

Breaking Down the Eye Exam

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What will you learn?

- The basic anatomy of the eye
- Parts of an eye exam

The Anatomy of the Eye

- 1 This structure is the most powerful refractive media of the eye
 - a. Lens
 - b. Cornea
 - c. Tear Film
 - d. Aqueous Humor
- 2 Cornea - The most anterior part of the eye
 - a. Allows light to enter the eye
 - b. 5 Layers
 - c. Epithelium, Bowmans Layer, Stromatolites, Descemet's membrane, Endothelium
 - d. Avascular
- 3 Crystalline Lens - The second most powerful refractive medium
 - a. Provides the focusing power to the eye
 - b. Allows the eye to focus from distance to near objects (accommodation)
 - c. Ciliary Muscle alters the shape of the lens
 - d. Change the focal distance to the retina and brings the image into sharp focus
 - e. Cataracts
- 4 Conjunctiva and Sclera - The Sclera is the white part of the eye that surrounds the cornea. It gives shape, structure and protection
 - a. What portion of the conjunctiva covers the sclera?
 - i. Bulbar Conjunctiva
 - ii. Palpebral Conjunctiva
 - b. What portion covers the inner surface of the eyelids?
 - i. Bulbar Conjunctiva
 - ii. Palpebral Conjunctiva
- 5 Lacrimal System - Glands and Ducts
 - a. Lacrimal Gland supplies the tear to the eye
 - b. Located Superior temporal to the eye
 - c. Lacrimal Duct is the drainage system for tears to reach the eyes
 - d. Nasolacrimal Duct is the drainage system for the tears to leave the eye
 - e. The tears enter the puncta to drain out
- 6 Iris and Pupil (What's your eye color?)
 - a. Iris is the colored part of the eye
 - i. Made up of two muscles

- ii. Dilator muscle and Sphincter muscle
 - b. The muscles control the center hole- Pupil and allows light to pass through. Together they control how much light enters the eye
- 7 What provides nutrients for the lens and cornea and carries away waste products?
- a. Choroid
 - b. Lacrimal Gland
 - c. Vitreous Humor
 - d. Aqueous Humor
- 8 Anterior Chamber and Aqueous humor
- a. Anterior chamber is the area inside the eye behind the cornea and in front of the lens.
 - b. It's filled with the clear watery fluid produced by the ciliary body - Aqueous humor
 - c. Maintains the intraocular pressure
 - d. Also fills the posterior chamber of the eye which lies between the iris and the front of the lens.
- 9 Vitreous Humor - The famous floaters!
- a. Vitreous chamber is the largest chamber
 - b. Jelly like consistency
 - c. Helps hold the shape of the eye
 - d. Helps the retina stay in place
- 10 What part of the retina is responsible for the color vision and clear central vision?
- a. Rods Photoreceptors
 - b. Choroid
 - c. Cones Photoreceptors
 - d. Macula
- 11 Retina - How the brain process light
- a. Comprised of layers of photoreceptors
 - b. Cones - color and central vision in bright light
 - i. Concentrated in the Macula and foveal center for maximum visual acuity
 - c. Rods - provides black and white vision, motion detection and dim light vision
 - i. Concentrated in the periphery
 - d. The images that fall on the nerve cells are then transmitted to the brain, where they are interpreted
- 12 Choroid
- a. Middle layer of tissue found between the retina and the Sclera
 - b. Made up almost entirely of blood vessels
 - c. Supply oxygen and nutrients to the outer part of the retina
- 13 Optic Nerve
- a. Carries impulses from the retina to the brain
 - b. Part of the nervous system - CN 2

- c. Optic disc is the only part of the brain that is visible from the outside
- 14 Which muscle is responsible for depression, adduction and extorsion?
 - a. Inferior Oblique
 - b. Inferior Rectus
 - c. Medical Rectus
 - d. Superior Oblique
- 15 Extraocular muscles - Control the eye movement and alignment
 - a. Rectus muscle (4) - attach directly to the eye
 - i. Superior: upward movement CN 3, adducts , intorsion
 - ii. Inferior: downward movement CN3, addicts and extorsion
 - iii. Medial: Inward CN3
 - iv. Lateral: outward movement CN 6
 - b. Oblique (2) do not attach directly to the eye
 - i. Superior: intorsion CN4, depression and abduct , sphenoid bone
 - ii. Inferior: extorsion CN3, elevates and abducts, orbital floor

