td>
<td>0.93x</td>
<td>36°</td>
<td>direct</td>
<td>Flange helps provide stability of lens on cornea; posterior pole viewing</td>
</tr>
<tr>
<td>Ocular Instruments Fundus Diagnostic Lens</td>
<td>0.93x</td>
<td>36°</td>
<td>direct</td>
<td>No flange; the flat front surface of this contact lens provides a direct image of the posterior pole</td>
</tr>
</tbody>
</table>
H. **Lenses for peripheral retina viewing** (Manufacturer’s Featured Lens Specifications)

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</tr>
</thead>
<tbody>
<tr>
<td>Volk High Resolution Centralis®</td>
<td>1.08x</td>
<td>74°/88°</td>
<td>indirect</td>
<td>High magnification and resolution of posterior pole</td>
</tr>
<tr>
<td>Katena SMT single-use Retina 90 lens</td>
<td>1.0x</td>
<td>90°</td>
<td>indirect</td>
<td>Used to view primarily within the retinal arcades; single-use eliminates need for disinfection</td>
</tr>
<tr>
<td>Volk Equator Plus®</td>
<td>0.44x</td>
<td>114°/137°</td>
<td>indirect</td>
<td>Lens of choice in eyes with poor dilation (can be used in pupils as small as 3mm); excellent choice for diabetics with miotic eyes</td>
</tr>
<tr>
<td>Volk High Resolution Wide Field</td>
<td>0.5x</td>
<td>160°/165°</td>
<td>indirect</td>
<td>Extreme peripheral retinal examination</td>
</tr>
<tr>
<td>Katena SMT single-use Retina 180 lens</td>
<td>0.8x</td>
<td>180°</td>
<td>indirect</td>
<td>Wide angle view of the retina, out to the ora serrata; single use eliminates need for disinfection</td>
</tr>
</tbody>
</table>
Maximizing your Retinal Exam with Slit Lamp Fundus Lenses -- Caroline B. Pate, OD, FAAO and Elizabeth A. Steele, OD, FAAO

I. **3-mirror lenses, for viewing different areas of the retina**

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<tbody>
<tr>
<td>Ocular Instruments high definition 3-mirror</td>
<td>.65x</td>
<td>3 mirrors¹: 64°/67°/73°</td>
<td>Central lens provides a direct image</td>
<td>10mm contact diameter; can be increased by adding detachable flanges (15mm or 17mm) for added stability</td>
</tr>
<tr>
<td>Volk 3-mirror</td>
<td>1.06x</td>
<td>3 mirrors¹: 60°/66°/76°</td>
<td>Central lens provides a direct image</td>
<td>15mm contact diameter</td>
</tr>
<tr>
<td>Ocular Instruments 3-mirror universal diagnostic</td>
<td>.93x</td>
<td>3 mirrors¹: 59°/67°/73°</td>
<td>Central lens provides a direct image</td>
<td>18mm contact diameter</td>
</tr>
</tbody>
</table>

¹ Additional lenses available for fundus viewing on 3-mirror (position lens opposite from where you need to examine – e.g., to view lesion located in between the equator and ora serrata in the superior retina, position the rectangular lens inferiorly on the eye):

**Trapezoid-shaped lens:**
- Largest
- Used to examine retina adjacent to the posterior pole out to approximately equator
- Requires dilation

**Central lens:**
- Direct, magnified view of posterior pole (approx. central 30-36°)
- High minus lens: -64D

**Rectangular lens:**
- Medium sized
- Used to examine retina from the equator out to ora serrata

**D-shaped lens:**
- Smallest
- Used for gonioscopy if pupils are undilated
- Use to view pars plana if pupils are dilated