Anterior Segment Ocular Photography

**Thank You!**

- TOA Board of Directors
- Dr. Kevin Gee, TOA President
- Ms. Sherry Ballance
  – TOA Events Coordinator

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- I have no direct financial or proprietary interest in any companies, products or services mentioned in this presentation.

- The content and format of this course may reflect commercial bias and may claim or imply superiority of a particular commercial product or service.
Anterior Segment Ocular Photography

Want to turn this?

Professional Photographers of America

Into this? – Every year!

CPT 92285 External Photography

- 92285- External ocular photography often INCORRECTLY considered ONLY as external photos of the eye.
- Requires interpretation and report for documentation of medical progress
CPT 92285 External Photography

- 92285- External ocular photography
  INCLUDES:
  - close-up Photography
  - slit lamp photography
  - goniophotography
  - stereo-photography
- Some Fundus cameras have dual modes

Mutually Exclusive Procedures on the SAME DAY

- 92285  External Ocular Photography
- 92250  Fundus Photography
- 92225/92226  Extended Ophthalmoscopy
- 92132  Scanning Laser – anterior segment
- 92133  Scanning Laser – posterior segment

Mutually Exclusive Procedures on the SAME DAY

- May have patient return another day to do a different procedure
- May do more than one mutually exclusive procedure in the SAME day IF you have multiple DISSIMILAR DIAGNOSIS to support each procedure

MEDICAL NECESSITY?

- Reason for diagnostic test?
- Directly stated or easily implied
- Will it affect diagnosis or treatment?
- REQUIRES WRITTEN INTERPRETATION & REPORT!

General payment policy

- Medicare reimburses reasonable and medically necessary care to diagnose and treat illness or injury or to improve the function of a malformed body member.

Specific payment policy

- CPT – Current Procedural Terminology Codes
- ICD – International Diagnostic Codes
- NCD - National Carrier Directives
- LCD - Local Carrier Directives
- The golden rule - check carrier contracts
- Use Professional Judgment
Opinions

• Are not payment policy
• Anything outside of NCD, LCD, CPT and ICD is opinion

Imaging medical necessity

• It is not necessary to photograph a condition simply to document its existence but rather to provide a baseline to compare later if the condition has changed and requires a change in treatment.
• It may be necessary to photograph a condition to help establish a proper diagnosis or provide treatment. NOTE REASON ON THE CHART!!

What Can I Photograph?

• Conjunctival problems
  – Pinguecula, pterygium, FB, pigmentation, pannus, burns, etc.
• Corneal problems
  – Ulcers, abrasions, neovascularization, keratitis, dry eye, etc.
• Eyelid problems
  – Ectropion, entropion, sty, hordeolum, ptosis, neoplasms, tumors, etc.
• Eyelash problems
• Cataract problems
• Triachiasis, maderosis, bacterial infection, neoplasms, lice, tumors, etc.
• Pupil problems
• Gonioscopic photography
• Coloboma, iritis, pigmentation, neovascular, trauma, etc.

What Can I Photograph?

• Comprehensive List of Conditions
  – Lists Ocular Conditions & ICD9 Codes

CPT 92285 – Photo Requirements

• The quality of the image should be of sufficient quality to be clinically relevant and graphically equivalent to a photograph. Images can be film based or digitally stored.
• Requires a WRITTEN interpretation and report.

CPT 92285 – Photo Requirements

• 92285 is a BILATERAL fee
  – use 52 Modifier for unilateral photo
• 92285 qty 1 for unilateral or bilateral
• Appropriate ICD9 diagnosis
• Modifiers E1, E2, E3 or E4 if eyelids.
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Photography

MACRO PHOTO TYPES
- Digital
- Film
- Slide
- Polaroid

CAMERA TYPES
- Point & Shoot
  - Viewfinder and/or LCD screen
  - Non-changeable lenses
  - May have accessory add-on lenses
- SLR & DSLR
  - Single Lens Reflex
    - View through lens
    - Changeable lenses

“Point & Shoot” CAMERA & LENS TYPES
- Point & Shoot
  - Viewfinder or LCD focus screen
  - Macro Zoom & Super Macro Zoom
  - Non-interchangeable lenses
  - Add on dioptic or macro lenses
  - Best if camera has manual controls
    - Full manual, aperture priority, shutter priority
    - Built-in flash
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**“Point & Shoot” Cameras**

