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### COT Written Exam Review

**Part 1 of 2**

Presented by:
Amy Jost, BS, COMT, CCRC, OSC

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--- | --- | --- | ---
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See pages 30–34 for COT exam content details.

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Preparing for the COT Exam: A Study Guide

Includes: descriptions of the exam, screen captures, sample exam questions, and study tips. $15.00

Ophthalmic Medical Assisting: An Independent Study Course, 5th Edition, AAO

Fundamentals for Ophthalmic Technical Personnel, Barbara Cassin


www.ophthobook.com/videos

History Taking (6% of Exam)

- Ocular – CC, HPI
- Medical/Surgical
- Medication – Allergies
- Social
- Family
History Taking

- All patient's history recorded with accuracy, in the patient's own words, if possible
- A good history provides valuable information
- Additions and corrections must be made properly.

Chief Complaint

- Chief complaint asks the question what is the reason for your visit? “Why is the patient here today?”
  - Problem = diagnosis, symptom, condition
  - This is the subjective problem in the patient's own words
  - Identify the problem with accuracy and efficiency
  - Listen first, write it second

Quantifiers of HPI

- Location (OD vs OS)
- Quality (Sharp or dull pain)
- Severity (mild, moderate or severe)
- Duration (How long does it last?)
- Timing (When did it start?)
- Context (Were you doing anything when it happened?)
- Modifying factors (Has the patient tried any treatments?, Does anything make it better or worse?)
- Associated signs and symptoms (flashes/floaters)

Ocular History

- Contact lens and/or spectacle wear history
  - Age at first eye glass prescription?
  - Were eyes equal then?
- Diagnosis of all eye diseases or conditions
- Eye injuries
- Surgeries and laser procedures
- Eye therapies, patching, prism, etc.
  - Past IOL information is important
  - Should include date of surgery, which eye, surgeon’s name, and specific pertinent details

Review of Systems

In general, what symptoms is the patient experiencing right now or in the recent past (within the last 2-3 days)

- Allergic/ Immunologic
- Cardiovascular/ Cardiac
- Constitutional Symptoms
- Ears, Nose, Mouth, & Throat
- Endocrine
- Eyes
- Gastrointestinal

- Genitourinary
- Hematologic
- Integumentary
- Musculoskeletal
- Neurological
- Psychiatric
- Respiratory

Medical History

- Diagnosis of systemic diseases and conditions
- Illnesses and Injuries
  - DM, HTN, heart disease, kidney disease, headaches, fractured hip
- Medical/Surgical treatments:
  - Especially recent, major, or relevant surgeries
  - Includes any therapies, such as chemotherapy, radiation, etc.
- Note the difference between a negative finding vs. an omission
Systemic Medications

- Prescribed medicines
  - Name, dosage, (strength if applicable), purpose
- OTC medications
  - Pain relievers, etc.
  - Vitamins and minerals
  - Herbs and supplements
- Watch your spelling
- Match medications with medical conditions

Ophthalmic Meds/Treatment

- All prescribed and non-prescribed drops, gels, ointments, injections, and oral medication patient is taking for their eyes
  - Dosage, strength, and specifics all should be included
  - Documentation of last dosage, if indicated, i.e. History of glaucoma
  - Compliance may also be noted
- Lid scrubs, hot or cold compresses, or similar therapies, patching, etc.

Allergies

- Drug
  - Systemic
  - Ophthalmic
- Environmental
- Differentiate Allergy vs. Adverse Reaction
  - Allergy- can be dangerous (i.e. itching, redness, rash, constricting airway, anaphylaxis)
  - Side effects- uncomfortable (i.e. nausea, dizziness, sleepiness)

Social & Family History

- Social Hx:
  - Usage of tobacco, alcohol, drugs
  - Occupational needs
- Family Hx:
  - Ophthalmic conditions: Glaucoma, cataracts, retinal disease, etc.
  - Systemic conditions: Diabetes mellitus, hypertension, cancer, etc.

Pupillary Assessment
(5% of Exam)

- Measure
- Compare
- Evaluate
- RAPD

Measure Size

- Size (in mm)
  - In each eye and comparison between 2 eyes
  - Anisocoria
    - Worse in dim or bright light?
    - Horner’s (miosis, ptosis, and anhidrosis)
    - Argyll Robertson/Adie’s tonic pupil (minimal light reaction, reacts to accommodation)
APD Video

Contact Lenses
(3% of Exam)

- Hard, Soft, and RGP lens characteristics
- Oxygen permeability/ dK value
- Toric lenses/ Truncated
- Bifocal/multifocal
- Aphakic/ Bandage lenses
- Daily wear/ Extended wear

CL Fitting: Base Curve

- Use keratometry
- Curvature of the back of a contact lens
- Typical base curves of soft contacts 8.4, 8.6, 8.8
- Steeper corneas need steeper base curves
  - Higher the K value, lower the BC value
- Base curve is crucial for a good fit.
  - Too tight
  - Too loose
  - Just right

Spherical Equivalent

- Equivalent (or "summary") of a glasses prescription expressed only as a sphere
- Used to calculate spherical contact lenses
- Calculate SE:
  - Step 1) Take half of the cylinder.
  - Step 2) Add this to the sphere algebraically.
  - Step 3) Drop the original cylinder & axis.

- Ex: -4.00 -2.00 x 90
  - Half of -2.00 = -1.00
  - (-1.00) + (-4.00) = -5.00 sph

CL Fitting: Power

- Amount of refractive correction in the lens
- Measured in diopters
- Vertex distance: "more plus" or "less minus" as you get closer to the eye,
  - Ex. -6.00 Rx in glasses, about -5.50D in CLs
- May be spherical (<1D of cyl) or contain astigmatic correction (≥ 1D of cyl)
- May also contain presbyopic correction

CL Fitting: Diameter and Curve

- Measured in millimeters (mm)
  - Cornea: 12mm
  - Soft CL: 14mm
  - RGP: 9–10mm

- Instruments: radiuscope (b.c. of lens), V-groove, Loupe, Shadowgraph, Lensometer (power of hard or RGP lens)
Cl Fitting: dK Value

- dK refers to the oxygen permeability of the lens.
- The higher the dK value, the greater the amount of oxygen that passes through the material of the lens.

