Criteria for Certification & Recertification, JCAHPO

JCAT PKG
175 Test Item Quiz, a study plan and The Ophthalmic Assistant, Stein, Stein, Freeman

The Ophthalmic Assistant, 9th Edition
Stein, Stein & Freeman

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

Fundamentals for Ophthalmic Technical Personnel, Barbara Cassin


History Taking
(6% of Exam)

History Taking

- All patient’s history recorded with accuracy, in the patient’s own words, if possible
- This history is part of the entire record which provides invaluable information
- Additions and corrections must be made properly.
Components of a History

- Personal History
- Chief Complaint
- Past Ocular History
- Medical and Surgical History
- Medications
- Allergies
- Social History
- Family History

Personal History

- Name (nickname) and Title
- Address
- Telephone numbers
- Social Security number
- Date of birth (age)
- Employer/Occupation
- Spouse or parent (guardian)
- Power of attorney

Chief Complaint

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

Required Elements of an 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)

HPI TEST

How many HPI elements can you count in the following hx:
- “cataracts ou; co/glare; exp with PM driving; c/o very blurred vision x 6 mos.”

Ocular History

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

- Complete ROS (review of systems) past and present
  The ROS should include 14 body systems and must be signed and dated by the examining physician
- Illnesses
  - Includes any therapies, such as chemotherapy, radiation, etc.
  - DM, HTN, heart/kidney disease, headaches
- Surgeries
- Injuries
- Is it really a negative finding, or an omission?

Review of Systems

- Allergic/Immunologic
- Cardiovascular/Cardiac
- Constitutional Symptoms
- Ears, Nose, Mouth, and Throat
- Endocrine
- Eyes
- Gastrointestinal
- Genitourinary
- Hematologic
- Integumentary
- Musculoskeletal
- Neurological
- Psychiatric
- Respiratory

Medications

- Prescribed medicines
  - Name, dosage, (strength if applicable), purpose
    - By Rx
- OTC medications,
  - Vitamins
  - Herbs and supplement
- Watch spelling!
- Match medication listed to a medical condition

Ophthalmic drops

- All prescribed drops and ointments
- All the OTC drops and ointments
  - "Lid scrubs" or similar therapies
    - Dosage, strength, and specifics all should be included
    - Documentation of last dosage, if indicated, i.e. History of glaucoma
    - Compliance may also be noted

Allergies

- Drug
- Systemic
- Ophthalmic
- Environmental
- Allergy vs Adverse Reaction
  - Allergy– can be dangerous (i.e. itching, constricting airway)
  - Adverse– uncomfortable (i.e. nausea)

Social History

- Usage of
  - Tobacco
  - Alcohol
  - Drugs
- Sexual History (STDs)
- Occupation
Family History

- Does anyone else in the family have a condition like yours?
- May uncover vital information
- More specific questions may be required
- *Absence of data* should not be construed as *negative* family history

Family History

- Questioning specific to ophthalmic subspecialty usually is indicated for completeness, i.e. Glaucoma, cataracts, strabismus, retinal detachment
- Systemic illnesses inherited, or familiar, with ophthalmic emphasis, i.e. Diabetes mellitus, hypertension, migraine, etc.

Pupillary Assessment

(5% of Exam)

- Size (in mm) – each eye and comparison between 2 eyes
- Reaction – each eye and comparison
- Shape – round, irregular

Evaluation of Pupils

- Light reaction
  - Consensual
  - APD
  - Hippus
  - Fixed
  - Anisocoria
- Recording pupil evaluation

Pupillary Reactions

- Lighting conditions
- Accommodation
- Medication
- Hormones
Afferent vs. Efferent Anatomy

- Retina Optic Nerve Chiasm
- Midbrain (3rd nerve nucleus)

- 3rd nerve Ciliary Ganglion Iris Sphincter & Ciliary Body

Evaluation of Pupils

- 3mm
- 7mm

APD Video

Contact Lenses

(3% of Exam)