**SLR & DSLR CAMERA & LENS COMBOS**

- **SLR** = Single Lens Reflex
- **DSLR** = Digital Single Lens Reflex
  - Standard Lens w/Dioptric add-on lenses
  - Standard Lens w/Extension tubes or bellows
  - Standard Lens – reversed on camera body
  - Standard Lens – coupled prime lenses
  - Dedicated Macro Lens

**Digital/Film/Slide SLR Cameras**

**5 Magnification Techniques**

1. Standard lens w/Dioptric add-on lenses
2. Standard lens w/Extension tubes or bellows
3. Standard lens reversed on camera body
4. Standard lens coupled with prime lenses for extremely high magnification
5. Dedicated macro lens

**Polaroid Macro 5 Camera**

- Polaroid
  - As of 2006 Macro 5 no longer produced
  - As of 2009 no more Polaroid film made
  - Also affects all retinal & slit lamp cameras w/Polaroid backs

**LENS TYPES**

- Prime (single focal length)
- Zoom (variable focal length)
- Dedicated Macro (single focal length)
- Accessory magnification solutions
  - Dioptric plus magnifiers and “macro”
  - Teleconverters
  - Extension Tubes
  - Bellows
Accessory Magnification Items
- Plus power magnifiers
- Teleconverters

DEDICATED MACRO LENSES
- Nikon 105mm AF Macro
- Nikon 200mm MF Macro

LIGHT SOURCES
- Ambient lighting
- Built-in camera flash
- Hot shoe mounted flash
- Supplemental lighting
  - Off camera flash, ring flash or twin bracket mount or lens mounted flashes
  - Studio lighting
  - Reflectors, shades, screens, fill lighting

Lighting
- Electronic Flash
- Novoflex twin arm flash brackets
- Novoflex

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Flash & Cord Samples

Lighting – Wireless Nikon R1C1

Lighting – Wireless Nikon R1C1

Point & Shoot Macro

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MAGNIFICATION METHODS
• Diopter Add-on lenses
• Extension tubes
• Bellows
• Teleconverters
• Reverse lens mounts
• Stacked lenses
• Dedicated macro lenses

DSLR w/kit lens & add-on Diopter
Hoya +10D Aspheric lens
Add +2D Close Up lens
Total +12D add-on

Zoerk Macroscope Lens
+12 D double aspheric lens
w/antireflective coatings

DIOPTER ADD-ON LENSES
• ADVANTAGES
  – Inexpensive (except Macroscope)
  – Compact
  – Works with lenses you already have

• DISADVANTAGES
  – Not quite as sharp as a true macro lens
DIOPTER ADD-ON LENS

- RECOMMENDATIONS / SUGGESTIONS
  - Hoya (or equivalent) +10D Aspheric Macro Lens
  - Order thread diameter for your lens 49, 52, 55, etc.
  - Use step rings, if needed, to fit your lens
    www.bhphotovideo.com
    • search Hoya Macro $89.90 + s&h
  - Add +2D to +10D = +12D total on 55mm lens
  - Or use Zoerk +12D Macro scope lens ~ $500

EXTENSION TUBES

- Total Extension
  ------------------- = Magnification
  Focal length
  • Takes 100mm of extension tube for a 100mm lens to reach 1:1 life size magnification.
  • You lose light with extension tubes (and bellows).
  • Compensation = 2 stops of light for every doubling of the lens-to-sensor distance

EXTENSION TUBES

- A hollow ring mounted between a lens and the camera body.
- ADVANTAGES
  - Relatively inexpensive
  - Relatively compact and easy to carry
  - No added glass layers

EXTENSION TUBES

- DISADVANTAGES
  - Not all tubes retain auto metering or auto aperture
  - Must refocus if you zoom
  - Difficult to get the exact length you want
    • Digital cropping or enlargement offsets some of this disadvantage.

BELLOWS

- ADVANTAGES
  - Great flexibility – variable length extension
  - Easy way to get a LOT of extension

DSLR w/Extension Tube or Bellows
**BELLOWS**

**DISADVANTAGES**
- Expensive
- Bulky
- Cumbersome to use
- Does not couple metering or aperture

**TELECONVERTER**

- Lens goes between camera body and camera lens
- May or may not retain auto meter & auto aperture

**ADVANTAGES**
- You may already have one
- No loss of light

**DISADVANTAGES**
- Useful, but somewhat limited for true macro

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**DSLR w/reversed lens**

No auto settings available w/ lens reversed.
Requires two hands to hold aperture “open”.

