CERTIFIED PARAOPTOMETRIC (CPO) EXAM:

STUDY RESOURCE

AMERICAN OPTOMETRIC ASSOCIATION®

CERTIFIED PARAOPTOMETRIC (CPO) EXAM – STUDY RESOURCE

This document is a resource that any paraoptometric can use when preparing for a Commission on Paraoptometric Certification (CPC) examination. The CPO study resources are not a prerequisite for taking the paraoptometric certification examination given by the CPC. Using this study resource does not guarantee passing the paraoptometric certification examination given by the CPC. However, this study resource is created based on the most current CPO Expanded Exam Outline provided by the CPC.

This resource is intended to be used in conjunction with all the CPO study materials that can be found on the American Optometric Association (AOA) EyeLearn: Your Professional Development Hub platform.

Recommended CPO Study Resource Checklist

- ☐ 2025 Paraoptometric Candidate Handbook
- ☐ 2025 CPO Expanded Exam Outline
- ☐ Certified Paraoptometric (CPO) Certification Prep-course
  - Interactive Learning: 5 Domains
  - Certified Paraoptometric (CPO) Exam: Study Resource Book
  - CPO Competencies Book
  - Optometric Terminology (PDF)
  - Certification Paraoptometric (CPO) Flash Cards
  - CPO Practice Assessment
- ☐ Para Certification Study Halls (ALL)
- ☐ Basic Anatomy and Conditions of the Eye (Webinar)

Contact

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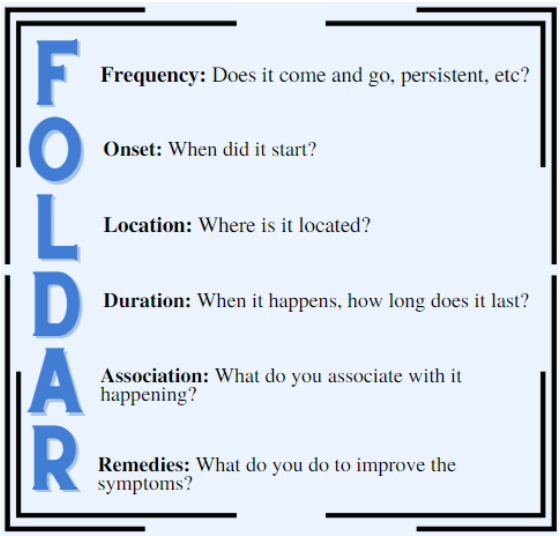
CLINICAL PRINCIPLES, TESTING AND PROCEDURES (52.2%)

RECORD CASE HISTORIES

CHIEF COMPLAINT

- A concise statement of the symptoms that caused a patient to seek medical care.
  - Examples:
    - "I'm here for my annual appointment."
    - "I broke my glasses."
    - "My doctor suggested I make sure my diabetes isn't affecting my eyes."
    - "I think I have metal in my eye."
- Asking the patient detailed questions about their chief complaint should be documented under their History of Present Illness (HPI).
  - Example: FOLDAR



OCULAR HISTORY

- Some ocular diseases have an increased risk due to genetics.
- Do you or anyone in your IMMEDIATE family have any of the following:
  - Cataracts
  - Glaucoma
  - Macular Degeneration
  - Color Vision Deficiencies
  - Eye Trauma
  - Eye Surgeries
  - Retinal Detachment
- If yes, record the condition and how the patient is related to the family member.
  - Example:
    - "My paternal grandfather has glaucoma."
  - Note: If the patient is adopted and does not know their parents, that should be recorded as well.

PERTINENT MEDICAL HISTORY

- Other health related diseases can also be hereditary.
- Do you or anyone in your IMMEDIATE family have any of the following:
  - Hypertension
  - Diabetes
  - Cancer

- Stroke
- Heart Attack (myocardial infarction)

- If yes, record the disease and how the patient is related to the family member.
  - Note: If the patient is adopted and does not know their parents, that should be recorded as well.

CURRENT MEDICATIONS

- Optometrists inquire about your medications both prescription and over the counter (OTC), for several important reasons:
  - Identifying potential vision issues: Optometrists need to rule out any medications, herbs, or supplements that might be causing vision problems.
    - For instance, if you've been taking antihistamines for allergies, which can lead to dry eyes, your optometrist will consider this when evaluating your eye health.
  - Avoiding future problems: By knowing your medication history, optometrists can anticipate potential issues that may arise in the future.
    - For example, long-term use of certain medications may gradually affect your eyesight. If you're planning cataract surgery, your doctor needs to be aware of medications like Tamsulosin, which can cause complications during the procedure.
  - Medications and eye health: Some medications are known to impact eye health.
    - For example. corticosteroids used for conditions like asthma or psoriasis can lead to cataracts or glaucoma over time.

SUPPLEMENTS

- Deficiencies in certain nutrients can increase eye conditions like glaucoma and cataracts. Taking a multivitamin and mineral can help address nutritional gaps in your diet.
- There are other OTC supplements, such as AREDS that are recommended by optometrists to slow down the progression of macular degeneration. Even though they aren't technically a prescription, they are an essential part in the care of macular health.
- Scopolamine patches are used to prevent nausea. This could be essential information if your patient calls with dilated pupils.
  - Often, these patients accidentally touch their eye after touching the patch and cause dilated pupils.

All medications, whether prescription or not should be reported to your doctor to receive the best possible care.

ALLERGIES

- It is essential to ask about allergies at every visit. The patient could be having an allergic reaction to a medication or environmental factor and may need your help to treat it.
  - Allergies should include both ocular and systemic medications along with environmental allergens.
  - You also don't want to prescribe a medication to treat a patient's ocular symptoms knowing that they have an ocular or systemic reaction.
  - It is also helpful to record what kind of reaction they have to the allergies whether it be anaphylaxis, itchiness, or a combination of symptoms.

SOCIAL HABITS

- Tobacco, recreational drugs and alcohol can have an effect on your eye health and vision, increasing your risk for disease such as macular degeneration.
    - Patients should be asked if they use tobacco, recreational drugs or alcohol, how often, and how many drinks or cigarettes they consume daily.
    - They can also confirm how long they have been free from alcohol or tobacco use.

WORK/SCHOOL

- With the prevalence of blue light, users can have many hours of eye strain from different screens (computer, phone, tablet, etc.). It is essential to make sure you know how your patients are using their eyes.
    - For example, a presbyope that works on the computer most of the day may need a special lens for computer tasks only.

HOBBIES

- Your optometrist asks about your hobbies to better understand your lifestyle and visual needs to personalize recommendations to ensure you have the best possible vision. Here's a few examples:
    - Outdoor activities - If you spend a lot of time outdoors, you may need sunglasses to protect your eyes from UV rays. Certain hobbies like fishing or water sports may benefit from polarized lenses.
    - Screen time - If you spend a lot of time on the computer or gaming, you might be at risk for digital eye strain or dry eye symptoms. Special computer glasses or coatings can help reduce this strain.
    - Detailed work - Hobbies like reading, sewing, or model-building often require focused vision for small details. You might benefit from multifocal contacts or reading glasses.
    - Sports - Certain sports require specific types of protective eyewear to prevent injury.
    - Art and photography - These hobbies might require you to have excellent color perception. Your optometrist can check your color vision and recommend solutions if needed.

VISUAL ACUITY TESTING

Visual acuity (VA) is a measure of the finest detail the eye can detect. The central area of the retina, the macula, is responsible for seeing fine detail. Visual acuity is the way we measure how much detail the eye can appreciate.