Cl Fitting: Patient Counsel

- Dry Eyes, Tear Quality
- Keratoconus
- Astigmatic Correction
- Presbyopic Correction
- Soft Lenses vs. Gas Permeable pro’s & cons

Diffractive Bifocal RGP

Toric CLs

- Toric indicator/alignment markings

Piggy-Back Contact Lenses

Cl Fitting: Materials

- Hard (PMMA) vs. RGP (silicone acrylic, silicone vs. fluoropolymers)
- Soft lenses
  - Most are HEMA material
  - Now fluoropolymers
  - Spincast vs. cast molded vs. lathe-cut
- Know general differences in materials
Patient Instruction

› Insertion and Removal
› Cleaning and Storage
   ◦ Solutions (peroxide cleaners most effective)
   ◦ Hygiene (of CL’s & CL storage case)
› Wearing time (follow recommendations)

Goals for Fitting CL:

› Centration
› Good movement
› Stable vision

Fitting Too Tight or Too Loose

› Loose lens:
   ◦ FBS, blur after blink, excessive movement, lens lag, edge stand off
   ◦ Better to start too loose than too tight, adjust to tighter fit as needed
› Tight lens:
   ◦ “Soreness, without FBS”, ghost images/shadows, foggy vision
   ◦ Redness, trapped air under lens, cornel edema, no lens movement

Other CL Fitting Considerations

› Pupil diameter
› Eyelid tightness and fissure size
› Fluorescein pattern
› Over–refraction
› Pediatric
› Contraindications

Neovascularization

› Development of new blood vessels; Pannus
› Lack of oxygen or corneal irritation from CL
› Recommend higher Dk/L &/or looser lens fit
› Worst case: discontinue CL use temporarily or permanently

Ulcers

› Infiltration of corneal tissue
   ◦ Bacterial, viral, fungal, protozoan (acanthamoeba)
   ◦ Can be caused by lack of oxygen
› Possibility of corneal perforation
› If recurrent, check if pt is immunocompromised
› Marginal vs. central
› Sterile vs. infectious
Spectacle blur

- Can be caused by
  - Corneal molding (warpage)
  - Corneal edema (swelling)
  - Combination of both
- Can last from minutes to weeks before resolves after D/C CL's
- RGP higher effect than Soft CL's

GPC

Lens Deposits

- Protein deposits
- Calcium deposits
- Inadequate cleaning method or solution
- May need enzymatic cleaner
- Can cause GPC
- Possible allergic response to deposits
- As deposits worsen, wearing time tolerability lessens

Protein Deposits on RGP

Keratoconus

- Thinning of cornea, bulging corneal tissue
- Irregular astigmatism
- Progressive steepening as ectasia worsens
- RGP can correct for early to mid-stage KCN
- RGP acts as new front surface for refraction
- Munson’s sign and bulge, as pt looks down, examiner can see the bulge

Equipment

Maintenance & Repair

(4% of Exam)

- Ophthalmic Lenses
- Instruments
- Equipment
**Instrument Maintenance**

- Acuity Projectors
- Ophthalmoscopes
- Retinoscopes
- Lensometers
- Perimeters
- Tangent Screen
- Phoropters
- Slit Lamps
- Ultrasound biometry
- Keratometers
- Lenses
- Tonometers
- Muscle Light
- Special Instruments (Equipment)
- Surgical Instruments

**Acuity Projectors**

- Used to measure visual acuity
- Electrical connections
- Projector—blow off dust
- Slides—lint-free cloth, photo-paper, replace darkened slides
- Bulb—avoid touching with your fingers (oils lessen the life of bulb)
- Mirror—use only canned air or specified cleaning cloths

**Ophthalmoscopes**

- Used to visualize/examine inside of the eye, usually the fundus
  - Direct
  - Indirect
- Electrical connections or battery
- Bulb
- Loose lenses (20D, 90D, others)

**Retinoscopes**

- Used to conduct retinoscopy (objective observance of refractive error)
- Front mirror—blow off dust
- Battery—Lithium ion, rechargeable
- Bulb—store instrument upright, filaments bend/distort light if stored horizontally

**Lensometers**

- Used to measure the refractive power of the lenses in glasses (or RGP/hard CLs)
- Manual lensometer
  - Cleaning lenses (blow off dust), dials (soft cloth), stands (do not lubricate/call professional)
- Auto–lensometer
  - Electrical connections
  - Cleaning lenses, stands
  - Utilizing correct modes

**Perimeters**

- Used to measure field of vision
  - Humphrey visual field
  - Goldmann visual field
  - Other
  - Calibrating lighting conditions
  - Cleaning
  - Maintenance
  - Trial lens maintenance
Phoropters
- Used for the measurement of refractive error including sphere, cylinder, axis, distance and near, with/without prism, IPD, level, etc.
- Cleaning lenses—blow off dust, lens tissue
- Face shields—clean &/or exchange as needed
- Other maintenance—always let a professional service inside the phoropter ~Q2yrs
- Do not use alcohol of phoropter (except face shields)

Slit Lamps
- Used to examine the eye at various magnifications; also used for tonometry
- Electrical connections
- Bulb
- Cleaning the:
  - lenses/mirrors (dust brush/cloth/photo—glass cleaner & cotton balls)
  - stand (clean the pad, sewing machine oil at ball joint)
- Maintenance of joystick, dials, etc.

Tonometers
- Used to measure intraocular pressure (IOP)
- Cleaning, maintenance, and storage
  - Goldmann
  - Tonopen
  - Non-Contact tonometer
  - Perkins tonometer
  - Schiotz tonometer
  - Other

Calibration of Tonometry Units
- Check at 0, 20, & 60mmHg

Ultrasound
- A-scans and/or B-scans used to measure axial length and/or orbital abnormalities
- Electrical connections
- Cleaning the probe
- Maintenance of probe, foot pedal, unit, printer (changing paper)
- Calibrating the unit

Keratometers
- Used to measure the corneal curvature, determine amount/location of astigmatism, identify corneal irregularities
- Electrical connections
- Bulb—check for deposits/darkening, & replace as needed
- Occluder
- A.K.A. Ophthalmometer
Check Calibration of Keratometer

- Check calibration with silver calibration spheres
- Call service professional if needed

40.50, 42.50, 44.75

Lenses

- Used to magnify a view of the eye for examination
- Cleaning, maintenance, and storage
  - Loose lenses
    - Non-contact: Hruby lens, Condensing lenses, funduscopic lenses
    - Contact: Gonio, fundus contact lens, Koepe lens
  - Trial lenses
  - Gonio lenses
  - RGP/hard contact lenses
  - Soft contact lenses (Bandage CLs)
  - Other

Muscle Light

- Used to illuminate external and some internal structures of the eye; used as a fixation focal point
- Battery
- Bulb - store instrument upright, filaments bend/distort light if stored horizontally

Special Instruments (Equipment)

- Used to measure various elements of structure and performance of the eye
- Cleaning, maintenance, and storage
  - Auto-refractor
  - Pachymeter
  - Endothelial Cell Count/Specular Microscopy
  - Topography units
  - OCTs, HRTs
  - Biometers
  - Cameras
  - Other

Surgical Instruments

- Used to perform various surgical procedures
- Cleaning/ Sterilizing of instruments
- Clean, maintenance, and storage
  - Sharps
  - Disposables
  - Reusable instruments
  - Microscopes
  - Loupes

Lensometry

(5% of Exam)
Lensometry
- Sphere
- Cylinder power/axis
- Prism
- Multifocal power
- Multifocal induced prism
- Base curve
- Lensometer
- Lens “clock”
- Estimation with loose lenses
- Aphakic lenses
- Recording prescription
- Transposition

Neutralize Spectacles
- Used to neutralize or “read” a prescription from a pair of glasses, loose lenses or rigid contact lenses.
- Used to locate optical centers of lenses.
- Used to “read” prism in lenses.
- Used to “read” bifocals, trifocals (adds)

Automated Lensometer
- Several brands on the market
- Measures quickly and accurately the sphere, cylinder, axis and prism of a lens.
- Digital display can be printed on paper tape.
- No focusing of eyepiece or target is required.
- Eliminates need for mathematical determination of cylinder or add power.