**REVERSING LENSES**

**ADVANTAGES**
- Optimizes lens for greater than life size
- Allows 1:1 or greater with only the lens

**DISADVANTAGES**
- No meter coupling
- No aperture coupling
- Requires two hands to hold aperture open to focus and operate the shutter

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**DSLR w/stacked lenses**

Put the longer focal length on the camera body and “stack” the shorter focal length in front. Set front lens to infinity focus. Capable of 6X life size macro photography. **SHALLOW DOF!**

**STACKED LENS**

**MAGNIFICATION**

Stacked Lenses

\[
\frac{\text{fl of Prime lens}}{\text{fl of Stacked lens}} = \text{Magnification}
\]
STACKED LENSES

**ADVANTAGES**
- Easy way to get HIGH magnification
- May work with lenses you already have

**DISADVANTAGES**
- Possible vignetting (darkened corners)
- Not all combinations work well

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MACRO LENS

- A regular lens with a greater than normal extension capability built in.

**ADVANTAGES**
- Excellent optical quality
- Convenient to use
- Can be used as regular lens too

**DISADVANTAGES**
- Price

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PHOTOGRAPHY TECHNICAL ISSUES

- Depth of Field
- F stops (aperture settings)
- Shutter speeds
- Focus
- Lighting
- ISO settings
- Working Distance
- “Cook Book” settings that work

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DEPTH OF FIELD (DOF)

- The “heart” of detailed macro photos!
- In macro photography, the biggest challenge is the depth of field.
- Image size, image working distance, magnification, light sources, aperture, shutter speed, lens focal length ALL conspire against larger DOF.
DEPTH OF FIELD (DOF)

- The distance between the closest and farthest items that look acceptably sharp is DOF.
- At normal subject distances, depth of field extends roughly 1/3 in front of your plane of focus and 2/3 behind it.
- At macro sizes, it becomes closer to 50/50. – WATCH YOUR FOCUS POINT!

APERTURE & DOF

- Aperture size is the single most important element controlling depth of field (DOF).
  - With exception of the Scheimpflug Effect
- Most “point and shoot” cameras have a limited range of apertures with f5.6 - f8.0 typically being the maximum and little or no manual controls to choose the aperture.
- SLR/DSLR have complete control of aperture size either on the lens or in the camera settings (f16 to f22+ common).

APERTURE & SLIT LAMPS

- Aperture size in almost all slit lamps is, effectively, “wide open”… I.e. the equivalent of f 1.4 or greater
  - Results in VERY small DOF
  - Higher magnification decreases DOF
  - 40x SLE magnification DOF = approx. 0.1mm
- Explains “why” most photos taken THROUGH bimicroscopes are only “clear” precisely on the focused object
- NO WAY to expand DOF through biomicroscopes due it ITS optics, not yours!

EXAMPLES - DOF

Depth of Field – DOF

“How it Works”

- Larger aperture = SMALLER DOF, small f#
- Smaller aperture = LARGER DOF, large f#
- Constant aperture – move closer, less DOF
- Constant aperture – move away, more DOF
DOF & Magnification

- Magnification affects DOF
- Increased Magnification = SMALLER DOF
- Decreased Magnification = LARGER DOF
- Keep camera body square to point of focus.

Aperture size = “f stops”

- F/stop = diameter of iris divided by focal length of lens,…a RATIO.
- “smaller” number f/stops = larger aperture diameter = Smaller DOF (depth of field)
- “larger” number f/stops = smaller aperture diameter = Larger DOF (depth of field)

Magnification, DOF & Aperture Examples

- 1/10\(^{th}\) life size – DOF = 1.5” @ f5.6
- 1/10\(^{th}\) life size – DOF = 6” @ f22
- 1:1 life size – DOF = <1mm @ f5.6
- 1:1 life size – DOF = 3mm @ f22
- 6X life size – DOF = 0.25mm @ f22!