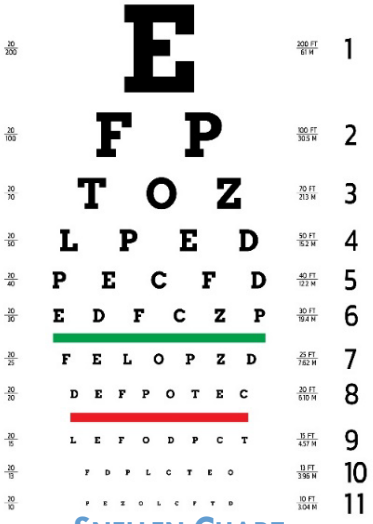
- The letter chart most often used to measure acuity at distance is called the Snellen Chart. Visual acuity is typically described as a Snellen Fraction.

  Snellen Fraction = Testing distance
  Distance at which letter is standardized to be read.

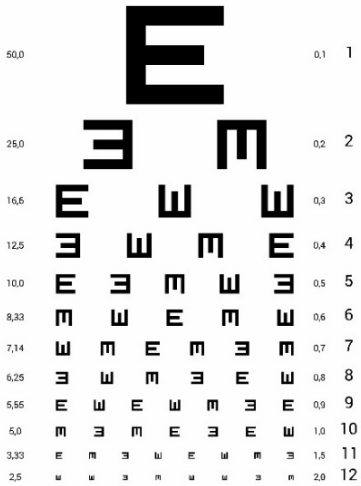
    - The numerator (or top number) of the fraction is the testing distance, which is typically 20 feet. The denominator (the bottom number) represents the distance at which a person with normal eyesight can read the same line correctly.

- When you see the Snellen fraction 20/20, for example, it means that the eye reads at 20 feet, which is standardized to be read at 20 feet. If a person read the 20/40 line on a visual acuity chart, that would indicate a person with normal eyesight can read the letter at 40 feet, while the patient can only read it from 20 feet.
- Letters on the same line vary in difficulty, a patient may not be able to read an entire line of letters. They may miss some letters on the smallest line they are able to see.
  - When this occurs, a patient can read majority of the letters on a line (getting 2-3 incorrect), then this is their measured visual acuity. As you can see, 20/20 does not mean perfect vision; it just tells how well that small part of the visual system is performing.
  - For example, if a patient misses one letter on the 20/30 line, it is recorded as:
    - 20/30-
  - They can also get a credit for seeing just one letter on a smaller line.
    - Example: 20/30+

- Some additional visual acuity charts include Tumbling E and Allen Figures.
  - Tumbling E Chart (also known as an E Chart): Useful for patients who are unable to read the alphabet. The patient tells the doctor which direction the E is facing.
    - Example: up, down, left or right
    - This is an excellent resource for patients that are unable to read the alphabet, small children, non-verbal or non-English speaking.
  - Allen Figures: Useful for testing on children or a patient with a developmental disability.
    - Instead of using letters, it uses familiar pictures such as a birthday cake, airplane and bird.



Snellen Chart



Tumbling E

Allen Figure

- Alternative Assessments of Visual Acuity
  - Counting Fingers (CF) - used to assess visual acuity in patients who cannot see the big E on the Snellen Chart at 20/400.
    - The paraoptometric typically holds up their fingers at varying distances and the patient reports the maximum distance at which they can see the fingers.

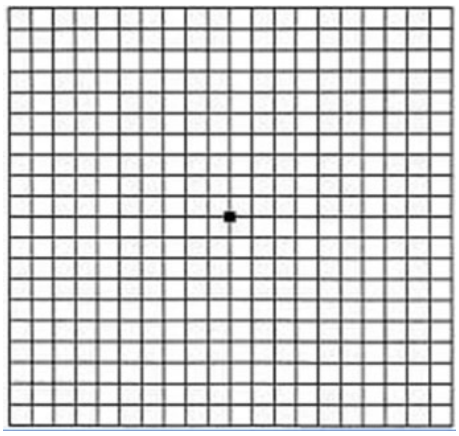
        - The visual acuity is recorded as VA=CF 5m or VA=CF 1m, depending on the specific distance. Imagine a patient who has severe vision loss due to retinal disease.
    - Hand Motion (HM) - HM represents an even lower level of visual acuity than CF.
        - The paraoptometric typically stands 50-100 centimeters away from the patient and waves their hand in front of them.
    - Light Perception (LP) - LP signifies that the patient can perceive the presence of light but cannot distinguish any form or movement.
        - The examiner would shine a penlight into the patient's eye, and if they could see the light, record their visual acuity as LP for light perception.
        - These patients most often have severe optic nerve or retinal damage.
    - No Light Perception (NLP) - NLP indicates the complete absence of light perception.
        - These patients may have conditions such as total retinal detachment or optic nerve atrophy.
- Pinhole Acuity Testing: Determines if a patient's vision can be improved with correctable lenses. This test is performed when a patient's vision is worse than 20/30 in one or both eyes.
    - A pinhole occluder is a special occluder with one or many small holes. It can be paired with the Snellen Chart to determine whether a patient has a decrease in vision due to refractive error or ocular pathology. It functions as a rapid screening tool for best-corrected visual acuity without having to refract the patient.
        - Looking through a pinhole leads to increased depth of focus and decreases retinal blur.
    - If the patient's acuities get better using the pinhole, that means that corrective lenses would be able to help the patient see better.
        - Visual acuity will improve if the patient's retina and visual pathway are free of abnormalities.
    - If the patient's vision does not improve, it is recorded as NI for no improvement. This would indicate that there is likely ocular pathology, rather than refractive error, that is causing decreased vision.
    - To perform pinhole acuity, the paraoptometric has the patient place a pinhole over the eye being tested, and the paraoptometric occludes the other eye. The patient lines the pinhole up to read the smallest possible line on the Snellen Chart. If the vision in each eye is 20/30 or worse, pinhole acuity is performed in both eye.
        - This is recorded as VA under PH (pinhole) and recorded the same as you would record any Snellen number.
            - Example: 20/25 or 20/30 PH

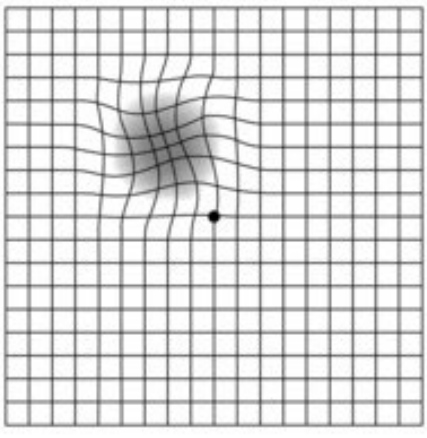
AMSLER GRID TESTING

This is a simple tool to evaluate a patient's central vision. It is often used to detect vision problems that occur as a result of macular pathology, most commonly macular degeneration.

- Other common conditions that necessitate Amsler Grid testing:
  - Central serous retinopathy
  - Blind spots or scotomas
  - Macular pucker
  - Epiretinal membrane
  - Cystoid macular edema
  - Diabetic macular edema
- Preparation:
  - Lighting: Test in a room with normal lighting that allows for easy reading
  - Eyewear: Wear your reading glasses, contacts, or any other prescribed eyewear.
  - Distance: Hold the Amsler grid at a distance that enables all the grid lines to be in focus, which is approximately 14-16 inches from your face.
- Procedure:
  - Individual eye testing: cover one eye and focus on the dot at the very center of the grid.
  - The patient should answer a series of questions while focusing on the central dot.
    - Questions include:
      - Do any of the lines appear wavy or distorted?
      - Can you see all four corners of the grid?
  - Repeat daily: If any changes are noted in the Amsler Grid, it could be an indication of progression of a macular condition.
- Recording Results
  - Does the patient see any areas of wavy lines or distortion (metamorphosia)?
  - Does the patient see any missing pieces or black areas in the pattern (scotoma)?