Manual Lensometer

Measuring Glasses
- Focus Eyepiece
- Place spectacles on the platform so that both lenses are resting on the platform
- Center the target
- Focus and align target using the power wheel and axis wheel
Spherical Lenses

- All target lines come into focus at the same time.

Astigmatic Lenses

- Thin target lines and wide target lines do NOT come into focus at the same time.

Lensometry Readings

Example:
The first reading (thin lines) is +3.00. The second reading (wide lines) is -1.00. The axis reads 45. What is the prescription?

Answer: +3.00 -4.00 x 045

Geneva lens clock

Measures lens base curve

Ground-In Prism and Slab Off

- Prism added to the glasses to accommodate for an abnormal eye turn
- Decreases or eliminates diplopia
- Increases vision quality and depth perception
- Slab off used when anisometropia causes vertical imbalance in a set of bifocal lenses

Fresnel Prism

- Prism “sticker” adhered to glasses
Aphakic glasses

Keratometry
(5% of Exam)

- Contact lens fitting
- IOL calculations
- Keratoconus detection
- Irregular cornea detection

Keratometry or Ophthalmometer

Keratometry

- Measures the central curvature of the anterior cornea
- Readings are called K-readings
- Measures in two meridians
- Measured in diopters
- Average cornea has a power of 42.00–44.00 D
- Note mire quality:
  - Clear vs. 1+ to 4+ distorted

Steps to Performing Keratometry

- Focus the eye piece
- Instruct the patient
- Position the patient
- Position the keratometer
- Focus and center the mires
- Locate the axis by rotating the drum
- Align the plus signs and minus signs
- Read/Record the measurement
Corneal Astigmatism

- For Example: K’s 42.00 x 90°/43.50 x 180°
- Steep Meridian = “the bigger one” = 43.50
- Flat Meridian = “the smaller one” = 42.00
- Difference between two meridians = amount of corneal astigmatism
  - 43.50 – 42.00 = 1.50 D
- Plus cylinder power: +1.50D x 180° or
- Minus cylinder power: -1.50D x 90°
- Keratometry does NOT measure lenticular astigmatism

Medical Ethics, Legal and Regulatory Issues

(3% of Exam)

- Coding
- Government/Institutional Rules & Regulations
- Quality Assurance
- Ethical & Legal Standards
- Scribing
- Confidentiality
- Informed consent

Third Party Coding

- Basic understanding of chart documentation to meet coding requirements
  - For Example:
    - 4 points HPI
    - 3 points for Family & Social History
- Basic understanding of coding levels
- E&M codes

Legal Forms & Government Services

- HIPAA, Privacy Laws
- Consent forms for surgery, procedures, services, & products
- Medicaid/Medicare
- BWC forms/services
- Disability forms
- FMLA forms

HIPAA

- Health Insurance Portability and Accountability Act of 1996
  - Restricts use and disclosure of health information
  - Confidential communications concerning patient’s condition and treatment
  - Printed copy of the privacy practice of the provider
Quality Assurance

- Protecting patient privacy
- Trained, skilled competent staff members
- Equipment is calibrated/cleaned/good working order

Ethical & Legal Standards

- Professional conduct
- Code of Ethics
- Respect and Sensitivity
- Thorough and accurate documentation
  - “If it’s not documented, it didn’t happen”
  - A patient’s chart is a legal document and should be treated as such.

Scribing

- Documentation standards
- Certification/Licensure required by CMS/CPOE
- Understand limitations

Informed Consent

- Patients have the right to make the decision about what they will and will not allow.
- Patient is educated and asked to help in the decision making process.
- Patient must be informed of common and uncommon risks.
- These steps must be documented in the patient’s chart.

Microbiology

(3% of Exam)

- Office antisepsis
- Universal precautions
- Specimens and biopsies
- Cultures

Office Antisepsis

- The technique of preventing infection and the growth of microorganisms.
  - Never touch the eye with a dropper bottle or ointment tube during instillation of meds.
  - Clean tonometer tips properly.
  - Use tonopen covers.
  - Wipe down equipment, occluders, chin rests, forehead straps, chairs, etc. between patients.
OSHA Regulations

- Personal Protective Equipment
- How to handle a blood spill
- What to do if a needle–stick occurs
- Sharps containers
- BioHazard containers

Universal Precautions

- Body fluids known to transmit HIV and HBV include:
  - Blood, Cerebrospinal fluid, Amniotic fluid, Synovial fluid, Semen, Vaginal secretions
- Body fluids not known to transmit HIV and HBV include:
  - Tears, Saliva, Sputum, Sweat
  - If contaminated by blood, these fluids should be suspected to carry HIV and HBV

Microbiology

- Inflammation
  - Causes damage
  - Symptoms: Redness, swelling, pain, heat
- Infection
  - WBC’s
    - Early: Phagocytes, Monocytes
    - Later: Macrophages

Bacterial Cultures

- Scrapings or smears of ocular tissues collected for evaluation of infection or disease
  - Chocolate
  - Blood
  - Sabouraud
  - Mannitol Salt

Other Cultures

- Viral
- Fungal
- Protozoan

An example of severe fungal keratitis (Dr Philip Thomas, Tiruchirappalli)
Pharmacology
(5% of Exam)

- Ocular medications
- Instilling and identifying
- Educate patients on medications
- Drug reactions

Drug Delivery

- Topical Administration
  - Drops (Solution vs. Suspension vs. Emulsion)
    - Advantage: Easy, quick absorption into eye with systemic absorption
    - Disadvantage: May not penetrate cornea, may not extend beyond anterior segment
  - Ointments
    - Advantage: longer contact time, more difficult for kids to flush away with tears
    - Disadvantage: blurred vision, longer contact time may irritate cornea
  - Sustained release
    - Advantage: longer contact time, dose less often
    - Disadvantage: uncomfortable, can dislodge

Drug Delivery (continued)

- Injections
  - IV (intravenous) - rapid absorption
  - IM (intramuscular) - for slower absorption of higher doses
  - Periocular - inject around the eye
  - Retrobulbar - behind the eye
  - Subconjunctival - under the conjunctiva
  - Intracameral - into the anterior chamber
  - Intravitreal - into vitreous
- Systemic (oral)
- Complications of each

Drug Delivery (continued)

- Systemic (oral)
  - Advantage: increased compliance, less hassle than eye drops/ointments, longer lasting effects
  - Disadvantage: systemic absorption, possible adverse reaction, longer lasting effects