Basic Principles

- Hard lenses
- Soft lenses
- Toric lenses
- Astigmatism
- Bifocal
- Aphakic
- Extended wear

- Gas permeable
- Truncated
- Bandage lenses
- Oxygen permeability
- Lens characteristics
- Rigid lenses

Contact Lenses

- Do you understand the difference between spherical and toric CL’s?
  - Know when to use and when to avoid.
  - Front, back, & bi-toric
  - Lens markings...
  - Rotation compensation: LARS (left add, right subtract)
- Bifocal/multi-focal CL’s
- Aphakic CL’s
- Piggyback lenses
- Treating keratoconus patients with CL’s
- Truncated
Measure
- Base Curve
- Power
- Diameter
- dK Value

Base Curve
- Curvature of the back of a contact lens
- Typical base curves of soft contacts 8.4, 8.6, 8.8
- Base curve is crucial for a good fit.
  - Too tight
  - Too loose

Power
- Amount of refractive correction in the lens
- Measured in diopters
- May be spherical or contain astigmatic correction
- May also contain presbyopic correction

Diameter
- Measured in millimeters (mm)

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.

Patient Counsel
- Dry Eyes
- Keratoconus
- Astigmatic Correction
- Presbyopic Correction
- Soft Lenses vs. Gas Permeable
Fitting

- Fitting CL’s: What are the advantages & disadvantages of “hard” vs. soft CL’s?
- 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

Fitting Procedures

- Keratometry
- Corneal diameter
- Pupil diameter
- Tear secretion
- Eyelid tightness and fissure size
- Fluorescein pattern
- Spectacle prescription conversion
- Over-refraction
- Pediatric
- Contraindications

Fitting Contact Lenses

- Goals:
  - Centration
  - Stable vision
  - Good movement
- Lens considerations:
  - Keratometry / base curve
  - Corneal diameter / lens diameter
  - Pupil diameter
  - Dry eyes?
  - Lid tightness (may need bigger lens if lid laxity)

Fitting Contact Lenses

- Keratometry:
  - Used to determine Base Curve
  - Considered normal when between 42.00 – 45.00D
  - Considered flat when less than 42.00D
  - Considered steep when greater than 45.00D
- Note mire quality:
  - Clear vs. 1+ to 4+ distorted
- Corneal warpage from CL’s
- Topography

Refraction

- Needed to determine the power of the contact lens.
- The amount of astigmatism in the refraction determines if a spherical or an astigmatic (toric) lens will be used.
- Typically, more than a diopter of astigmatism indicates the need for a toric lens.
- If less than one diopter of astigmatism, then the spherical equivalent of the refraction (in minus (-) cylinder) is used to determine the power of the contact.

Spherical Equivalent

- Equivalent of a glasses prescription expressed only as a sphere
- Used to calculate spherical contact lenses.
- Used to reduce the amount of cylinder in a glasses prescription.
**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
Answer = -5.00 sph

**What is the spherical equivalent of:**

-+2.00 -1.00 x 75
-0.50

-0.50 + (+)2.00 = +1.50
Answer = +1.50 sph

**Piggy-Back Contact Lenses**

**Diffractive Bifocal RGP**

**Patient Instruction**

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

**Trouble Shooting Problems**

- Tight/ Loose
- Vascularization
- Ulcers
- Spectacle blur
- Giant papillary conjunctivitis
- Deposits
- Pain
- Keratoconus
- Edema
- Solutions
- Modifications
- 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, corneal edema, no lens movement

Vascularization

- Development of new blood vessels
- Due to lack of oxygen or corneal irritation from CL
- Recommend higher Dk/L &/or looser lens fit
- Worst case: discontinue CL use temporarily or permanently
- Pannus: blood vessels growing from outside