Note: Make sure to record where the abnormalities are on the grid





BLOOD PRESSURE MEASUREMENT (AUTOMATED)

- Blood pressure is the force of your blood pushing against the wall of the arteries.
  - How to check blood pressure:
    - Ensure the patient is seated comfortably in the chair with their feet flat on the floor.
    - The patient's legs should be uncrossed, and their back should be supported.
    - Patient's arm should be relaxed with the palm facing up.
      - It is recommended that the patient is seated for a couple minutes before taking blood pressure.
    - Each automated cuff has its own instructions on where they need the patient's arm to rest. Depending on the cuff model, your hand should rest either across the chest or just bent up slightly as indicated by a light on the cuff.
    - The patient should refrain from talking while the cuff is taking the measurement.
    - Systolic value (top number) followed by the diastolic value (bottom number)
      - Example: 120/80 mmHg read as "120 over 80"

Blood Pressure Category	Top Number (systolic) in mm Hg	And/Or	Bottom Number (diastolic) in mm Hg
Normal blood pressure	Below 120	and	Below 80
Elevated blood pressure	120-129	and	Below 80
Stage 1 high blood pressure (hypertension)	130-139	or	80-89
Stage 2 high blood pressure (hypertension)	140 or higher	or	90-higher
Hypertensive Crisis (consult your doctor immediately)	Higher than 180	and/or	Higher than 120

STEREOACUITY TESTING

The measure of acuteness of depth perception provides an indication of the level of sensory binocularity an individual has, meaning it measures the patient's fine depth perception through their ability to fuse stereoscopic targets.

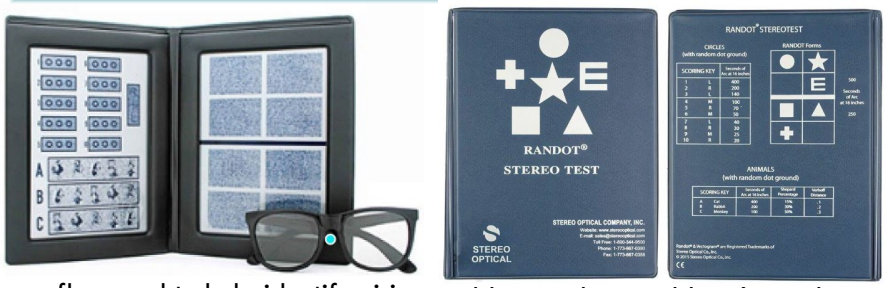
- Stereo testing is performed with both eyes open while wearing polarized lenses. By wearing polarized lenses with different orientations for each eye, it allows each eye to see slightly different images. The brain fuses these different images together and it appears as if the image jumps off the page.
- Different Test Booklets:
  - Randot Stereotest - a multiple-choice test that evaluates depth perception. Instruct the patient to wear their glasses or contacts if they have them and put the stereo glasses over their corrective lenses. Have the patient hold the book sixteen inches away. The patient will see ten rectangles with three circles in each. Only one of the circles has a crossed

disparity, which, when seen binocularly, should appear to stand forward from the other two. Ask the patient which one seems to float forward or appears "different" from the others. Record the level of stereopsis at the last one chosen correctly. If one is missed, go back, and test the preceding line again to determine whether the subject can achieve this or is guessing. The answers to each of the tests are printed on the back cover of the book for the technician to correspond to.
Simplified: identify which circle appears to be floating above the page or appears closest; stop when two consecutive incorrect answers are given.

Tests and evaluates stereo depth perception for both gross stereopsis evaluation (500 to 250 seconds of arc) using six geometric forms from random dot backgrounds.

Graded circle test for children (400 to 20 seconds of arc)

Animals (400 to 100 seconds of arc)



- Stereofly - used to help identify vision problems such as amblyopia, and suppression. With the polarized lenses, the patient will see a fly with wings that stands off the page. The patient is instructed to pinch the wings. If the patient pinches the wings above the page, this is considered passing the test. If the patient doesn't see wings that come off the page then it is a fail. If they can't, there is no need to go on to the circles or animal portion of the test. *Simplified*: pinch wings of fly
  - For adults, you can move on to the nine boxes with four dots in each box. Ask the patient which one circle sticks up in each box. As soon as the patient misses one or says that there are no circles that stick up, that box's corresponding seconds of arc is recorded.
  - For children, there are three rows (A, B, C) of five animals in each row, with one animal sticking up in each row.

Evaluate both gross stereopsis (355 to 700 seconds of arc) and fine depth perception.

Graded circle test (800 to 40 seconds of arc)

Animal test for children (400 to 100 seconds of arc)

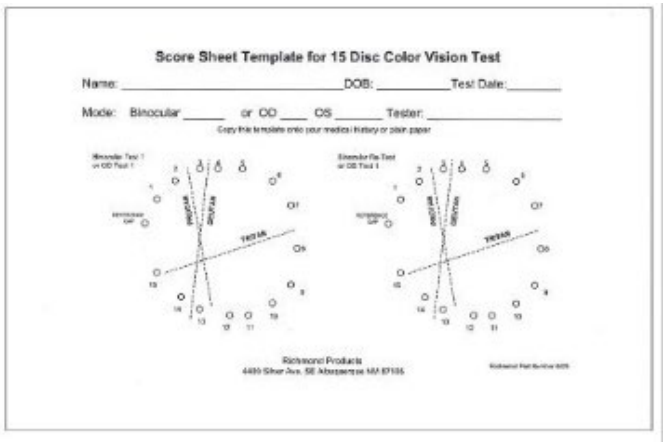
COLOR VISION ASSESSMENT

Patients that have Achromatopsia, or total color blindness, are rare. There are two types. Complete Achromatopsia means that vision is limited to black, white, and shades of grey. Incomplete Achromatopsia means that color vision is limited, with dull hues that can be difficult to distinguish. These patients are born with a genetic disorder that causes the retina to use only rods to see.

Color vision deficiency is the inability to distinguish certain shades of color. The term "color blindness" is also used to describe this visual condition, but very few people are completely color blind. Color vision is possible due to photoreceptors in the retina of the eye known as cones. These cones have light-sensitive pigments that enable us to recognize color. Cones are found in the macula, the central area of the retina. Each cone is sensitive to red, green, or blue light (long, medium or short wavelengths). The cones recognize these lights based on their wavelengths. Normally, the pigments inside the cones register different colors and send that information through the optic nerve to the brain. This enables us to distinguish countless shades of color. But if the cones do not have one or more light-sensitive pigments, colors cannot be seen.

- Most common test types:
  - Ishihara (Pseudo-Isochromatic Plates): tests for detection of red-green color deficiencies.
    - Equipment: occlude, lamp, test book
    - Test each eye separately
    - Ask the patient to identify a number or figure on page

- D-15 (arrangement test):
  - Color blindness test based on a set of colored plates or discs which have to be arranged in the correct order. It identifies color vision deficiencies, such as red-green and blue-yellow blindness, as opposed to testing full-color acuity.
  - Example: Farnsworth Dichotomous Test
    - Organizing 15 color caps in order of color
    - Tester maps outline the pattern to find which type of color anomaly the patient has using the panel.
    - Take them all out of the holder. You will be left with the start disc that does not come out of the holder.
    - Ask the patient to put next to the start disc the next color that most closely matches it.
    - When the patient has put all fifteen discs in the holder, close it and flip it over. You'll see the back side of the discs that have numbers on them.
    - Using the Score Sheet, start at "Start" and draw a line to the number that the patient picked next. If there are any color vision deficiencies, your drawn line will run along the same line as the defect line.
  - Another Example: Farnsworth Dichotomous 100 Test: which uses 100 color caps.