Aperture & “f stops”

- Typical lens markings:
  - 32 22 16 11 8 5.6 4 2.8 2 1.4
- F/stops double or half the adjacent value exposure
- “stopping down” = making the aperture hole smaller
**Our “Secret Weapon” Effective Aperture & Magnification**

- **Effective Aperture** = Lens Aperture x (1 + Magnification)
- At 1:1 magnification the effective aperture (for gauging exposure) is therefore, approx. 2 “f-stops” smaller than that set on your lens
- i.e. a lens setting of f22 becomes effectively approx. f38 = **greater DOF**

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**What about DIFFRACTION?**

- In “regular” photography using the smallest size aperture can induce “diffraction” and degrade image sharpness.
- In MAGNIFIED MACRO photography diffraction does not appear to be a significant problem!

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**Scheimpflug Effect**

- Increases depth of field simply by tilting the camera lens along its axis in the direction of the image plane.
- **ONLY** technique that increases DOF independently of aperture.

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**Scheimpflug Uses in Optometry**

- Oculus Pentacam (2005) & Oculus Pachycam
- CSO Sirius 3D Tomographer
- Ziemer Galilei G1 Dual Scheimpflug Analyzer Topographer

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Scheimpflug Effect DOF Illustrated

Zoerk Scheimpflug Effect Lens

Nikon swing/tilt Lens

Multi-focus System — tilt, swing, macro
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Zero Lens Tilt

0.5 Degree Lens Tilt

1 Degree Lens Tilt

2 Degree Lens Tilt

3 Degree Lens Tilt

4 Degree Lens Tilt
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**5 Degree Lens Tilt**

**6 Degree Lens Tilt**

**8 Degree Lens Tilt**

**Carrying it “too far”!**

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**FOCUS**

- Critical due to shallow DOF
- **TIP:** in ocular photography focus carefully on the corneal reflection of a light because DOF using aperture of f22 – f38 will result in almost every anterior structure of the eye being in focus from the tip of the eyelashes to the iris!

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**LIGHTING**

- Flash lighting recommended.
  -- Eliminates “grain/noise” in photo
- On-board flash works well for physically shorter lenses, but may cast a shadow with physically longer lenses.
- External lights (ring, single or twin flash) mounted on end of lens eliminate shadows
  -- Recommend single or twin but NOT ring flash (HUGE light artifact)
- TTL (through-the-lens) metering or manual settings depend on lens & camera used.
ISO SETTINGS

- International Standards Organization
- “Speed” rating of image sensor
- Similar to ASA ratings of film speed
- Higher ISO allows faster shutter speeds or smaller aperture for same amount of light
- Many cameras offer “auto” ISO settings
- Better quality images at ISO less than 400
  - Avoids digital “noise” / grainy appearance
- Best images at ISO 100 or 200

WORKING DISTANCE

- Macro photography is almost always close to the subject.
- Longer lenses = longer working distance
  - 55mm lens = 3-4” working distance
  - 105mm lens = 6-8” working distance
  - 200mm lens = 12-16” working distance
- Longer working distance = increased DOF
- Shorter working distance = decreased DOF

PHOTOMACROGRAPHIC ABFO No. 2 RULER

$3.95 from www.crimesciences.com
Or use your PD ruler

“COOK BOOK” SETTINGS

- DSLR – kit lens (typically 55mm lens)… set at longest focal length… 55mm - Add +12D Macro close-up lenses
- Focus – infinity
- Shutter – Manual @ 1/60 or 1/125 sync
- Aperture – maximum or near maximum available (f16 – f32… eff. f22 to f45)
- On board flash – ON
  - TTL metering – ON
- Auto focus – OFF
- Manually move to focus on a light reflex on cornea or desired specific structure

Set zoom lens to 55mm

Program Dial to Aperture
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Aperture set to Max. f stop

Or... manually set Aperture to Max. f stop & shutter to M 1/125

Or... manually set Aperture to Max. f stop & shutter to M 1/125

Add +10 Macro & +2 Diopter

Or use +12D Zoerk Macroscope
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Set Focus at Infinity

Auto Focus set to Manual

Camera ready for macro photo

“COOK BOOK” SETTINGS

- DSLR with dedicated 90 or 105mm macro lens
- Set desired amount of magnification on lens
- Set Program Dial to Manual
- Built-in flash – ON
  - TTL metering – ON if “auto lens”
- Manual metering if not automatic lens
  - may have to manually set amount of flash in menus
- Aperture – set f22-f32
- Shutter – within rating for camera flash sync
- Focus set at infinity – Manually move to focus on a light reflex on cornea or desired specific structure