Ulcers

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

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

- 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

Lens Deposits
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

Verification of Lenses

- Power
- Base curve
- Diameter
- Central thickness
- Edge profile
- Instruments: radiuscope (b.c. of lens), V-groove, Loupe, Shadowgraph, Lensometer (power of hard or RGP lens)

Equipment Maintenance and Repair

(4% of Exam)

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)
- Screens–
- Mirror–use only canned air or specified cleaning cloths
- Other
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

Tangent Screen
- Used to measure field of vision
- Maintenance of tangent screen

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 lens/mirrors (dust brush/cloth/photo-glass cleaner & cotton balls)
- Stand (clean the pad, sewing machine oil at ball joint)
- Maintenance of joystick, dials, etc.
- Calibration of tonometry unit

**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
- Check calibration with silver calibration spheres; call service professional if needed

**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, Koepp lens
  - Trial lenses
  - Gonio lenses
  - RGP/hard contact lenses
  - Soft contact lenses (Bandage CLs)
  - Other

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

Surgical Instruments

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

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)

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

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

- Focus Eyepiece
- Place spectacles on the platform so that both lenses are resting on the platform.
- Center the target
- Focus target using the power wheel and axis wheel.

All target lines come into focus at the same time.

Thin target lines and wide target lines come into focus at different times.

Measuring Glasses

Spherical Lenses

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

When reading a pair of glasses, the first reading (thin lines) is +3.00. The second reading (wide lines) is -1.00. The axis reads 45. Write the prescription.

Answer: +3.00 -4.00 x
Lensometer

Fresnel Prism
- Prism “sticker” adhered to glasses

Ground-In Prism
- 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

Geneva lens clock
- Measures lens base curve

Aphakic glasses
Keratometry
(5% of Exam)

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 42–44 D

Uses for Keratometry
- Contact lens fitting
- IOL calculations
- Keratoconus detection
- Irregular cornea detection

Steps to Performing Keratometry
- Focus the eye piece
- Instruct the patient
- Position the patient
- Position the keratometer
- Focus the mires
- Locate the axis by rotating the drum
- Align the plus signs and minus signs
- Read/Record the measurement
Medical Ethics, Legal and Regulatory Issues
(3% of Exam)

Third Party Coding
- Basic understanding of chart documentation to meet coding requirements
- Basic understanding of coding levels
- E&M codes

Government and Institutional Rules and Regulations
- HIPAA regulations
- Research related guidelines

Confidentiality
The patient’s right to privacy.

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
- A patient’s chart is a legal document and should be treated as such.

HIPPA

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

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)

Specimens and Biopsies

- Ocular Fluid or tissue samples collected for evaluation of abnormalities
  - Lid
  - Corneal
  - Conjunctival
  - Collected in Surgery or Clinic

Bacterial Cultures

- Scrapings or smears of ocular tissues collected for evaluation of infection or disease
  - Chocolate
  - Blood
  - Sabouraud
  - Mannitol Salt
Pharmacology
(5% of Exam)

Drug Delivery

- **Topical Administration**
  - **Drops (Solution vs. Suspension vs. Emulsion)**
    - Advantage: Easy, quick absorption into eye with little 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

- **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
  - **Intravitreous** - 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

Instillation and Identification

- Describe proper instillation
- Identify classes of drops, color of caps, generic names

Educate Patients on Medications

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

- Allergies
- Side Effects
- Contraindications

Ocular Pharmacology

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

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

Ocular Pharmacology

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

Basic Ocular Motility

**DEFINITIONS:**
- **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
  - Infraduction: Vertical downward eye movement
- **Versions:** an eye movement involving both eyes moving synchronously and symmetrically in the same direction

Ocular Motility

(5% of Exam)
Basic Ocular Motility

**DEFINITIONS: CONT’D**
- **Saccade**: fast eye movements that move the eye from one target to another
- **Pursuit**: slow, smooth eye movements that track a target
- **Nystagmus**: a form of involuntary eye movement characterized by alternating smooth pursuit in one direction and saccadic movement in the other direction
- **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