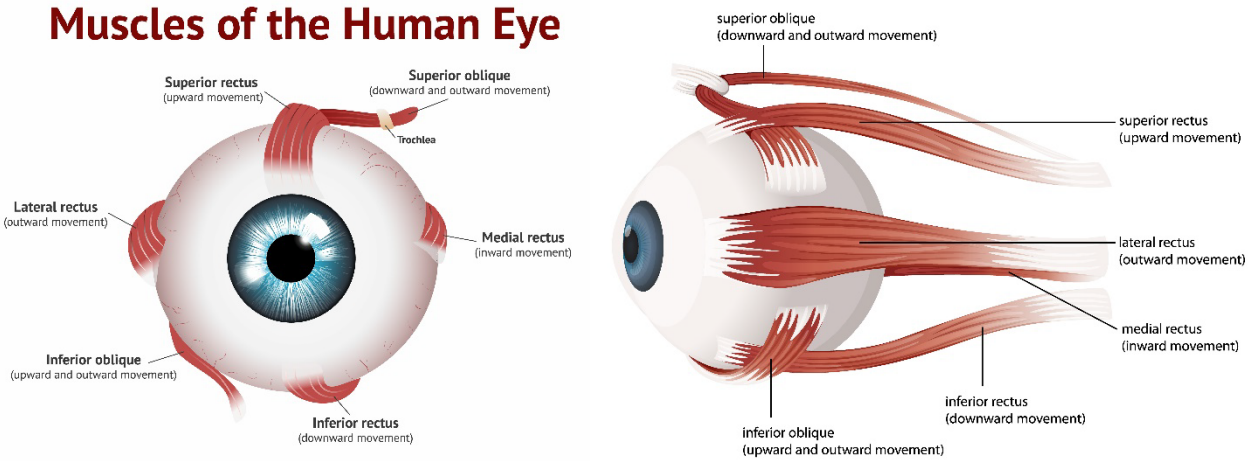
- Most Common Color Deficits:
  - Red/Green - There are four types of red-green color blindness:
    - Deuteranomaly is the most common type of red-green color blindness. It makes green look more red. This type is mild and doesn't usually get in the way of normal activities.
    - Protanomaly makes red look more green and less bright. This type is mild and usually doesn't get in the way of normal activities.
    - Protanopia (red) and Deuteranopia (green) both make you unable to tell the difference between red and green at all.

OCULAR MOTILITY TESTING

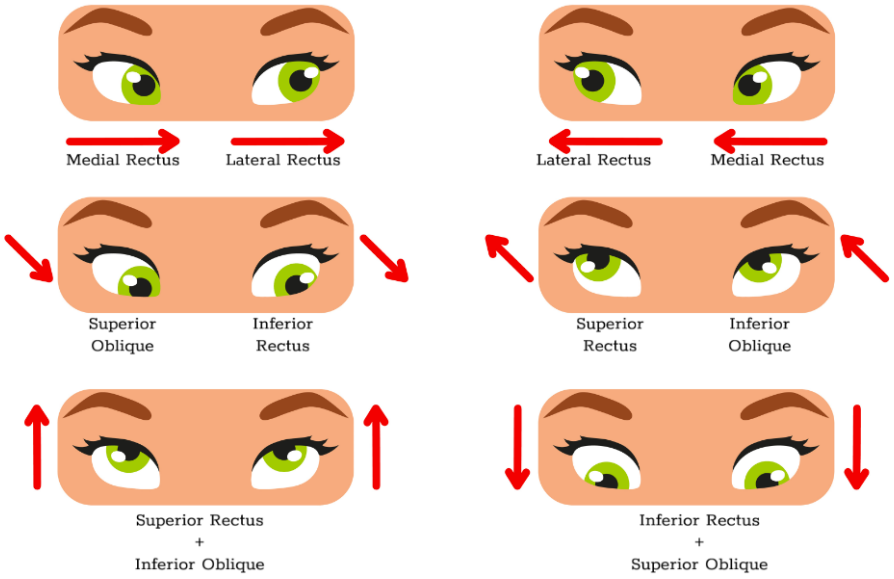
There are six muscles attached to the sclera from the orbital bones. Extraocular Motilities (EOM) evaluates smooth, coordinated eye movements. An inability to move the eyes fully in any direction, uncoordinated movements, or eye shaking may indicate a problem.

Extraocular Muscle	Direction of Eye Movement
Medial Rectus	In
Inferior Rectus	Down
Lateral Rectus	Out
Superior Rectus	Up
Superior Oblique	Down & Out
Inferior Oblique	Up & Out

- Muscles of the Human Eye and Their Movements:
  - Medial rectus - The most powerful of the extraocular muscles. Its only action is to turn the eye toward the nose (adduction).
  - Inferior rectus - Its primary action is to turn the eye downward (depression). It also adducts the eye. Additionally, it can rotate the top of the eye toward the temple and the bottom of the eye toward the nose (extorsion).
  - Lateral rectus - Its only action is to move the eye away from the nose (abduction).
  - Superior rectus - Its primary action is to move the eye upward (elevation). It also adducts the eye. Additionally, it can rotate the top of the eye toward the nose and the bottom of the eye toward the temple (intorsion).
  - Superior oblique - Its primary action is intorsion. It is also responsible for depression and abduction.
  - Inferior oblique - The only extraocular muscle that has its origin at the front of the orbit. Its primary action is extorsion. It is also responsible for elevation and abduction.



- To Evaluate:
  - Have the patient take off their glasses.
  - Position the penlight 12-14 inches from the patient's face.
  - The examiner tells the patient to follow light with their eyes only. Moving the light in a broad H pattern, each muscle is tested at least each muscle once.



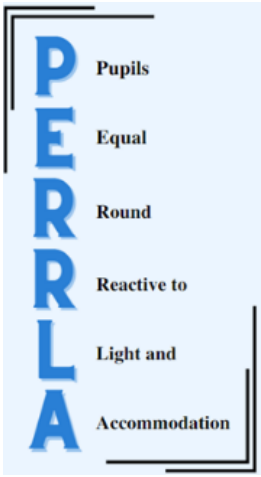
  - Examiner observes smoothness of movement, accuracy of following penlight, and extent of movement. Recording eye muscle movements uses a grading system +1 to 4 to indicate over action and -1 to 4 to indicate under action. Zero represents normal full movement.
  - When performing EOM, you should ask the patient if they experience any diplopia or pain.
  - Recording EOM: SAFE
    - If restriction is noted, documentation should be made.
      - For example: restricted abduction OS.

PUPILLARY RESPONSE TESTING

Normal pupil constriction and dilation occur as a result of a delicate balance between the sympathetic and parasympathetic nervous systems. Therefore, examination of the function of the pupils is utilized to evaluate the function of the patient's nervous system.

- In bright light the pupil should constrict or get smaller to reduce the amount of light entering the eye.
  - This is due to the parasympathetic innervation leading to pupillary construction.
- In dim light the pupil dilates or gets bigger to allow more light into the eye to improve visibility.
  - This is due to sympathetic innervation leading to pupillary dilation.
- When light is shone into one eye, both pupils should constrict.
  - If the pupils do not constrict when the light is shone in the eye, this can be a sign of Relative Afferent Pupillary Defect (RAPD).
  - Some causes of RAPD (also known as Marcus Gunn Pupil) include:

        - Optic neuritis
        - Severe glaucome causing trauma to optic nerve
        - Direct optic nerve damage (trauma, radiation, tumor)
        - Retinal detachment
        - Very severe macular degeneration.
- Equipment: Penlight/Transilluminator, Distant Fixation Target
- Observe size and speed of pupil constriction in both eyes
- How to Test Pupil Response:
    - Pupil size and shape in normal illumination should be noted. The technician should look for any signs of anisocoria (where one pupil is larger than the other) or a misshapen pupil.
    - Test in a dim room with the patient looking at the distance. Use bright light about 30cm from patient's eyes. Technicians should observe the direct pupil response or constriction of the pupil when the light is shone into the eye.
    - Technicians should observe that the opposite eye's pupil should also constrict when light is shown in the first eye. This is known as the consensual pupil response.
    - Steps one through three are repeated with the opposite eye. Swing light between the eyes for 2-3 seconds per eye.
- What to look for (**PERRLA**):
    - **P**upils: They should be in the center of your iris.
    - **E**qual: Healthy pupils should be about the same size.
    - **R**ound: Your pupils should look like circles with even boarders.
    - **R**eactive to Light: Healthy pupils constrict or dilate in response to light.
    - **A**ccommodation: Healthy eyes respond in the same way. When you look up close your pupils should get smaller and when you look far away pupils should get wider.