Ocular Pharmacology

- Diagnostics:
  - Topical Anesthesia
  - Mydriatics and Cycloplegics
  - Ophthalmic Dyes

- Therapeutics:
  - Antibiotics
  - Antivirals
  - Dry Eye
  - Corticosteroids
  - NSAIDS
  - Combination Drugs
  - Allergy
  - Oral

- Therapeutic Ophthalmic Drugs:
  - A drug used to treat an ocular disease
  - Local
    - Eye Drops
    - Ointment
    - Gel
    - Periocular (sub-conj, sub-tension, peribulbar, retrobulbar)
    - Intracocular (intracameral, intravitreal)
  - Systemic
    - Oral
    - IV
    - Intramuscular
Educate Patients on Medications

- Hygiene
- Proper instillation
- Proper Storage
- Dosing
- Compliance
- Expiration and Usage

Drug Reactions

- Allergies
- Side Effects
- Contraindications

Basic Ocular Motility

- **Fixation:** maintaining the gaze in a constant direction
- **Vergence:** simultaneous movement of both eyes in opposite directions to obtain/maintain single binocular vision
  - Convergence: simultaneous inward movement of eyes
  - Divergence: simultaneous outward movement of eyes
- **Ductions:** an eye movement involving one eye
  - Abduction: Horizontal lateral eye movement
  - Adduction: Horizontal medial eye movement
  - Supraduction: Vertical upward eye movement
  - Infrauduction: Vertical downward eye movement
- **Versions:** an eye movement involving both eyes moving synchronously and symmetrically in the same direction

Ocular Motility

**Understanding the Color Code:**

- **TAN:** anti-infectives or anti-microbials
- **PINK:** anti-inflammatories or steroids
- **GRAY:** NSAIDs
- **RED:** mydriatics or cycloplegics
- **GREEN:** miotics
- **YELLOW/BLUE:** beta-blockers
- **PURPLE:** adrenergic antagonist
- **ORANGE:** carbonic anhydrase inhibitors
- **TURQUOISE:** prostogandin analogues

Ocular Motility

(5% of Exam)

- Version and Ductions
- Functions, Anomalies/Nystagmus
- Cover Tests, Worth 4-Dot test, Maddox rod
- Hirschberg test, Krimsky test
- Stereoacuity, Fly Test
- Strabismus with prisms
- Near point convergence/ Near point accommodation
- Fusional convergence amplitudes
- Convergence training/Amblyopia therapy

Basic Ocular Motility

- **Saccade:** fast eye movements that move the eye from one target to another
- **Pursuit:** slow, smooth eye movements that track a target
- **Nystagmus:** involuntary movement of the eyes in a rhythmic pattern (vertical, horizontal, rotary)
- **Accommodation:** the process by which the eye increases optical power to maintain a clear image (focus) on an object as it draws near
- **Stereopsis:** the ability of the eyes and brain to interpret a presented image as three dimensional
- **Anisometropia:** unequal refractive error between the two eyes

Sclera

- Definition
- Description
- Structure
- Function
Muscle Insertions

Muscle Innervation

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Innervating Nerve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior oblique</td>
<td>CN IV (Trochlear Nerve)</td>
</tr>
<tr>
<td>Lateral rectus</td>
<td>CN VI (Abducens Nerve)</td>
</tr>
<tr>
<td>Superior rectus</td>
<td>CN III (Oculomotor Nerve)</td>
</tr>
<tr>
<td>Inferior rectus</td>
<td>CN III (Oculomotor Nerve)</td>
</tr>
<tr>
<td>Medial rectus</td>
<td>CN III (Oculomotor Nerve)</td>
</tr>
<tr>
<td>Inferior oblique</td>
<td>CN III (Oculomotor Nerve)</td>
</tr>
</tbody>
</table>

Note: Remember, “LR6, SO4, all the rest are 3”

Extraocular Muscle Actions

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Primary Function</th>
<th>Secondary Function</th>
<th>Tertiary Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medial rectus</td>
<td>Nasal (adduction)</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Lateral rectus</td>
<td>Temporal (abduction)</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Superior rectus</td>
<td>Upward (elevation)</td>
<td>Incyclotorsion</td>
<td>Adduction</td>
</tr>
<tr>
<td>Inferior rectus</td>
<td>Downward (depression)</td>
<td>Incyclotorsion</td>
<td>Adduction</td>
</tr>
<tr>
<td>Superior oblique</td>
<td>Incyclotorsion (rotate towards nose)</td>
<td>Depression</td>
<td>Abduction</td>
</tr>
<tr>
<td>Inferior oblique</td>
<td>Excyclotorsion (rotate away from nose)</td>
<td>Elevation</td>
<td>Abduction</td>
</tr>
</tbody>
</table>

Evaluation Assessment Methods

Worth 4–Dot Test
- Normal binocular vision = four lights
- Eye behind red lens (right) is suppressed = three lights
- Eye behind green lens (left) is suppressed = two lights
- Patient has diplopia = five lights

Maddox Rod:
- Used to objectively measure a heterophoria by placing Maddox Rod in front of one eye of a subject and viewing a spot of light binocularly

Stereopsis (Titmus Fly Stereotest):
- Consists of various vectograms
  - Approximately 3000 seconds of arc of retinal disparity at 40 cm
- The other vectograms of the test provide finer tests for stereoscopic acuity
**Evaluation Assessment Methods**

**Cover-Uncover Test:**
- If no movement, then ortho
- If movement, the patient has a tropia, not Exo-, Eso-, Hyper-, or Hypotropia

**Alternating Cover Test:**
- The occluder is introduced and held in front the eye for 1-2 sec and then moved quickly to the other eye and held in place for 1-2 sec
- Repeat at least 3 times – not allowing binocular fixation to occur
- If no movement, then no phoria or tropia
- If a phoria is detected, note the direction
  - Exo-, Eso-, Hyper-, Hypophoria
- Neutralize deviation using prism

**Hirshberg’s test:**
- To detect the difference between strabismus and pseudostrabismus
- Direct a penlight into the child’s eyes
- If the eyes are aligned, the reflection from the light will be in the same spot of each eye
- If strabismus is present then the reflection from the light will not be in the same spot of each eye

**Krimsky Prism Test:**
- Neutralize the Hirschberg reflex with prism
- Place prism before the fixating eye until the light reflexes are symmetrical

**Near Point of Accommodation “Push Up Test”:**
- Slowly move relatively small letters closer to the eye until they become blurry
- Measure the distance the letters became blurry

**Near Point of Convergence (NPC):**
- This test measures the distance from your eyes to where both eyes can focus without double vision
- Record in mm (or to the nose)
- Normal $\leq 7$ mm

---

**Assisting in Surgical Procedures**

(6% of Exam)
Assisting with Surgical Procedures
- Instrument preparation
- Refractive surgery
- Aseptic technique
- Non-refractive laser therapy
- Intraocular injections
- YAG laser
- Sterilization
- Surgical site identification
- Scrub technician duties
- Surgical ophthalmic equipment
  - Phacoemulsifier
  - Vitrectomy units
  - Laser automated keratometer
- Laser safety