The Eye Exam

- 16 Parts of the Exam
 - a. Case History
 - b. Entrance Tests
 - c. Subjective Refraction
 - d. Tonometry
 - e. Biomicroscopy
 - f. Dilated Fundus Exam
 - g. Assessment
 - h. Plan
- 17 Case History - Why the patient came to be seen today
 - a. Demographics
 - b. Chief Complaint
 - c. history of present illness
 - d. Social History
 - e. Current Medications
 - f. Allergies to medications
- 18 Entrance Tests - What they are and why we need them
 - a. Lensometry
 - b. Auto Refraction / Retinoscopy
 - c. Pachymetry
 - d. Keratometry
 - e. Topography
 - f. Visual Field

- g. VA sc/cc
 - h. Cover and Uncover Cover test
 - i. Pupil Testing
 - j. EOMS
- 19 Lensometry
- a. Measure the power of spectacle and Contact lenses
 - b. Measures the sphere, cylinder power and axis, prism and Adds
- 20 Auto Refraction and Retinoscopy
- a. Retinoscopy is an objective measure of the refractive power
 - b. Retinoscope
 - c. Analyze the red reflex in the eye
 - d. Autofraction does the same quicker
- 21 Pachymetry
- a. Measure of the corneal thickness
 - b. Used in monitor progression in some disorders
 - c. Access if patient is a good candidate for refractive surgery
- 22 Keratometry
- a. Measures the curvature of the cornea
 - b. Estimates the focusing power of the cornea, amount of astigmatism and the evaluating the integrity of the front surface of the eye
- 23 Topography
- a. Measures a thousand of points across the cornea
 - b. Used in refractive surgery and fitting of specialty contact lens
 - c. Diagnosing refractive disorders
- 24 Essential Preliminary Testing (Pre-Testing)
- a. Visual Acuity
 - i. Measures how much detail the eye can see
 - ii. Snellen letters: Testing distance /and the distance the letter should be read
- 25 Pupil Testing
- a. Test the reaction of pupils to light
 - b. Detects abnormalities of the retina, optic nerve, midbrain
- 26 EOMS
- a. Measures the function of the eye muscles and nerve innervation
- 27 Visual Field
- a. Measures what a person can see in the peripheral vision while looking straight ahead
 - b. Confrontation fields or Automated
- 28 Cover Test
- a. Examines how the eyes work together
 - b. Access if there is a deviation and how much

- 29 Subjective Refraction - What is the eyeglass prescription?
 - a. Uses the patient's response to get the best correction for them
 - b. Phoropter contain lenses uses to determine how much power the eye has
- 30 Refractive Errors
 - a. Myopia - nearsighted, image is focus in front of the retina, long eye corrected by minus lenses
 - b. Hyperopia - farsighted, image behind the retina, short eye corrected by plus lenses
 - c. Astigmatism - 2 focal points, found in myopia and Hyperopia, lenses added to the correct axis
 - d. Presbyopia - the inability to see clearly at near due to lack of accommodation, begins in the 40s , adding reading glasses
- 31 Ocular Evaluation - Slit Lamp and More
 - a. Biomicroscopy
 - b. Magnified view of the ocular structures
 - c. Fitting contact lenses, checking the health of the front surface as well as the back of the eye uses special lenses
- 32 Tonometry
 - a. Measures the intraocular pressures
 - b. Screening for glaucoma
 - c. NCT vs Goldman vs Icare tonometers
- 33 Dilated Fundus Exam and Fundus Photography - Evaluating the health of the back of the eyes
 - a. Dilated Fundus exam requires the pupil to be dilated to get complete look in the back of the eye
 - i. Side effects - Blurry vision, photophobia
 - b. Fundus Photography takes a picture of the back of the eye to document the health of the structures of the back of the eye.
- 34 What did we find and what are we planning to do about it?
 - a. Assessment - Discussing the differential diagnoses and supporting history and exam findings
 - b. Plan - What is the management and treatment for each problem found?