Functions

- Used to detect weakness in the extraocular muscles
- Test the horizontal, vertical and oblique meridians.
- Primary and the eight cardinal positions of gaze

Anomalies

- **Strabismus**
  - Eso- , Exo-, Hyper-, Hypo-
  - Tropias
  - Phorias
- **Amblyopia**
- **Suppression**
- **Diplopia**

Muscle Insertions

**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>Inyclotorsion</td>
<td>Adduction</td>
</tr>
<tr>
<td>Inferior rectus</td>
<td>Downward (depression)</td>
<td>Exyclosotrsion</td>
<td>Adduction</td>
</tr>
<tr>
<td>Superior oblique</td>
<td>Out/Down (inyclosotrsion)</td>
<td>Depression</td>
<td>Abduction</td>
</tr>
<tr>
<td>Inferior oblique</td>
<td>Out/Up (exyclosotrsion)</td>
<td>Elevation</td>
<td>Abduction</td>
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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>
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<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>

Extraocular Muscle Actions

Strabismus

Tropia:
- A misalignment of one eye, relative to the other, during binocular viewing
- It typically involves a lack of coordination between the EOM’s which prevents bringing the gaze of each eye to the same point in space and preventing proper binocular vision

Phoria:
- Deviation of the eyes occurring after after binocular vision is interrupted
- If you remove the sensory information about the eye’s position in the orbit (alternating cover test), there is no stimulus to binocular fusion, and the eye will move to a position of "rest"
- The difference between this position, and where it would be were the eye uncovered, is the phoria
- Usually asymptomatic unless it is not overcome by fusional vergence, and then signs and symptoms appear (decompensated phoria)

Pseudostrabismus:
- The false appearance of crossed eyes
- Generally occurs in infants and toddlers whose facial features are not fully developed
  - the bridge of their nose is wide and flat.

Refractive or Anisometropic Amblyopia:
- Refractive amblyopia may result from anisometropia
- The eye which provides the brain with a clearer image typically becomes the dominant eye
- The image in the other eye is blurred, which results in abnormal development of one half of the visual system

Amblyopia Detection
Amblyopia Detection

Form – Deprivation Amblyopia:
- Results when the ocular media become opaque
  - ex. cataracts or corneal scarring
- Opacities prevent adequate visual input from reaching the eye, and therefore disrupt development
- If not treated in a timely fashion, amblyopia may persist even after the cause of the opacity is removed
- Ptosis or some other problem causing the upper eyelid to physically occlude a child’s vision, may also cause amblyopia

Strabismic Amblyopia:
- Strabismus usually results in normal vision in the preferred sighting eye, but may cause abnormal vision in the deviating eye
- Children’s brains can suppress images from one of the eyes, eliminating the double vision
- This interrupts the brain’s normal development, resulting in the amblyopia

Evaluation Assessment Methods (cont’d)

Cover Test:
- Determine the presence, magnitude, direction and frequency of tropias and phorias.
- Unilateral Cover (Cover-Uncover) Test
- Alternating Cover Test

Unilateral Cover (Cover-Uncover) Test:
- Note direction –
  - Exotropia – deviating eye moves inward after the fellow eye is covered
  - Esotropia – deviating eye moves outward after the fellow eye is covered
  - Hypertropia – deviating eye moves down after the fellow eye is covered
  - Hypotropia – deviating eye moves up after the fellow eye is covered
- Note laterality – R, L, or alternating
- Note frequency – Constant or intermittent
- Proceed to alternating cover test to measure the magnitude of deviation

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, the patient does not have a phoria or tropia
- If a phoria is detected, note the direction –
  - Exophoria – eye moves inward after the fellow eye is covered
  - Esophoria – eye moves outward after the fellow eye is covered
  - Hyperphoria – eye moves down after the fellow eye is covered
  - Hypophoria – eye moves up after the fellow eye is covered
- Neutralize deviation using prism
Hirshberg’s test:
- To detect the difference between strabismus and pseudostrabismus
- Direct a penlight into the child’s eyes
- When the child is looking at the light a reflection can be seen
- If the eyes are aligned with one another then 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