TONOMETRY (CONTACT AND NON-CONTACT)

Tonometry is a test used to measure intraocular pressure (IOP). It measures the pressure inside of the eye by flattening the cornea.

- The more force that is needed to flatten the cornea, the higher the pressure is inside the eye.
- Patients with thin corneas (less than 555um) can show a lower IOP reading than what actually exists and thick corneas can show a higher IOP.
- Tonometry and Glaucoma:
    - There are three types of glaucoma:
        - Primary open-angle glaucoma (POAG): Most common type of glaucoma, happens because the fluid in the eye builds up and does not drain quickly enough, putting pressure on the optic nerve and causing irreversible damage.
        - Normal-tension glaucoma: Type of open angle glaucoma that happens despite the patient having a normal pressure range.
        - Angle-closure glaucoma: Develops suddenly due to a fluid blockage from the iris, characterized by pain and redness.
- There are several different instruments called tonometers that are used to measure this pressure.

- Non-Contact Tonometer (NCT) - a device used to measure IOP. The NCT sends a puff of air against the eye to measure the pressure within. It does not require a numbing (anesthetic) drop in the patient's eye and does not touch the eye directly.
  - The non-contact tonometer is generally referred to as the air puff and the one that patients think of as the glaucoma test.

- Contact Tonometer: typically used when IOP is elevated, for a more accurate reading.
  - Tono-pen - a held-held device that requires the eye to be numb. An Ocufilm tip cover is placed on the pen and then the tip will touch the corena several times to get an average reading.

  - Rebound Tonometry - a hand-held device that doesn't require anesthetic/numbing. It uses a small disposable probe that touches the cornea several times in a row to get an average reading.

CONFRONTATION VISUAL FIELD SCREENING

Confrontation fields (CF) are a quick and easy screening to measure a patient's field of vision. Comparing a known field of vision (yours) to an unknown field of vision (your patient's) will give you a rough estimate of patient's peripheral vision. A more detailed automated test may be required to fully understand and diagnose visual field defects.

FCF - Finger Counting Fields Full to Confrontation

- Proper Testing Distance: 40-60cm
- How to Perform a Screening:
  - Sit across from the patient. If you or the patient are wearing glasses these should be removed.
  - Ask the patient to cover their left eye and look at your left eye. The examiner should cover their own right eye.
  - Hold up 1-2 fingers in your peripheral vision. Starting with your fingers out of your line of sight, slowly move them into your line of sight until the patient tells you that they can see them. Do this at least one time in each quadrant (left, right, up, and down).
  - Repeat with the patient covering their right eye and looking at the examiner's right eye. The examiner will cover their left eye this time.
  - If you can see your fingers in your peripheral, the patient should be able to see them in their peripheral too.
- Recording Restrictions:
  - Make sure to record any areas where the patient cannot see your fingers.
  - Record defects (spots the patient did not see) using words like nasal, temporal, inferior, and superior.

AUTOREFRACTION AND AUTOKERATOMETRY

AUTOREFRACTION

A refraction is the test used to measure refractive error. A refractive error happens when the light entering your eye does not come into focus on the fovea.

- Autorefraction – An autorefractor is a machine that uses light rays and a computer to measure how light changes as it comes into the eye, estimating a patient's prescription.
  - Most doctors use the autorefractor as a starting point and compare it with the results they find from performing retinoscopy or a manifest refraction, taking into account the patient's perception of vision as well.

AUTOKERATOMETRY

Autokeratometry is a specific function that some autorefractors have or can be a stand-alone piece of equipment. It measures the curvature of the central 3 mm of cornea using several bright rings of light.

- Keratometry is used to estimate the amount of astigmatism present and give an evaluation of the integrity of the front surface of the eye.
    - This measurement is useful for contact lens fitting, intraocular lens (IOL) calculations and for corneal refractive surgery.

DIAGNOSTIC & THERAPEUTIC EYE DROPS

E-Prescribe is like an email system to a pharmacy that allows the doctor to communicate the medication name, how often to take the medication, dosing instructions, and number of refills. Some drug companies have a free sample program where the Optometrist can get samples of medications to provide to patient's on an as needed basis.

Ophthalmic drugs can be delivered in two different ways; topically in the form of eyedrops or ointments, or systemically, in the form of an oral or injected medication.

- Ocular drugs/medications can be used to:
    - dilate the pupil for fundus examination
    - paralyze accommodation
    - constrict the pupil
    - treat ocular conditions
    - anesthetize (numb) the eye

TESTING TO EVALUATE THE CORNEA

PACHYMETRY

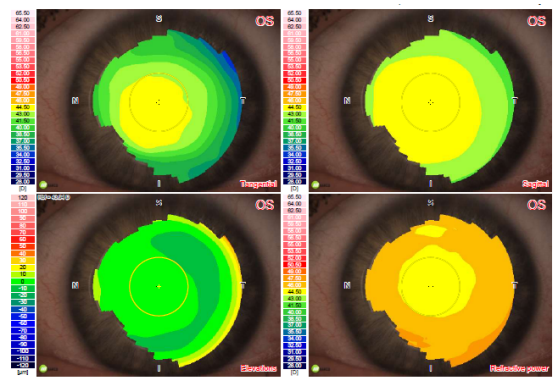
Pachymetry measures the thickness of the cornea, the clear front part of the eye.

- The average corneal thickness is 555 microns.
    - Measuring corneal thickness can help determine if the cornea is swollen due to an increase of fluid inside of the eye.
    - A corneal thickness measurement is essential to make sure the cornea is thick enough for refractive surgeries like LASIK.
- Pachymetry is also important for accurately monitoring intraocular pressure for glaucoma patients.

CORNEAL TOPOGRAPHY

Corneal Topography uses imaging technology that maps the surface of the cornea.

- The topographer uses Placido disc patterns or mires that reflect off the tear film, converting that information to a color scale.
  - It makes a 3D map of the cornea, helping identify corneal curvature, shape, and structure.
  - It is used for screening patients before refractive surgery, for fitting contact lenses, for adjusting post-surgical corneal transplants, keratoconus, and for diagnosing refractive disorders and diseases.