Common Eye Disorders

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We will discuss common eye disorders and surgeries

- 1 Blepharitis
 - a. Inflammation of the eyelid margins
 - b. Dandruff like flakes from bacteria
 - c. Itchy, irritated, crusty, redness
 - d. Lid hygiene with warm compress and lid scrubs
- 2 Hordeolum vs Chalazion
 - a. Hordeolum "Stye"
 - i. Glands become blocked infected and inflamed in the eyelid margins
 - ii. Acute localized pain
 - iii. Antibiotic ointment with warm compress
 - b. Chalazion
 - i. Slow growing lump that painless due to glands becoming blocked
 - ii. More in the upper eyelid
 - iii. Warm Compress for 10-15 minutes 4-6 times a day to soften the hardened oil
- 3 Conjunctivitis
 - a. Inflammation and swelling of the conjunctivitis
 - b. Allergic: watery discharge, itching
 - i. Remove irritant and cool compress with Artificial tears, antihistamines, or steroids
 - c. Infectious: Yellow green discharge, eye lids swelling and crusty
 - i. Antibiotics, cool compress, wash hands frequently
 - d. Chemical: watery and mild pain
 - i. Flushing the eyes and steroids "Pink eye "
- 4 Dry Eye Syndrome
 - a. Burning, gritty, tearing, redness, blurred vision, contact lens discomfort, eye fatigue, light sensitivity
 - b. Blinking spreads tears across the front surface of the eyes and into the drainage system
 - c. Poor tear quality, tear evaporation, decrease production
 - d. Treatment - Ocular Lubrication, Lid hygiene, Nutrition
- 5 Keratoconus
 - a. Disorder of the cornea that becomes thin and irregular (cone) shaped
 - b. Heredity 1 in 10 has a close family member. Late teens and early 20s
 - c. Frequent eye rubbing
 - d. Contacts lens, cornea cross linking surgery, corneal transplant

- 6 Pinguecula
 - a. Yellowish abnormal growth of tissue on the conjunctiva
 - b. Due to chronic exposure to the sun and UV radiation
 - c. Cause redness or irritation
 - d. Artificial tears, steroids
 - e. Sunglasses / Transitions
- 7 Subconjunctival hemorrhage
 - a. Accumulation of blood under the conjunctiva
 - b. Broken blood vessel
 - c. Straining, lifting heavy, coughing, vomiting and blood thinner medication
 - d. No treatment - resolves in a week or two
- 8 Cataract
 - a. Cloudy or opaque area of a crystalline lens
 - b. Interferes with normal vision - scatters light
 - c. Age related but can be due to trauma or medications
 - d. Types include nuclear, cortical (spoke), posterior capsular
 - e. Diabetes, UV radiation, Alcohol, Smoking, Family History
 - f. Aphakia - absence of the lens, corrected with CL or spectacles
 - g. Pseudophakia - intraocular implant
- 9 Strabismus
 - a. Condition where both eyes do not look at the same place at the same time.
 - b. Due to poor eye control
 - c. Lack of depth perception, cause double vision, develop poor vision in the turned eye
 - d. More common in infants and young children
 - e. Eso, Exo, Hyper, Hypo,
 - f. Constant or intermittent
 - g. Alternating or unilateral
- 10 Nystagmus
 - a. Eye makes repetitive, uncontrolled movements
 - b. Results in reduced vision and depth perception, balance, and dizziness
 - c. Causes of nystagmus: Albinism, high refractive errors, CNS diseases, lack of development early in life
 - d. Null point, where the least amount of nystagmus is seen- adopt a head posture
 - e. No cure. Glasses, contact lens and surgery can help improve vision
- 11 Computer Vision Syndrome / Digital Eye Strain
 - a. Caused by prolonged computer and cell phone use
 - b. Eye strain, headaches, blurred vision, dry eyes, neck, and shoulder pain
 - c. Poor lighting, glare, viewing distance, poor posture, uncorrected vision correction
 - d. 20/20/20 rule

12 Glaucoma

- a. Disorders that cause progressive damage to the tissue of the optic never resulting in loss of vision
- b. Commonly due to increase of ocular pressure (primary open angle glaucoma)
- c. Angle closure - less common and is a medical emergency that can cause vision loss in within a day
- d. Lower pressures: medications, surgery, implants
- e. Family history

13 Diabetic Retinopathy

- a. Diabetes damages the small blood vessels in the retina causing blood and fluid to leak
- b. If left untreated can cause blindness
- c. Treatment is injections or laser to stop new vessel formation and leakage
- d. Annual exams with dilation
- e. Take medications, follow up with PCP, exercise and eat healthy, control blood pressure

14 Macular Degeneration

- a. Disease affecting the macula causing loss of central vision
- b. Occurs in adults over 50 years, leading cause of severe vision loss
- c. Two forms: Dry (atrophic) and Wet (exudative)
- d. Gradual loss of vision, distortion, wavy or crooked lines, loss of color vision
- e. Vitamins, Mediterranean diet, UV protection, no smoking, injections