Diagnostic Positions of Gaze:
- This test evaluates the functioning of the six extraocular muscles and cranial nerves III, IV, and VI
- 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
- The Maddox rod and eye together form a long streak of light perpendicular to the axis of the grooves and this retinal image is so unlike the image formed in the other eye that the fusion reflex is not stimulated

Maddox Rod: cont’d
- If there is a phoria the streak of light will not intersect the spot of light
- For horizontal phorias the rod axis is placed horizontally and for vertical phorias, vertically
- The amount and type of the phoria can be quantified by placing a prism of appropriate power and direction in front of either eye such that the streak appears superimposed on the spot of light
Evaluation Assessment Methods (cont'd)

Worth 4–Dot Test:
- A clinical test for suppression
- Patient wears glasses with a red lens over one eye and a green lens over the other eye
- The patient is shown a modified flashlight with four holes
  - Traditionally, the holes are arranged with the top hole showing only red light, the left and right showing only green light, and the bottom showing white light
- Because the red filter blocks the green light and the green filter blocks the red light, it is possible to determine if the patient is using both eyes simultaneously

Evaluation Assessment Methods (cont'd)

Stereopsis (Titmus Fly Stereotest):
- Consists of various vectograms
  - including one with a stereoscopic pattern representing a housefly
  - 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 (cont'd)

Near Point of Convergence (NPC):
- This test measures the distance from your eyes to where both eyes can focus without double vision
- Hold a small target in front of patient and slowly move it closer until the patient either experiences double vision, or you notices a break in fusion
  - or it touches the patients nose
- Record in mm (or to the nose)
- Normal = ≤ 7mm

Evaluation Assessment Methods (cont'd)

Amblyopia Treatment
- Patching/Dilation of the "good eye"
- Muscle Therapy
- Strabismus Surgery
- Congenital Cataract Surgery
- Corneal Surgery
Convergence Training

» Strengthens patient’s ability to converge

Nystagmus

» Involuntary rapid movement of the eyeball
» May be lateral, vertical, rotary or mixed.
» Occlusion of one eye may make nystagmus greater.
» Visual acuity is usually better if vision is tested with both eyes.

Assisting in Surgical Procedures

(6% of Exam)

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

OSHA Regulations

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

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.
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

Universal Precautions

- Steps taken to reduce the risk of bloodborne infection
  - Includes washing hands before and after contact with patients
  - Gloves, masks, gowns in situations with the possibility of contact with body fluids
  - Needles should never be recapped, bent or clipped

Intraocular Injections

- Intravitreal injections
- Sub-Conjunctival injections
- Intra-cameral injections
- Various anesthesia injections: Retro-bulbar, peri-bulbar, etc.

Intravitreal injections

-┼-Sub-Conjunctival injections
-┼-Intra-cameral injections
-┼-Various anesthesia injections: Retro-bulbar, peri-bulbar, etc.

Fundamentals of Microbial Control

- **Disinfection**
  - Reduce microorganisms or inanimate surfaces with chemical or physical agents (Cleaning instruments, spills, etc.)
- **Sterilization**
  - Rendered free of living microorganisms with autoclave, ethylene oxide gas, dry heat and ionizing radiation (Sterilizing re-usables)

Fundamentals of Microbial Control

- **Aseptic Technique:**
  - Sterile: all instruments, supplies, clothing and skin free from living microorganisms
  - Non-sterile: not free of living microorganisms
  - Surgically clean: reduced number of microorganisms
  - 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

Laser Safety

- **Protective Equipment:**
  - Eye protection
  - Limited number of people present in the room
  - Calibrations preformed
  - Equipment in good working order
Refractive Surgery