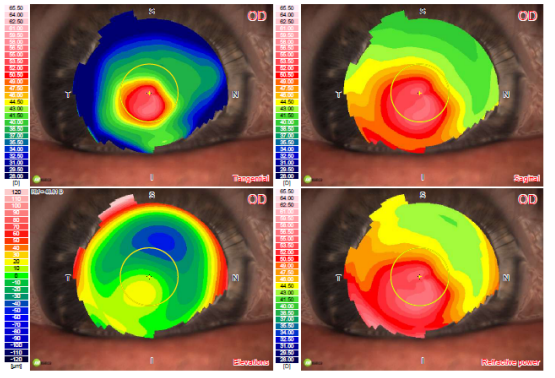
Summary Indices
HVID* = 11.29 mm
Pupil (Topographic)
r = 0.04 mm @ 256°
Ø = 3.37 mm

Keratoconus screening
AK = 45.12 D
(r = 2.20 mm @ 247°)
KVf = 1 µm
(r = 1.64 mm @ 225°)
SIf = 0.36 D
BCV = 0.19 D @ 239°
Rbf = 7.56 mm
RMS/A = 0.03 µm/mm²
Class:
- 'Normal'

K readings
Sim-k
K1 = 44.27 D @ 1°
K2 = 44.63 D @ 91°
Avg = 44.45 D
Cyl = -0.36 D Ax = 1°
Ø=3mm
K1 = 44.38 D @ 3°
K2 = 44.79 D @ 93°
Avg = 44.58 D
Cyl = -0.42 D Ax = 3°
Ø=5mm
K1 = 44.30 D @ 3°
K2 = 44.65 D @ 93°
Avg = 44.48 D
Cyl = -0.35 D Ax = 3°
Ø=7mm
K1 = 44.15 D @ 3°
K2 = 44.41 D @ 93°
Avg = 44.28 D
Cyl = -0.26 D Ax = 3°

Shape indices
Ø=4.5mm
rf = 44.51 D Ax 177°
rs = 44.84 D
p = 0.77
RMS/A = 0.01 µm/mm²
Ø=8.0mm
rf = 44.69 D Ax 0°
rs = 44.89 D
p = 0.71
RMS/A = 0.03 µm/mm²

NORMAL



Summary Indices
HVID* = 13.08 mm
Pupil (Topographic)
r = 0.20 mm @ 148°
Ø = 3.35 mm

Keratoconus screening
AK = 56.71 D
(r = 0.80 mm @ 267°)
KVf = 21 µm
(r = 0.82 mm @ 225°)
SIf = 7.89 D
BCV = 3.59 D @ 232°
Rbf = 6.80 mm
RMS/A = 0.24 µm/mm²
Class:
- Keratoconus compatible
Area = 4.0 mm²
Volume = 0.029 mm³

K readings
Sim-k
K1 = 48.84 D @ 30°
K2 = 51.78 D @ 120°
Avg = 50.27 D
Cyl = -2.94 D Ax = 30°
Ø=3mm
K1 = 50.96 D @ 30°
K2 = 53.65 D @ 120°
Avg = 52.27 D
Cyl = -2.70 D Ax = 30°
Ø=5mm
K1 = 49.24 D @ 25°
K2 = 50.99 D @ 115°
Avg = 50.10 D
Cyl = -1.74 D Ax = 25°
Ø=7mm
K1 = 47.84 D @ 17°
K2 = 49.20 D @ 107°
Avg = 48.51 D
Cyl = -1.35 D Ax = 17°

Shape indices
Ø=4.5mm
rf = 52.91 D Ax 22°
rs = 55.12 D
p = -1.69
RMS/A = 0.28 µm/mm²
Ø=8.0mm
rf = 51.57 D Ax 163°
rs = 52.29 D
p = -0.55
RMS/A = 0.24 µm/mm²

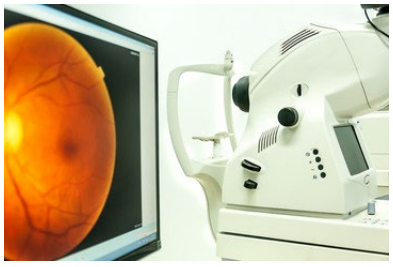
ABNORMAL

FUNDUS PHOTOGRAPHY AND OPTICAL COHERENCE TOMOGRAPHY (OCT)

FUNDUS PHOTOGRAPHY

Fundus photography takes pictures of the back inside surface of the eye. These images are needed to document the health of the optic nerve, vitreous, macula, retina, and blood vessels. They are used for comparison, documentation, and sometimes to diagnose certain eye conditions. The wider the field of view, the more likely diseases are to be detected at an earlier stage.

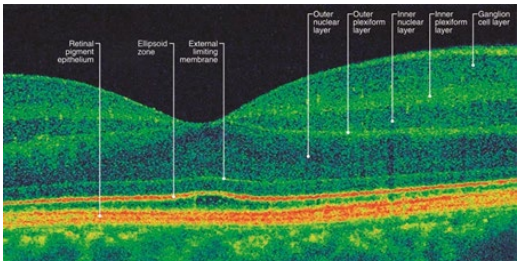
- Traditional fundus cameras capture the posterior pole, referring to the central 50 degrees of the retina.
- Wide field photography has a field of view of 60-100 degrees.
- Ultra-widefield imaging captures the far peripheral fundus, with a field of view of 110-220 degrees.

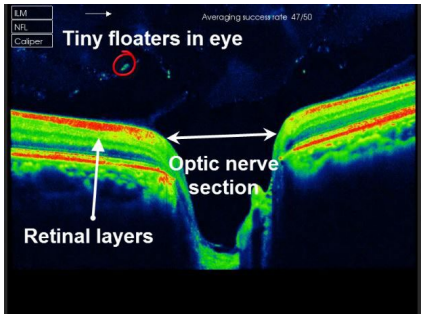


OPTICAL COHERENCE TOMOGRAPHY (OCT)

A laser-based, non-contact, non-invasive imaging technique that is capable of obtaining high-resolution images of the retina and its components. It uses light waves to obtain cross-sections of all ten layers of the retina, similar to an ultrasound.

- It is clinically useful in visualization of:
  - Macular holes
  - Macular edema
  - Age-related macular degenerations
  - Epiretinal membranes
  - Central serous chorioretinopathy
  - Glaucoma
  - Optic neuropathy





OPTIC NERVE OCT

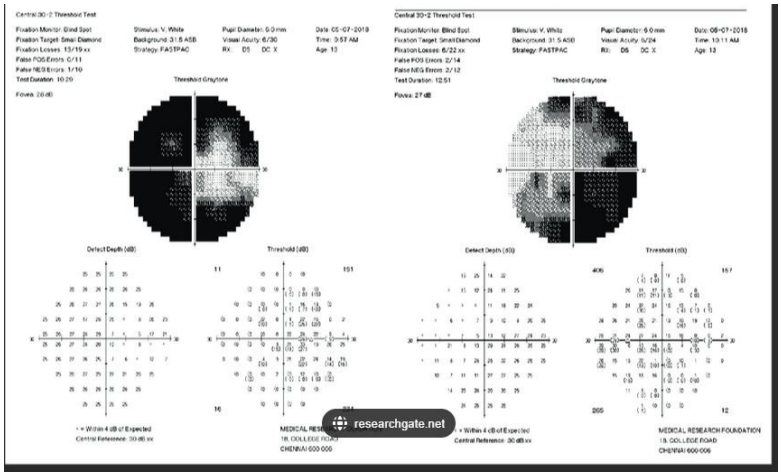
AUTOMATED VISUAL FIELD TESTING

The visual field represents the area in space that is visible to the eye. The test used to measure this area is called perimetry. An area that the patient cannot see is called a scatoma.

- Scatoma is a visual field abnormality or a blind spot.
  - Temporary scotomas as usually caused by brain disorders (seizure, migraine or reduced blood flow)
  - Fixed or permanent blind spots can be cause by disorders of the optic nerve (glaucoma or multiple sclerosis).
- For each type of automated visual field that can be performed, the instructions are very similar.
  - One eye will be covered, and the opposite eye will be tested.
  - The uncovered eye will stare directly at the focal point and the patient will click the button when they can see a stimulus like a squiggle or a light.
  - There are screener automated visual fields test that require just the patient's age.
  - Use trial lenses when needed
  - The tests explained below require age, name, and distance prescription to be entered into the machine. This information is needed to calculate the trial lens prescription at exactly the testing distance for the patient to view the stimulus as sharply as possible.
    - 30-2 is most commonly used to diagnose and monitor neurological conditions like stroke.
    - 24-2 visual fields are the common clinical standard, especially for glaucoma management.

- 10-2 visual fields test is often used to detect Plaquenil retinopathy. Many patients take this drug for arthritis pain management. Long term use of Plaquenil can cause macular toxicity, potentially leading to irreversible vision loss.