Assisting with Surgical Procedures
- In the OR
- In the Laser Room (YAG- Capsulotomy or Iridotomy; Argon)
- In the Refractive Laser Center
- In the Minor Room
- In the Exam Lane

In the OR
- In the Laser Room (YAG- Capsulotomy or Iridotomy; Argon)
- In the Refractive Laser Center
- In the Minor Room
- In the Exam Lane

Surgical Site Identification
- Time-out: Verify patient, doctor, procedure and which eye, what location

Fundamentals of Microbial Control
- Universal Precautions:
  - Treat every patient as though he or she has an infectious disease.
- Sanitation
  - Hand hygiene - VERY important
  - Personal Protective Equipment (PPE)
- Contamination
  - Safe handling & disposal of sharps/waste
  - Disinfection - reduce microorganisms
  - Sterilization - eliminate microorganisms

Fundamentals of Microbial Control
- Aseptic Technique:
  - Don’t touch what isn’t sterile
  - Don’t drop hands below table level
  - Nothing behind you is sterile
  - Don’t pick up fallen objects
  - Avoid skin contact
  - You must acknowledge/mention violation of sterile field

Refractive Surgery
- Basic understanding of options
  - LASIK, LASEK, PRK
YAG Laser

- PCO
- PI

Laser Safety

- Protective Equipment:
  - Eye protection
  - Limited number of people present in the room
  - Calibrations performed
  - Equipment in good working order

Minor Surgery

- Surgeries which are typically performed in the doctor’s office.
  - Examples: chalazion excision, lid lesion excision, lacrimal duct probe and irrigation

Minor Surgery

- Cryo – uses cold
  - Ex: retinal tears, lesions
- Cautery – uses heat
  - Stops bleeding
- Laser – uses focused amplified light
  - Retinopathy, glaucoma, PCO

Minor Surgery

- Assisting the surgeon
  - Anesthetics
  - Preparing the patient
  - Instruments/supplies
- Instructing the patient
  - Consent
  - Expectations

Intraocular Injections

- Intravitreal injections
- Sub-Conjunctival injections
- Intra-cameral injections
- Various anesthesia injections: Retro-bulbar, peri-bulbar, etc.
Speaking of Sharps...
Cut! Let's take a break...

Ophthalmic Patient Services and Education
(7% of Exam)

Anatomy & Physiology
- Basic understanding of systemic conditions and how they may affect the eye

Ocular Diseases and Disorders
- Know common disorders of the:
  - Eye muscles
  - Eye lids
  - Conjunctiva
  - Sclera
  - Cornea/anterior segment
  - Glaucoma/anterior chamber
  - Iris
  - Lens/cataract
  - Vitreous, retina, macula, choroid
  - Optic nerve

Patient Services and Education
- Patient Education
  - Surgery
  - Safety glasses
  - Systemic & ocular diseases
  - Anatomy & physiology (general & ocular)
- Patient Instruction
  - Medication
  - Tests
  - Procedures
  - Treatments
- Eye Dressings
- Patient flow
- Triage
- Forms & Manuals
  - Vital signs
  - CPR

COT Written Exam Review
Part 2 of 2
Presented by:
Amy Jost, BS, COMT, CCRC, OSC
Ocular Dressings and Shields

- Indications
  - Post-surgical dressings
  - Pressure patch
  - Prevent lid movement or
  - Minimize bleeding
  - Protective eye shield
  - Amblyopia

- Proper use
  - Tape, dressing, shield

- Contraindications:
  - Open globe
  - Contact Lenses

Assisting the patient

- Physically disabled
- Visually disabled
- Pediatric/Children

Patient Instructions

- Medications
- Tests
- Procedures
- Treatments
- Contact Lenses

Triage

- The fine “art” of listening to a patient’s symptoms and deciding if the patient must be seen on an emergency basis.
  - Emergency
  - Urgent
  - Elective

Ocular Emergencies

- Emergencies
  - Chemical injuries
  - Blunt forces trauma injuries
  - Perforating injuries
  - Abrasive injuries
  - Glaucoma emergencies
  - Retinal emergencies

Forms and Manuals

- Training and Education
  - For patients
  - For technicians/staff
Vital Signs

- Blood pressure
- Heart rate/pulse
- Temperature
- Respirations
- Weight
- Height

Cardiopulmonary Resuscitation

- CPR
  - Adult, child, infant (rates & steps of action)
- Fainting/ Vasovagal response
  - Blood pressure drops, reduced circulation to the brain, and causing loss of consciousness
  - Can happen during eye exams, diagnostic testing, drop instillation, discussion of surgery, etc.
- Cardiac Arrest
  - AED, CPR, call for help & 911
- Acute Drug Reaction
  - Course of action, Benadryl, Epinephrine, call for help & 911

Ophthalmic Imaging

(7% of Exam)

- Slit lamp/anterior segment photography
- Fundus photography
- Fluorescein angiography
- External photography
- Imaging artifacts
- Diagnostic/standardized A-Scan
- B-Scan
- Corneal topography
- Scanning tests for glaucoma/retina
  - HRT, GDX, OCT

Photography

- Basics of Photography
- Fundus Photography
- Defects/Artifacts (false results)

Basics of Photography

- Film (speed, ISO, color vs. B&W)
- Exposure (utilize flash, gain & gamma changes to avoid under- or over exposure)
- Focal length
- Depth of field (aperture)
- Synchronization (shutter and flash)
- Beam splitters (image split between reviewers)
- Reticles (focus)
- Ocular (focus first)
- Focus (reticle and image clear simultaneously)
- Video
- Astigmatic correction
Defects and Artifacts

- Focus – eyepiece: too close/not close enough
- Anatomical obstacles/Patient blink
- Alignment – pupil, lids/lashes, centration
- Patient fixation – instruction important
- Dust/material on lenses
- Shutter/synch off
- Inappropriate filtration
- Wrong flash setting or film speed for best image

External Photography

Used to document dermatochalasis, chalazions, cysts and lesions of the lids, ptosis, etc.

Photos courtesy of Jeffrey Nerad, MD

Slit lamp photography

- Topographical map of the cornea
- Used to screen cornea before refractive surgery
- Used to diagnose and follow keratoconus, irregular astigmatism, and other corneal surface abnormalities

A–scan Biometry

- Axial length
  - Length of the eye from front of cornea to front of retina (in mm)
  - Average size of adult eye = 23–24 mm
  - Similarity between the two eyes
    - Myopic eyes are longer/steeper
    - Hyperopic eyes are shorter/flatter

A–Scan Ultrasonography

- Manual A–scan has a probe that touches central cornea.
- Immersion A–scan probe does not touch the eye; Prager shell/water bath combo is used.
- Portable units available, used in surgery
Phakic Scans: Cornea, anterior lens, posterior lens, retina/sclera/orbital fat.