- Basic understanding of options

Surgical Site Identification

- Time-out
- Verify patient, doctor, procedure and which eye, what location

Minor Surgery

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

YAG Laser

- PCO

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

- Assisting the surgeon
  - Anesthetics
  - Preparing the patient
  - Instruments/supplies
- Instructing the patient
  - Consent
  - Expectations
Ophthalmic Patient Services and Education
(7% of Exam)

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

Vital Signs
- Blood pressure
- Heart rate/pulse
- Temperature
- Respiration
- 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

Ocular Anatomy & Physiology

Ocular Disease
- Refractive errors
- Infection
- Injury
- Red eye
- Presbyopia
- Other common disorders
  - Conjunctiva, sclera, cornea/anterior segment, glaucoma/anterior chamber, iris, lens/cataract, vitreous, retina, macula, choroid, optic nerve
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
  - Ruptured globe
  - Contact lens

Assisting the patient

- Physically disabled
- Visually disabled
- Pediatric / Children

Patient Instructions

- Medications
- Tests
- Procedures
- Treatments

Patient Flow

- Waiting room time
- Flow through clinic
  - Tech work-up
  - Time in testing
  - Time with doctor
  - Time scheduling, education, instruction, etc.

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

- First aid
  - Chemical injuries
  - Blunt forces trauma injuries
  - Perforating injuries
  - Abrasive injuries
  - Glaucoma emergencies
  - Retinal emergencies
- Management in the absence of the physician
- Triage
Forms and Manuals

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

Legal Forms & Government Services

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

Ophthalmic Imaging

(7% of Exam)

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

External Photography

- Used to document dermatochalasis, chalazions, cysts and lesions of the lids, ptosis, etc.
Slit lamp photography

Corneal Topography

- Topographical map of the cornea
- Used to screen cornea before refractive surgery
- Used to diagnose and follow keratoconus
- Irregular astigmatism

A–scan Biometry

- Axial length
  - Length of the eye from front of cornea to front of retina (in mm)
  - Average size of adult eye = 23.00 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

Manual A–scan print–out

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)
Macular Hole

Cystic Fluid BRVO

Fundus Map

Fundus Photography

Fundus Photography

- FA (& OCT) vs. ICGA

- Superior Branch Retinal Vein Occlusion (BRVO)

- Macular degeneration
Stereo photos

Fluorescein Angiography

Intravenous Fluorescein Angiography (IVFA) is a diagnostic test that is used to capture the blood flow in the back of the eye, allowing physicians to diagnose different types of retinal disease. It is particularly helpful in the diagnosis and management of Diabetic Retinopathy, Macular Degeneration, and Vein/Artery Occlusions.

Filling of the retinal arteries and veins are the next part of the early phase of the angiogram. Typically, these vessels are completely full at around 30 seconds.

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

There are 3 basic phases of a Fluorescein Angiogram:

1. The early phase (transit phase) - this usually occurs in just over 10 seconds after the injection of dye. In this phase, you will see the first presence of dye in the choroid.

2. The mid phase (recirculation phase) - in this phase, the brightness of the fluorescence is less intense now, as much of the fluorescein is removed from the bloodstream after the first pass through the kidneys.

3. The late phase - shows the gradual elimination of dye from the retinal and choroidal vasculature.
B-Scan
Ultrasound Image of the eye allowing imaging of the vitreous, choroid, and retina

Normal vs. Retinal Detachment

RefRACTOMETRY
(7% of Exam)

Physical Optics
- The eye responds to wavelengths of 400–800 nm.
- White light is a mixture of all colors
- White light isn’t broken unless it travels through a different medium like water or glass
- Each wavelength range has a particular color hue:
  - Red has longest wavelength
  - Violet has the shortest wavelength

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.