30-2	**Measures 30 degrees temporally and nasally and tests 76 points**
24-2	**Measusres 24 degrees temporally and 30 degrees nasally and tests 54 points**
10-2	**Measures 10 degrees temporally and nasally and 68 points**



OPHTHALMIC OPTICS AND DISPENSING (11.1%)

LENSOMETRY

The instrument used to measure the power of spectacle lenses.

- Measures sphere power, cylinder power and cylinder axis of a lens
- Measures amount of prism:
  - In the lens and the orientation (base direction) of that prism.
  - The location of the prism reference point of a lens
  - Powers of multifocal adds

AUTOMATED & MANUAL LENSOMETER

- Lens Types: single vision, progressive, bifocal & trifocal all are read the same way.
  - With multifocal lenses be sure you are not reading through the near vision areas.

Automated Lensometer:

Steps:

1. Secure glasses with the lens holder.
2. Adjust lens until it is centered and the + appears in the center.
3. The prescription will be presented on the screen.
4. Using the PD arm will allow measuring the PD while reading the lenses.

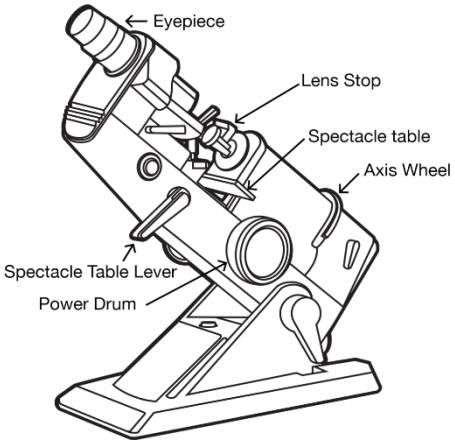
Manual Lensometer:

Steps:

1. Place glasses on the platform, starting with the right lens, secure the glasses with the gimbal
2. Use the power drum to dial in the three thin lines until clear. This is the sphere reading. Write it down.
3. Turn the power drum dial again to focus the three thick lines. This is the cylinder reading. Write it down.
4. Adjust the axis wheel until the thick lines are straight. This number on the axis wheel is the axis.
5. Continue to the left lens.

THIN LINES ARE SPHERE

THICK LINES ARE CYLINDER



- American National Standards Institute (ANSI): a private, non-profit organization responsible for managing and organizing the voluntary standards and conformity assessment system in the United States.
  - ANSI works with industry and government stakeholders to create standards and conformity solutions that address national and global issues.
- Identifying errors outside ANSI standards:
  - To ensure manufactured eyewear meets the minimum standard all labs and optical retailers are encouraged to adhere to ANSI standards.
  - It is recommended to use the ANSI Quick Reference Guide
  - Any lens that does not meet these parameters outlined by ANSI should not be dispensed to the patient.

INTERPUPILLARY DISTANCE MEASUREMENT

PUPILLARY DISTANCE

- Pupillary Distance (also known as interpupillary distance or PD) – The distance between the center of the pupil of each eye. This is considered the patient's PD and is measured in millimeters.

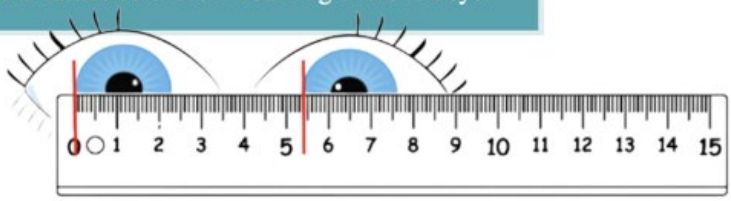
To ensure accuracy pupillary distance measurement should be taken for each lab order. There are three ways to take this measurement; manually, pupilometer and digitally. There are three common pupillary measurements: distance, intermediate and near.

MANUAL PUPILLARY MEASUREMENT

To measure a pupillary measurement, use a small ruler called a PD stick.

Steps:

1. Have the patient sit squarely in front of you at the same height.
2. Instruct the patient to look at your right eye or ear.
3. Line the PD stick up with the outside of the temporal side of the limbal ring (dark circle around the iris) of the patient's right eye.
4. Ask the patient to look at your left eye/ear.
5. Read the measurement on the nasal side of the limbal ring of the left eye.



THE DISTANCE PD IN THIS EXAMPLE IS 54MM

PUPILOMETER PUPILLARY MEASUREMENT

Steps:

1. Adjust the pupilometer to the working distance desired
   - Distance vision set to infinity (∞)
   - Reading set to 40
   - Intermediate set to 50
2. Have the patient sit squarely in front of you at the same height.
3. You can instruct the patient to hold the pupilometer like they are looking through binoculars, or you can hold it for them.
4. Instruct the patient to look directly at the light inside.
5. Take the measurement by looking through the opposite side and by sliding the lines over the light reflecting off the retina.

BINOCULAR PD
The number in the middle. BI means two and this measurement is for two eyes.

MONOCULAR PD
The numbers under right/left. Mono means one and this measurement is for one of two eyes.

DIGITAL PUPILLARY MEASUREMENT

Digital measurements are gathered by using a device/machine that takes a picture/image of the patient wearing a frame. Often there is a device, or markings placed on the front of the frame, to allow the machine conducting the measuring to "see" the frame and eyes. These machines will collect the position of wear measurements as well.

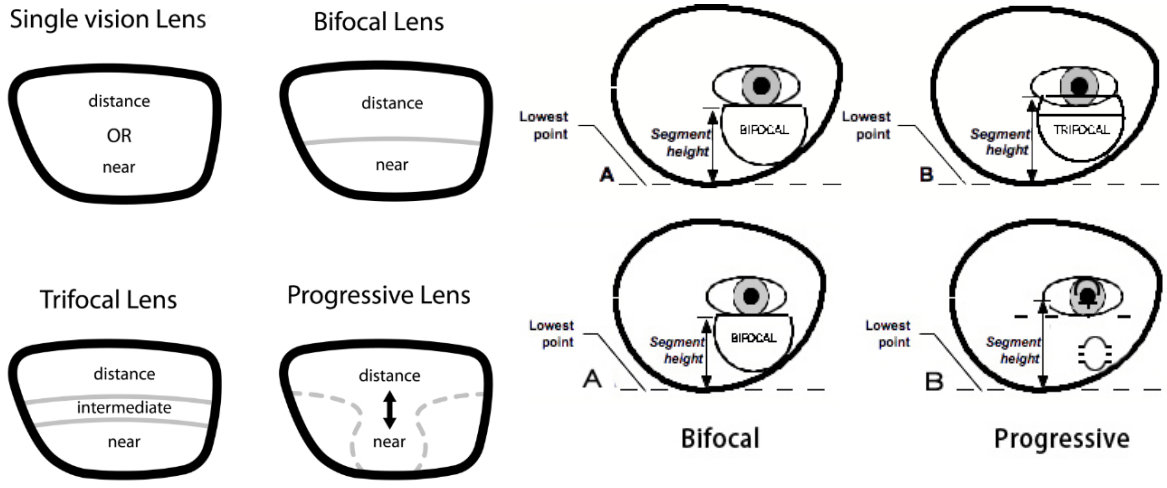
- Position of wear measurements are taken in addition to the PD. They are used in manufacturing compensated digital lenses and include measurements of vertex distance, pantoscopic tilt, and the wrap of the frame. Compensated lenses are a way to provide the wearer with the prescription determined by the refraction during the eye exam. They provide precision not possible with other methods of lens processing. Patients with a high or complicated prescription will benefit most.

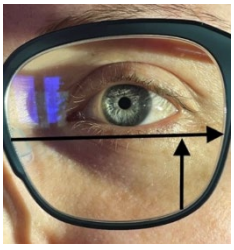
Near pupillary measurement – used for reading glasses. A near PD is the distance PD minus (-) 3. In the example of a distance PD of 54, by subtracting 3 we get a near binocular PD of 51, or monocular of 25.5 oculus uterque (OU = both eyes).