15 Flashes and Floaters

- a. Small cloudy particles in the vitreous seen in your vision floating around
- b. Appear as the vitreous fluid deteriorates due to aging
- c. Flashes are stimulation of the nerves in the retina due to tugging of the retina
- d. New floaters and flashes need dilated eye exam
- e. Brain will ignore over time
- f. Can be associated with retinal tears, holes, detachments

16 Retinal Detachment

- a. Separation of the layer of the retina
- b. Causes: high myopia, trauma, retinal breaks, lattice retinal degeneration, after cataract surgery
- c. Symptoms of flashes of light, floaters and curtain moving over vision
- d. Treatment includes laser, cryotherapy, sclera buckle, oil injection

17 Refractive Surgery

- a. LASIK (laser in-situ keratomileusis)
- b. Treats myopia, hyperopia, astigmatism
- c. Cut a cornea flap, laser the stroma, then flap set back in place to heal
- d. Photorefractive keratectomy (PRK)
- e. Similar to LASIK but great for thin corneas or dry eyes.

- f. Does not cut a flap, special brush is used to remove the outermost layer of the cornea
- g. Radial Keratotomy (RK)
- h. Oldest surgery
- i. Cuts are made to flatten the cornea

18 Refractive Surgery

- a. Automated Lamellar keratoplasty (ALK)
- b. Treated high levels of myopia and mild hyperopia
- c. Laser thermal keratoplasty (LTK)
- d. Holmium laser to heat certain areas of the cornea and shrinks part of the cornea making it steeper
- e. Conductive keratoplasty (CK)
- f. Noninvasive procedure which uses radio frequency energy to correct presbyopia and low hyperopia. Can also correct for residual refractive error after LASIK
- g. Intracorneal ring (intacs)
- h. Micro thin prescription inserts previously used for low myopia but it now FDA approved for keratoconus

19 Cataract Surgery

- a. Cloudy natural lens is removed and replaced by a clear artificial lens. (Intraocular lens)
- b. Tiny incisions with a laser or blade at the edge of the cornea
- c. They break down the lens with a phacoemulsification instrument to remove it
- d. Placement of new lens
- e. <https://youtu.be/LIza4BiEoOk>
- f. Posterior capsular pacification can over after surgery and needs a YAG laser to remove it

20 Glaucoma Surgery

- a. Trabeculectomy: creates a tiny opening in the top of the eye under the eyelid allowing fluid to drain away lowering the pressure.
- b. Implant: a tiny tube or shunt is implanted onto the white of the eye and helps drain extra fluid out of the eye lowering the pressure
- c. Minimally invasive glaucoma surgery (MIGS): newest procedures to help minimize complications
- d. Possible side effects: cataract, eye pressure to low and vision loss

21 Retinal Surgery

- a. Retinal detachment is a medical emergency
- b. Pneumatic retinopexy: inject small air bubble into the eye pushing the retina back into place so the doctor can laser it freezes any holes or tears
- c. Scleral buckle: place a tiny flexible band around the white part of the eye pushing the eye toward the retina helping it reattach. Its permanent
- d. Vitrectomy: removing the vitreous with a suction tool then use a laser or inject a

bubble of air to hold the retina place. Also replace the vitreous with silicone oil

Contact Lens Basics

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- 1 Objectives
 - a. History of Contact Lens development and technology
 - b. What we treat with contact lenses
 - c. Types of contact lenses
 - d. Soft
 - e. Rigid
 - f. Hybrid
 - g. Parameters of contact lenses
- 2 History of Contact Lenses
 - a. 1508 the concept of contact lens was sketched by Leonardo De Vinci
 - b. 1823 practical designs were created by Sir John Hershel
 - c. 1887 first CL made from glass and fitted over the entire eye
 - d. 1939 first plastic CL
 - e. 1948 first plastic CL that covers only the cornea
 - f. 1971 soft contact lens
 - g. 1978 RGP
 - h. 1981 overnight wear FDA approved
 - i. 1996 daily disposable introduced
 - j. 2002 Silicone hydrogel first marketed
 - k. 2002 OrthoK approved by FDA
- 3 What we treat with contact lenses:
 - a. Refractive Error
 - i. Myopia (nearsightedness)
 - ii. Hyperopia (farsightedness)
 - iii. Astigmatism
 - iv. Presbyopia (changes in accommodation)
 - When writing a prescription the brand type , power , base curve and diameter is needed
 - b. Corneal Traumas and Diseases
 - i. Severe corneal abrasions
 - ii. Sterile corneal ulcers
 - iii. Keratoconus
 - iv. Corneal ectasia
 - c. Ocular Surface Disease
 - i. Scleral Lenses are being prescribed for the management of ocular surface disease.
 - ii. Protects the ocular surface and provides continuous hydration