Physical Optics
- Index of Refraction 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)

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)

Geometric Optics

- Prisms in ophthalmology
  1. Gonioscopes and ophthalmoscopes
  2. Measurements of muscle balance
  3. Spectacles
  4. Reflectors or mirrors

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

Geometric Optics

- 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 are apex to apex)
  - Negative lenses diverge rays of light
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. \( D = \frac{1}{f} \)

---

### 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

---

### Steps in Performing Retinoscopy

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

---

### Spectacle Skills

(3% of Exam)

---

### Transposition

Change a prescription from 
(+)
 or from 
(-)

to 
(-)
 or to 
(+).
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 -) and (- to +).

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

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

Step 3) Change the axis by 90 degrees

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

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

\[80^\circ + 90^\circ = 170^\circ\]

or....

Step 3) Change the axis by 90 degrees

Subtract 90° to the axis to ensure the axis is \(\leq 180\)^\circ.

Ex: \(-1.00 \ -2.00 \times 180\)^\circ

\[180^\circ - 90^\circ = 90^\circ\]

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: nose piece, size noted on frame
  - Eye Size: distance between lenses, size noted on frame
  - Temple: Ear pieces, size noted on frame
**Spectacle Principles**

- **Vertex Distance** -
  - Distance in mm from the back surface of the lens to the front surface of the cornea
  - Used in Rx of > ± 4.00D

**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”)

**Spectacle Principles**

- **Measuring prism**

**Right eye: 2D base-up, 2D base in**

**Spectacle Principles**

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

**Supplemental Skills**

(9% of Exam)

**IOL power calculation**

- Axial Length
- Keratometry Reading
- Various formulas can be used to calculate
**A-Scan**
- Contact vs. Immersion
- Optical Biometry & Laser Interferometry (IOLMaster and LenStar)
- Measures length of the eye from the front of the cornea to the front of the retina
- Needed to calculate IOL Power

**Anterior Chamber Depth (ACD)**
- Distance between cornea and lens
- Needed for some IOL Calculation Formulas

**Anterior Chamber**
- Angle
- Ciliary body
- Trabecular Meshwork
- Aqueous humor (fluid)
- Iris

**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
- Also: IOL Master, LenStar, Visante OCT

**Pachymetry**
- Corneal Thickness
- Suitability for LASIK/Refractive Surgery
- Intraocular Pressure

**Calibration of Biometry Instruments**
- Perform calibrations regularly as recommended by the manufacturer
WaveFront Diagnostics

- Physical representation of the optical quality of a light beam
- Aberrations can affect Visual Clarity
  
More than just the refraction is measured

WaveFront Diagnostics

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

Schirmer's Test

- Measures tear production
- May be performed with or without anesthesia
- Filter paper strip is inserted under lower lid for 5 minutes
- 10mm is considered normal tear production
- Used to determine dry eye or suitability for contact lenses.

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

- Used with Cobalt Blue filter, fluoresces bright green
- Detects damage to the cornea
- Stains damaged cells
- Helps diagnose dryness of the conjunctiva and cornea

- Used differently to capture fluorescein angiography
- Injected into vein, fluoresces retinal vasculature
- Detects retinal damage

Rose Bengal

- Adheres to degenerating epithelium
- Stains damaged cells
- 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
- Plaquinil 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 (above)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ishihara Color Plate</td>
</tr>
<tr>
<td>Left</td>
</tr>
<tr>
<td>Top</td>
</tr>
<tr>
<td>Middle</td>
</tr>
<tr>
<td>Bottom</td>
</tr>
</tbody>
</table>

Color Plates

- Hardy–Rand–Ritter
  - Circles, triangles and crosses of color on neutral gray background
**FM 100–Hue Test & FM D–15 Test**

- 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.