DSLR w/105mm Macro lens

Set Magnification & Aperture
Program Dial to Manual

Auto Focus set to Manual

DSLR w/105mm 1:10 ratio

DSLR w/105mm 1:1 ratio

Twin flash 1:1 Magnification

EYE-FI SD CARD

- Eye-Fi SD wireless memory cards
  - 4GB ($40) & 8GB ($80) & 16GB ($99) cards available
  - Wireless connection to Computer via Wi-Fi
  - Adapters available for MMC & CF cameras
- Automatically transfers photos to computer wirelessly!
- www.eye.fi (no, this is NOT a .com URL)
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### DSLR Cameras to Consider

Pssst #1... your skill as a photographer is more important than the brand of camera.
Pssst #2... More pixels isn't as important as learning to focus well & hold the camera STILL!

**Pentax**
- K100DS (6MP), <$300 eBay
- K200D (10MP), <$300 eBay

**Canon EOS**
- Rebel T2i, T3i, T4i - 18 MP - ~ $650

**Nikon**
- D40 [2006-2010] - 6MP - ~ $400
- D3200 - 24MP - $700
- D800 - 36MP - $3,000

### Macro Lenses to Consider

Auto-focus lens is NOT a priority! Manual focus in macro photography gives you MUCH more control!

- **Lester-A-Dine Macro 105mm… aka Kiron Macro 105mm – OUTSTANDING lens (almost legendary glass)**
- **Vivitar Series-1 105mm macro lens – also Excellent glass**
- **Any Brand name dedicated Macro lens of 90-105mm focal length**
  - Check f-stop specifications, nothing less than f22
- **Pentax lenses of almost ALL generations fit and work on Pentax DSLR bodies… and they are usually VERY affordable!**

### Wanna go “all-in”?!?

Hasselblad H40D-200MS – 50MP raw to 200MP w/6 shot sequential combination

$36,000 BODY ONLY Lenses $5K to $10K EACH!

### SAMPLE PHOTOS

Normal healthy eye wearing soft contact lens 1:1.5
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Normal healthy eye wearing contact lens 1:1

Corneal FB before removal

Cornea after FB removal

FB on 28 gauge insulin needle

FB on Q-tip

Cornea after FB removal & Algar brush

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Nasal pterygium

Conjunctival Neovascular Cyst

Subconjunctival hemorrhage & irregular pupil
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Viral conjunctivitis “pink eye”

Double corneal graft w/neovascularization

Protein deposits on contact lens

Protein deposits on contact lens

Corneal haze/scarring after Herpes Simplex

Hair growing out of facial neoplasm near eye
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- Dermoid cyst w/ hair growing out of it
- Dermoid cyst after hair removed
- Blepharochalasis / Dermatochalasis
- Stye/hordeolum
- Stye/hordeolum & peripheral iridotomy
- Ptosis & Facial Telangiectasia (tel-an-jeck-tasia)
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Heterochromia

Nuclear sclerotic cataract through slit lamp

Iris coloboma – inverse keyhole

Ciliary Ruff (aka ectropion of Uvea)

DINE Pentax Optio V10 Intra-Oral Dental Camera

SAMPLE PHOTOS

www.dinecorp.com
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Anterior Photo Challenges

- Ocular photography is NOT too difficult.
- Ocular photography IS profitable.
- Anterior Segment Photography is medically reimbursable.
- Enhances YOUR practice and improves patient education.

Anterior Photo Challenges

- It is NOT hard to learn to utilize the technology
- OD’s frequently have a hard time billing what they and technology are worth
- Learn to “order tests” vs “selling tests”
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PRACTICE BENEFITS

• Better documentation
  – Which is better, your hand drawn picture or a detailed, well lighted, in-focus photo?
• Great Patient Education tool.
• Great telemedicine via Encrypted PDF files or surface mail with MD's.
  – Comanagement & Referrals
• Ties patient to YOUR practice.

Let’s Talk $$$ - Reimbursement

• CPT 92285 – Medicare TX - $44.44
• 1 per day x 240 days = $10,666
• 3 per day x 240 days = $31,998
• 5 per day x 240 days = $53,330
• Takes 1 minute to take photos
• Takes 4 minutes to process/print interpretation and report.
• Can be delegated to staff!

Possibilities?

Dreams CAN come True!

Questions?

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