Aphakic Scans: Cornea, capsule remnant (sometimes), retina/sclera/orbital fat.

Pseudophakic Scans: Cornea, IOL, echo with reverberations, retina/sclera/orbital fat.

A-scan Biometry
- IOL Master
- LenStar

Scanning Laser Tests for Glaucoma/Retina/Optic Nerve
- HRT
  - Heidelberg Retina Tomograph (optic nerve head)
- GDX
- Laser Diagnostic Technologies (Nerve fiber layer)
- OCT
  - Optical Coherence Tomographer (RNFL, Macula & Optic Disc)
Superior Branch Retinal Vein Occlusion (BRVO)

Macular degeneration

Diagnostic test
- Blood flow in the back of the eye
- View and diagnose different types of retinal disease.
  - Diabetic Retinopathy
  - Macular Degeneration
  - Vein/Artery Occlusions

FA Phases:
- A-B: Pre-injection
- C: choroidal flush
- D: Arterial
- E: Arterial-Venous (Laminar flow)
- F: Brightest/Microvasculature visible
- G-I: recirculation, dye fades; ON stains

ICG Angiography

Stereo Disc Photos
B-Scan
Ultrasound Image of the eye allowing imaging of the vitreous, choroid, and retina

Normal vs. Retinal Detachment

Refractometry
(7% of Exam)
- Refractive error (automated)
- Manifest refractometry
- Retinoscopy

Physical Optics
- The eye responds to wavelengths of 400–800 nm.
- White light is a mixture of all colors
- Each wavelength range has a particular color hue:
  - Red has longest wavelength, lowest frequency
  - Violet has shortest wavelength, highest frequency

Geometric Optics
- Prism: triangular piece of glass or plastic with an apex and a base
- Rays of light, entering from air and going through a prism, bend toward the base of the prism.
  - This is related to the oblique surface of the prism and its medium

Prisms in Ophthalmology
- Gonioscopes and ophthalmoscopes
- Measurements of muscle balance
- Spectacles
- Reflectors or mirrors

Geometric Optics
- Reflection
  - Rebounding of light from one surface and thrown in a different direction (i.e. off a mirror)
- Mirrors
  - Concave: reflect light in front of them, so the image is magnified (i.e. shaving mirrors)
  - Convex: reflect light away from their principle axes, images appear smaller (i.e. security mirrors)
Physical Optics

- Each wave of light travels at the same speed, but with different vibration.
- Refraction of light
  - Light travels at different speeds through different media, therefore it can look bent as it goes through water.
  - The more optically dense the substance, the slower the speed of light and the higher the refractive index (IR).

Index of Refraction (IR) for Substances in Ophthalmology:
- Aqueous humor 1.33
- Cornea 1.38
- Lens 1.41
- Vitreous humor 1.34

Geometric Optics

- Transmission of light as rays
- Divergence
  - Rays of light from any luminous point of light will spread out or diverge.
- Convergence
  - When a bundle of rays are brought together they are said to converge.
- Parallel Rays
  - Light rays are assumed to be parallel if they emanate from a distant light source (i.e., the sun).

Lenses
- Convex: one or both surfaces of the lens are curved outward (two prisms base to base)
  - Plus lenses converge rays of light to a focus behind the lens
- Concave: one or both surfaces of the lens are curved inward (two prisms apex to apex)
  - Negative lenses diverge rays of light

Minus Lens
- The ray penetrating the center of the lens is undeviated, but all the rays on either side (paraxial rays) will converge to or from a point.
  - Central ray travels along the principle axis
- Focal Point
  - Paraxial rays converge to a point on the principle axis
- Focal Length
  - Distance of the focal point to the center of the lens
- Power of a lens
  - Equals the reciprocal of its focal distance measured in meters. Power is expressed in diopters (D = 1/F)
Steps in Performing Retinoscopy

- Prepare for retinoscopy – adjust for proper working distance
- Position the Patient and Phoropter
- Fog the fellow eye
- Identify the two meridians with your retinoscope
- Determine the sphere power
- Set and determine the cylinder axis
- Determine cylinder power
- Subtract working distance from final results
- Document your results

Steps in Performing Refractometry

- Occlude the fellow eye on the phoropter
- Refine the sphere power
- Position the Jackson Cross Cylinder to assess axis
- Refine the cylinder axis
- Position the JCC to assess cylinder power
- Refine the cylinder power
- Refine the sphere power

Spectacle Skills
(3% of Exam)

- Transpose cylinder readings
- Prescriptions
- Vertex distance
  - Measure
  - Conversion

Transposition

Change a prescription from (+) cylinder to (–) cylinder or from (–) cylinder to (+) cylinder.

Transposition

Step 1) Take the cylinder of the Rx and add it algebraically to the sphere.

Ex: \(-1.00 - 2.00 \times 80^\circ\)

\[-1.00 + (-2.00) = -3.00\]

Step 2) Change the sign of the cylinder (+ to –) or (– to +).

Ex: \(-1.00 - 2.00 \times 80^\circ\)

\[-2.00\text{ becomes } +2.00\]
Transposition

Step 3) Change the axis by 90 degrees

Either ADD 90° to the axis to ensure the axis is \( \leq 180° \).

Ex: \(-1.00 \cdot -2.00 \times 80°\),
\[ 80° + 90° = 170° \]
Answer: \(-3.00 \cdot +2.00 \times 170° \) or...

SUBTRACT 90° from the axis to ensure the axis is \( \leq 180° \).

Ex: \(-1.00 \cdot -2.00 \times 180°\),
\[ 180° - 90° = 90° \]
Answer: \(-3.00 \cdot +2.00 \times 90° \)

Spectacle Principles

- **Interpupillary Distance (IPD or PD)**
  - Sit across from pt, use mm ruler on bridge of patient's nose, measure distance between the centers of the patient's pupils

- **Frames**
  - Understand possible adjustments, types, care of glasses
  - Bridge: size of nose piece
  - Eye Size: distance between lenses
  - Temple: length of ear pieces

- **Vertex Distance**
  - Distance in mm from the back surface of the lens to the front surface of the cornea
  - Used in Rx of \( > \pm 4.00 \)D
  - Changes effective power

- **Measuring prism**

  Right eye: 2D base-up, 2D base in
Spectacle Principles

- Measuring prism

If the lensometer mires of a right lens are off the target scale to your right (lots of base-in prism), then a base-out prism must be used to move the mires back onto the scale. (Hint: bring image ‘back to base’)

Supplemental Skills

(9% of Exam)

IOL power calculation

- Axial Length
- Keratometry Reading
- Various formulas can be used to calculate

A–Scan

- Measures length of the eye from the front of the cornea to the front of the retina
- Contact vs. Immersion
- Optical Biometry & Laser Interferometry (IOLMaster, LenStar, etc.)
- Needed to calculate IOL Power

Supplemental Skills

- Multifocal: bi-, tri-, progressive, transition, occupational types
- “Safety” lenses & frames
- Adjustments & repairs
- Care of spectacles
- Lens materials
  - Relative resistance to breakage and scratching
  - Poly carbonate safe for kids

IOL power calculation

- Calibration
- Biometry instruments
  - Topography unit
- Anterior chamber depth
- Exophthalmometry
- Glare testing
- Color vision testing
- Contact A–Scan
- Wavefront diagnostics
- Corneal sensitivity testing
- Laser interferometry (IOL Master)
Estimation of Anterior Chamber Depth

- Measurement of the distance between the cornea and iris
- Angles - Closed, narrow, open, deep
- Slit lamp evaluation vs. pen light evaluation
- Gonioscopy
- Testing: IOL Master, LenStar, Visante OCT, etc.