**Farnsworth–Munsell 100 Hue**

**D–15**

- 15 pastel chips are arranged in a color sequence and scored

**Exophthalmometry**

- The process of measuring and assessing the forward protrusion of the eye with an instrument called the exophthalmometer
- Recording exophthalmoscopy results, in mm from lateral orbital rim to the corneal apex

**Schirmer Tear Test**

- Measurement of tear production over period of specific time (usually 5 minutes)
- Test strip placement
- With or without anesthesia
- Recording Schirmer Tear Test results

**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

Figure 3: Cochet-Bonnet esthesiometer for the measurement of corneal sensitivity. Image courtesy of Western Ophthalmics. www.west-op.com.
Tonometry
(5% of Exam)

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
  - Schiotz
  - Tonopen
- Non-contact
  - air puff

Goldmann Tonometer
- Double prism
- Rod
- Housing
- Force-adjustment knob

Perkins Hand Held Tonometer

Schiotz Tonometer

Tonopen
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

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

Scleral Rigidity

- The amount of elasticity in the wall of the eye.

Aqueous Humor

- Production and flow of aqueous humor
  - Produced by the ciliary processes, passes from the posterior chamber thru the pupil into the anterior chamber. It leaves the eye thru the trabecular meshwork into the canal of Schlemm and then the deep scleral plexus.
- Aqueous humor
  - Helps maintain the IOP and the metabolism of the cornea, trabecular meshwork and lens.

Glaucoma

- Basic mechanisms
- Angle closure
- Cupping
- Basic medical management
- Basic surgical management
**Glaucoma**

- Types of Glaucoma
  - Angle Closure – Caused by a mechanical obstruction (usually the iris)
  - Open Angle Glaucoma – Anterior chamber appears normal, asymptomatic
  - Secondary Glaucoma – Caused by another ocular disease
  - Congenital – Occurs in infants

**Ocular Examination for Glaucoma**

- Tonometry
- Gonioscopy
- Visual Fields
- Scanning Laser
- Stereo Disc Photos
- Optic Nerve Evaluation

**Management of Glaucoma**

- Eye drops
- Laser
- Surgery
- Shunts

**Optic Nerve Cupping**

**Visual Assessment**

*6% of Exam*

**Method of Measuring/Recording 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 Accomdata Corp
  - Smart System PC (SS) by M&S Technologies

**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

**Low Vision**

- 20/200 E recorded at feet seen i.e. 5ft/200
- Count fingers recorded at feet seen i.e. c.f.@2ft
- Hand Motion recorded as HM
- Accurate Light Projection – recorded as ALP
- Light Perception – recorded as LP

**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 room light.
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.

Visual Fields

(6% of Exam)

Visual Fields

- Questions here may be equipment or disease related!
- Remember that even Amsler Grid and CVF are types of visual fields
- Measures the expanse and sensitivity of a patient’s vision
- Visual field defects coincide with optic disc damage

Visual Pathways

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

Visual Pathway

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

Any Questions?
Characteristics of Target Visibility
- Size
- Intensity — “brightness”
- Speed of Movement
- Color
- Background illumination
- Correction of Refractive Error
- Patient responsiveness

Definitions
- 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

Definitions (cont’d)
- 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

Types of Visual Fields
- Automated –
  - Humphrey Visual Field
  - Frequency Doubling Test+
- Manual –
  - Goldmann
  - Frequency Doubling Test
  - Tangent Screen
  - Autoplot
  - Arc perimetry
  - Confrontation Visual Field

Techniques
- 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

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
Visual Field Defects from Disease

- Retinal disease
  - Rod–Cone Dystrophy

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

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

Confrontation Fields

- Static Test – put your hand into position then present fingers.
- Kinetic Test – move from outside view to within patients view.

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

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 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.

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
Tangent Screen

- Measures central 30° at 1 m
- 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

Bibliography

- *Fundamentals for Ophthalmic Technical Personnel*, (B. Cassin, 1995, W.B. Sanders Company)

Contact Information

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- Talk to your manager – make a plan for Certification
- Contact other trainers on the CE Committee
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What’s Your Next Step?

- Study the areas you feel weakest
- Borrow/purchase additional resources
- Attend in–services at CEI
- Ask Amy Jost for assistance
- Form a study group
- Create your own study aides

Get Certified!