- iii. Cover the entire cornea and provides a fluid reservoir between the back of the lens and the
 - d. Front surface of the cornea
 - i. Sjögren's syndrome - chronic autoimmune disease presenting with dry eyes and mouth
 - ii. Exposure keratopathy - results from eyelid malposition
 - iii. Neurotrophic keratopathy - impaired corneal innervation and decreased corneal sensitivity.
 - e. Color Vision Deficiency
 - i. Inherited condition with no cure
 - ii. Most commonly trouble seeing red and green or blue and yellow
 - iii. Glasses that block certain wavelengths of light and increase the ability to detect red and green
 - iv. New research on dyes to be added to contact lens and block the wavelengths that lies between red and green
 - f. Orthokeratology
 - i. Temporarily reshapes the cornea to improve vision
 - ii. Worn at night to reshape the cornea while you sleep
 - iii. Mainly used to correct and control myopia
 - iv. Rigid gas permeable lenses
- 4 Soft Contact Lenses
 - a. Made of polymers that absorb water
 - b. Need to be kept in solution to keep from drying out
 - c. Flexible and comfortable to wear
 - d. Handling can be tricky
 - e. Spherical correction
 - f. Toric for astigmatism
 - g. Mono vision or Multi-focal fit
 - h. Color/ tinted
- 5 Rigid Contact Lenses
 - a. Older material PMMA did not allow oxygen to flow through to the cornea.
 - b. Lack of oxygen caused retainment of water and swelling
 - c. RGP's
 - d. Now made of polymers and plastics that are oxygen permeable
 - e. Last longer and provide sharper vision
- 6 Scleral Contact Lenses
 - a. Cover the entire corneal surface and rest on the sclera
 - b. Care and Handling
 - c. Adaptation period
 - d. Tinted
 - e. Long life Hard lenses

- 7 Hybrid Contact Lenses - Best of both worlds- best visual acuity of RGP and comfort of soft lens
 - a. Center RGP with soft skirt
 - b. Great for corneal astigmatism
 - c. Great for trouble with soft toric lens movement
 - d. Multifocal
- 8 Contact Lens Wear Schedule
 - a. Daily Disposable- wear when awake and remove before bed
 - b. Bi-weekly
 - c. Monthly
 - d. Quarterly
 - e. Annual
 - f. Extended Wear - continuous or overnight wear
 - i. 6 days to 30 days
 - ii. Could increase risk of complication, need regular monitoring
- 9 Care and Handling
 - a. Medical devices
 - b. Washing hands before handling
 - c. Cleaning, rinsing, and disinfecting
 - d. Cleaner Removes debris from lens surface
 - e. Rinse removes the cleaner and loosen debris from the surface
 - f. Storage case filled with disinfecting and conditioning solution
 - g. Enzymatic cleaners may be added to reduce build of protein on the surface of the lens
- 10 Parameters of contact lenses
 - a. Lens Design and Power
 - i. Prescription of contact lens is different than spectacle because it fits on the eye and not information of the eyes
 - ii. This takes account the vertex distance
 - iii. RGP are custom made
 - iv. Soft contacts are fit by parameters that are provided by the manufacturer
 - a. Base Curve Radius
 - i. Primary curve on the posterior of the lens
 - ii. Approximate the shape of the cornea
 - iii. Millimeters of radius of curvature
 - iv. Measured by a radiuscope or keratometer
 - b. Overall Diameter and Optical Zone Diameter
 - i. OAD is the size of the lens from edge to edge at the widest point
 - ii. Rigid lens is 8.5mm to 9.5mm
 - iii. Soft lens is 11mm to 15mm

- iv. OZD
 - v. Center area that provides optical correction for the patient Vision
 - vi. Differed depending on pupil size, the OAD and peripheral curve width
- c. Peripheral Curves
 - i. Additional curves on the back surface of the Elena that surround the optical zone to help tailor the lens to fit each patient
 - ii. Steeper in the center and flatter in the periphery
- d. Edge and Center Thickness
 - i. Center thickness: lens thickness of the center of the lens from posterior to anterior
 - ii. The increased thickness of a lens reduces its oxygen permeability
 - iii. Hyperopia prescription has a higher center thickness
 - iv. Edge thickness is the thickness of the edge of the lens
 - v. Important factor in the comfort of the lens, a thick edge can cause discomfort and irritation
 - vi. Higher in myopia prescriptions