Pachymetry

- Corneal Thickness
- Endothelial damage
- Suitability for LASIK/Refractive Surgery
- Intraocular Pressure

Calibration of Biometry Instruments

- Perform calibrations regularly as recommended by the manufacturer

WaveFront Diagnostics

- Aberrometers use wavefronts to objectively measure the overall refractive power error of the eye.

Schirmer Tear Test

- Measurement of tear production over period of specific time (usually 5 minutes)
- Test strip placement
- Without (Type I) or with anesthesia (Type II)
- 10mm is considered normal tear production

Wrong: central/nasal
Correct: slightly temporal
Corneal Sensitivity Testing
- Measures areas on the cornea that have lost sensitivity
- Leads to less blinking and exposure issues

Tear Break-up Time (TBUT)
- Time it takes for the tear film to break up on the corneal surface
- Less than 10 seconds is abnormal
- Usually fluorescein dye is used for visibility

Fluorescein Dye
- Slit lamp visualization:
  - Used with Cobalt Blue filter, fluoresces bright green
  - Stains damaged corneal cells
  - Used in applanation tonometry
  - Helps diagnose dryness of the conjunctiva and cornea
- Fluorescein angiography
  - Injected into vein
  - Fluoresces retinal vasculature
  - Detects retinal damage (blockage/leakage)

Rose Bengal
- Stains degenerating corneal (and conjunctival) epithelium
- Helps diagnose dryness of the conjunctiva and cornea
- Patients say it burns/stings more than fluorescein

Lissamine Green Dye
- Stains damaged conjunctival cells
- Helps diagnose dryness/damage of the conjunctiva and cornea

Glare Testing
- Corneal and Lenticular opacities may induce glare
- The affects of glare on vision can be measured
  - BAT (Brightness Acuity Test)
  - Other: pen light, transilluminator
Color Vision Testing

- Used to evaluate color blindness and degrees of color blindness
- Macular Changes
  - Plaquenil Toxicity
  - Cone Dystrophy
  - Multiple Sclerosis

Physiology of Color Vision

- Color is perceived by the cones.
- Located in the central retina.
- Normal cones have three photosensitive pigments: red, green, blue

Ishihara Color Test

<table>
<thead>
<tr>
<th>Results For Ishihara Test</th>
<th>Normal Color Vision</th>
<th>Red-Green Color Blind</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
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<td>56</td>
</tr>
<tr>
<td>Bottom</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

Color Plates

- Hardy-Rand-Ritter
  - Circles, triangles and crosses of color on neutral gray background

FM D-15 Test FM & 100-Hue Test

D-15

- 15 pastel chips are arranged in a color sequence and scored
Farnsworth–Munsell 100 Hue

- Has 85 rainbow colored caps in four trays.
- Patients are asked to arrange the caps and then the trays are scored.
- Time consuming and difficult to score.

Exophthalmometry

- The process of measuring and assessing the forward protrusion of the eye
- Recorded in mm from lateral orbital rim to the corneal apex

Tonometry

(5% of Exam)

- Goldmann applanation tonometer
- Clean, Disinfect, Calibrate
- Intraocular pressure

Types of Tonometers

- Applanation – measures the force necessary to flatten the central cornea
  - Goldmann
  - Perkins hand held
- Indentation – measures the force necessary to indent the surface of the central cornea
  - Schiötz
  - Tonopen
- Non-contact tonometry (NCT)
  - Air puff

Goldmann Tonometer

Perkins Hand Held Tonometer
Sources of Error

Applanation
- Too much/too little flourescein
- Semicircles not in the middle of the field
- Examiners fingers resting on the globe instead of the brow bone
- Astigmatism greater than 3 diopters
- Patients holding their breath
- Collar too tight
- Obese patient can make it difficult to obtain a reading

Indentation
- Scleral rigidity – in high myopes and young patients, there is more elasticity causing greater indentation. This can cause a false low pressure
- Poor technique – pressure on the globe or tense patient can elevate the pressure
- Tight collar
- Corneal deformities

Sources of Error

Non-contact Tonometer
- Patient squeezes or closes their eye
- Tight collar
Advantages

- Applanation
  - Accurate
- Indentation
  - Instruments are portable
- Non-contact
  - Doesn’t touch the cornea

Cleaning

- Applanation
  - Use 3% hydrogen peroxide or 1:10 bleach/water solution for 10 minutes
  - Rinse and dry
- Indentation
  - Unassemble & clean all parts with alcohol and pipe cleaner soaked in alcohol

Pearls

- Corneal thickness
  - Thin corneas – can cause the reading to be artificially low
  - Thick corneas – can cause the reading to be artificially high
- Diurnal variations
  - IOP will vary at different times of the day
  - Usually will be highest in the morning

Contraindications For Tonometry

- Herpes Zoster in or around the eye
- Corneal abrasions
- Foreign body
- Penetrating injury
- Infection

Aqueous Humor

- The clear fluid that is between the cornea and the iris
- Produced by the ciliary processes in the ciliary body

Glaucoma

- Types of Glaucoma
  - Open Angle Glaucoma – Anterior chamber can appear normal to shallow, asymptomatic
  - Angle Closure – Caused by a mechanical obstruction (usually the iris)
  - Secondary Glaucoma – Caused by another ocular disease
  - Congenital – Occurs in infants
Ocular Examination for Glaucoma
- Tonometry
- Gonioscopy
- Visual Fields
- OCT
- Scanning Laser
- Stereo Disc Photos
- Optic Nerve Evaluation

Management of Glaucoma
- Eye drops
- Laser
- Surgery
  - Trabeculectomy, Shunts, Stents, goniosynechiolysis

Optic Nerve Cupping

Visual Assessment
(6% of Exam)
- Visual acuity
  - Optotype, Snellen, ETDRS
- Projection chart, EVA
- Contrast sensitivity and glare testing
- Potential acuity meter measurement
- Pinhole acuity

Measuring/Recording Visual Acuity
- Distance & Near acuity
- Children & Non–Verbal
- Low vision
- Illumination of target & background
- Pinhole
- Artifacts
- Contrast Sensitivity
- Recording

ETDRS Vision Chart
- Early Treatment of Diabetic Retinopathy Study
- Standardization of eye charts and VA testing
- Often used in research studies
EVA
- Electronic Visual Acuity Tester
- Computerized optotypes:
  - EVA
  - Stimuli Acuity System (SAS) by Accomodata Corp
  - Smart System PC (SS) by M&S Technologies

Low Vision
- Move pt closer to the chart
  - 20/200 “E” recorded at feet seen
    - i.e. 5ft/200
- Count fingers recorded at feet seen
  - i.e. CF @2ft
- Hand Motion, recorded as HM
- Light Perception , LP
  - Accurate Light Projection, ALP
  - LP with/without projection
- No Light Perception, NLP

Potential Acuity Meter (PAM)
- Measures potential vision
- Performed at slit lamp

Near Acuity
- Measured at 14–16 inches
- Use a “near” card
- Snellen types recorded as 14/14 (seen at 14 inches)
- Jaeger card recorded as J1, J1+, J4 etc.
- Measured in bright lighting conditions

Pinhole
- Eliminates peripheral rays of light, allowing remaining light to focus on the retina.
- Helps differentiate between refractive errors and disease.
- Shows potential best corrected acuity.

Testing VA in Children & Non-Verbal Adults:
- Infant:
  - Fixation behavior: CSM, F&F
  - Preferential looking
- Toddler (As soon as child can talk)
  - Pictures
- Pre-School:
  - Matching: HOTV, Lea
  - Tumbling E
  - Landolt rings
- As soon as possible:
  - Snellen letters
  - Numbers

EVA
- Electronic Visual Acuity Tester
- Computerized optotypes:
  - EVA
  - Stimuli Acuity System (SAS) by Accomodata Corp
  - Smart System PC (SS) by M&S Technologies
Visual Fields

(6% of Exam)

- Amsler Grid
- Goldmann perimetry
- Confrontation fields
- Automated perimetry

Questions may be equipment or disease related
- Measures the expanse and sensitivity of a patient’s vision
- Visual field defects coincide with damage to the optic nerve (ON) and retinal nerve fiber layers (RNFL)
- Remember that Amsler Grid and CVF are types of visual fields

Visual Pathway

- Temporal retinal fibers stay on same side of brain.
- Nasal retinal fibers cross to opposite side of brain.

Retina
- Retinal nerve fiber layer
- Optic Nerve
- Optic Chiasm
- Optic tract
- Lateral geniculate body
- Optic radiation
- Occipital lobe/Visual cortex

Visual Field Defects with Corresponding Anatomical Location

Retinal disease
- Rod-Cone Dystrophy

Neurological
- Papilledema – enlarged blind spot
- Optic Neuritis – any defect possible
- Pituitary Tumor – asymmetric or symmetric bitemporal loss

Glaucma
- Generalized depression
- Enlarged blind spot
- Arcuate defects
- Nasal step

Visual Field Defects from Disease

- Temporal retinal fibers stay on same side of brain.
- Nasal retinal fibers cross to opposite side of brain.

Retina
- Retinal nerve fiber layer
- Optic Nerve
- Optic Chiasm
- Optic tract
- Lateral geniculate body
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Visual Field Defects with Corresponding Anatomical Location

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Anatomy of Glaucoma

Isopter: The line connecting points denoting areas of equal sensitivity to light. The boundary between seeing and non-seeing areas within the field.

Threshold: Weakest size of intensity of a target that can be seen by the patient. The region where the patient sees the target about ½ the time
- Infrathreshold = outside isopter
- Suprathreshold = inside isopter

One apostilb is equal to amount of light coming off of one square cm of solidifying platinum at 2040 degrees Kelvin

Decibel = a scale used to measure changes in stimulus luminance

Kinetic
- Stimuli is moved from a non-seeing area until the patient first sees it.

Static
- Targets that are gradually increased in light intensity until seen by patient

Types of Visual Fields

Automated -
- Humphrey Visual Field
- Frequency Doubling Test+

Manual -
- Confrontation Visual Field
- Goldmann
- Frequency Doubling Test
- Tangent Screen
- Autoplot
- Arc perimetry

Confrontation Fields

Quick, manual test used to find generalized VF defects
- FTCF or FTHM

Techniques
- Static Test - put your hand into position then present fingers
- Kinetic Test - move from outside patient’s visual field to within patient’s view
**Amsler grid**

- Measures central 20°
- Card should be held at approximately 14" from the eyes, with good lighting
- Wear reading correction if needed
- Each eye is checked separately
- Cover one eye and look at the center dot. With the uncovered eye note any visual disturbance, such as wavy, blurred or distorted lines or scotomata
- Recording Amsler grid results

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**Automated Visual Field**

- Automated static visual field
  - Examples: Humphrey, Octopus,
- Computer system and visual field tech both important in good outcomes
- False negatives: patient did not respond to target previously seen
- False positive: patient responds to a target they likely should not be able to see

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**Goldmann Visual Field**

- Targets
  - Roman Numerals – object size, I, II, III, IV, V
    - Size V is the largest
  - Numbers – brightness of target that changes in whole log units, 1, 2, 3, 4
    - 4 is the brightest target and 1 is the dimmest
  - Small Letters – for brightness changes in 0.1 log units, a, b, c, d, e
    - "e" is the brightest and "a" is the dimmest
- Example
  - V4e, III4e, II

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**Tangent Screen**

- Measures central 30° at 1m
- Used for hysterics or malingerers
- Test each eye at both 1 and 2 meters
- Record results after each isopter
- Test one entire side at a time – do not cross over in front of the patient
- Watch the patient’s eye and not the chart

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Tangent Screen

The 1-meter black felt screen is mounted on a spring roller with mounting brackets. It also comes with a small white test object, 18" wand, black marking pins and chart sheets.
Errors in Visual Field Testing
- Machine calibration
- Recording and printing results
- Correcting lens (power and positioning)
- Stimulus selection
- Patient preparation
  - Instructions, positioning, comfort, special situation, e.g. low vision, wheelchairs
- Test selection
- Catch trials, fixation losses, & fluctuation
- Artifactual loss
- Examiner process and/or inconsistencies

Visual Field Target Visibility
- Size
- Intensity – “brightness”
- Speed of Movement
- Color
- Background illumination
- Correction of Refractive Error
- Patient responsiveness

Add for Age (Both HVF and GVF)
- Age in Years:
  - under 30  no add needed
  - 30–39   +1.00 over distance correction
  - 40–44   +1.50 over distance correction
  - 45–49   +2.00 over distance correction
  - 50–54   +2.50 over distance correction
  - 55–59   +3.00 over distance correction
  - 60+     +3.50 over distance correction

Add for Age (Both HVF and GVF)
- Add is based on patient’s age not bifocal power
- Exceptions to the add for age is:
  - Pseudophakia
  - Aphakia
  - Cycloplegic drops
- The Humphrey will automatically put in the add for age.
- The Goldmann requires you to do the add manually.

What’s Your Next Step?
- Study the areas you feel weakest
- Borrow/purchase additional resources
- Attend in–services
- Ask for assistance
- Form a study group
- Create your own study aides

Get Certified!

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