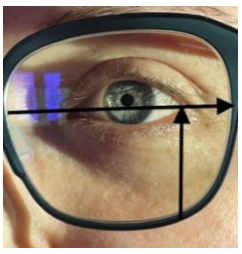
Intermediate pupillary measurements – most commonly used for computer glasses. Subtracting 1.5mm from distance PD standard.

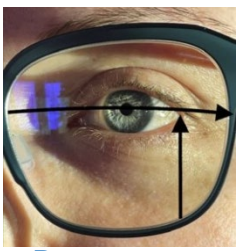
OPTICAL CENTER/SEGMENT HEIGHT/FITTING CROSS HEIGHT

- Optical Center (OC) – Necessary for single-vision digital and anti-fatigue lenses. The measurement is from the center of the pupil to the base of the lens where it meets the frame. This measurement moves the best vision of the lens from the geometric center to directly in front of the pupil.
- Segment Height (Seg Height) – The height of the reading portion of a multifocal lens (bifocal, trifocal or progressive segment) is measured from the deepest part of the eyewire to a reference point, such as the lower eyelid (bifocals) or pupil center (progressive addition lenses).
    - This measurement is taken in millimeters.




BIFOCAL


TRIFOCAL


PROGRESSIVE

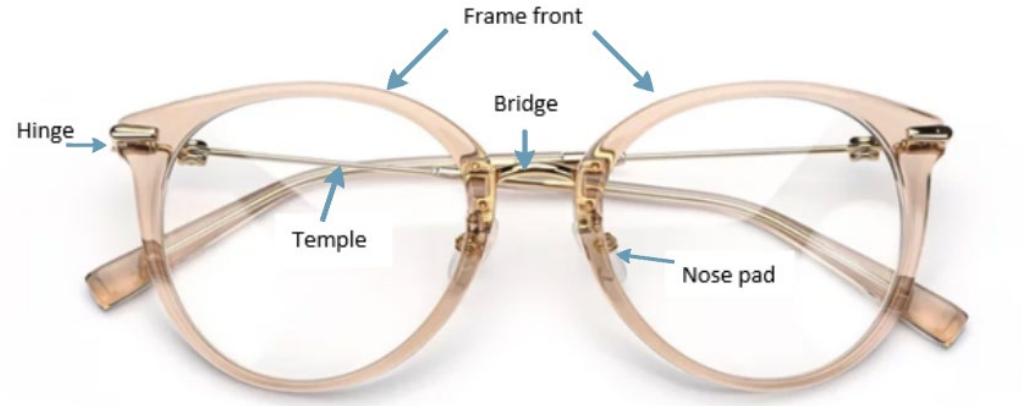
- Fitting Cross Height – The fitting cross is part of a progressive addition lens. There are two pieces of information about the lens that the fitting cross defines.
    - The horizontal line, in the fitting cross, is the point where the segment height is measured, to the base of the lens where it meets the frame.
    - The vertical line defines the location of the monocular PD.
        - The monocular PD is the distance from the vertical line to the center of the bridge at its shortest width, aka the DBL (distance between lenses).

SELECTING EYEWEAR

The first and most important step in frame selection is the patient's prescription. The paraoptometric should assist the patient in selecting a frame that is not only cosmetically appealing but fits properly too.

The following are some rules for proper frame fit:

- The width of the frame should be approximately equal to the width of the patient's face. The longer the face, the greater the vertical depth of the frame should be; the shorter the face, the smaller the vertical depth of the frame.
- The bridge of the frame should rest flat on the sides of the nose. The bridge distributes the weight of the frame, so this is a critical component of the frame fit.
- The temples should be long enough to extend over the patient's ear and far enough beyond to balance the weight of the front of the frame. They should be shaped to fit the contour of the head.

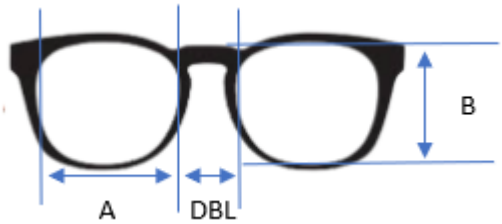


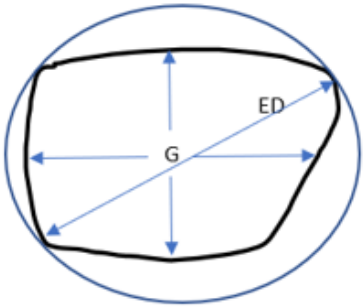
PRINCIPLES OF FRAME SELECTION

- Frame Sizes:

A	Eye Size
B	Eye Height
DBL	Distance Between Lenses
ED	Effective Diameter
G	Geometric Center
Frame PD	A + DBL

BOXING SYSTEM





- Well-Centered Eye:
  - Best indicator of a well-fitting frame.
  - A frame that is too big will cause the eyes to be positioned near the bridge of the frame.
  - A frame that is too small will cause the eyes to be positioned near the outer portion of the frame.

Well-fitting Frame

Too Big

Too Small

Nose Piece Fit

Saddle bridge: Most common. For best fit it should be like a saddle on a horse, no gaps.

Keyhole bridge: Great for smaller noses. The smaller space between the lenses are the best point of contact.

Low Bridge fit: Best plastic option for very small and flat bridges.

- Frame Materials:
  - Plastics – Made of many rugged polymers. These are the most common types of frames. Adjusting these frames usually requires warming them to make the material more pliable and then bending the material to shape to fit the face.
  - Metals – The front and temples are comprised of metal. Adjusting these frames usually requires some special pliers and other tools. The lenses are held in by eyewire that is tightened with a screw to hold it in place.

LENS MATERIAL

- What does the refractive index refer to?
  - It is the measure of bending a light ray when passing from one medium to another.
  - The ratio of velocity of a light ray in an empty space to the velocity of light in a substance.
  - Formula:

N	refractive index
C	speed of light (186,000 miles per sec)
V	phase velocity of light

$$N = \frac{C}{V}$$

- Types:
  - Crown Glass:
    - Refractive Index = 1.523
    - Pros: optics
    - Cons: easily breakable and heavy
  - Cr-39 Plastic:
    - Refractive Index = 1.498
    - Pros: great optics and tints easy
    - Cons: medium weight and not impact resistant
  - Polycarbonate:
    - Refractive Index = 1.586
    - Pros: highly impact resistant and lightweight
    - Cons: does not tint
  - Trivex:
    - Refractive Index = 1.532
    - Pros: impact resistant, lightweight, great optics and tints easily
    - Cons: slightly thicker than polycarbonate
  - High Index:
    - Refractive Index = 1.60/1.67/1.74
    - Pros: thinner lens
    - Cons: reduced optical quality and not impact resistant

LENS FEATURES

- Scratch resistance - coating made from resin
- Anti-reflective coating – eliminates internal lens reflections, reduces glare at night, good for computer, more visibility of wearer's eyes
- Ultraviolet (UV) coating - filters out UV light
- Mirror coating - reflects some of the light striking lens, increases density of lens
- Sports coating– improves contrast sensitivity, reduces glare
- Blue light protection– blocks or filters blue light given off digital screens, glare protection, reduces damage to retina

ORDERING EYEWEAR & COMPONENTS OF EYEGLASS PRESCRIPTIONS

- Order eyewear
  - Specify the frame color, eye size, bridge size, and temple length.
  - Confirm the prescription for the lenses in each eye, patient's P.D. at far and near, lens design (single-vision, bifocal style, etc.), lens material, segment height (if not single vision) and any tints or coatings that should be used.
  - An eyeglass prescription is a formal communication from a physician to the eyecare professional ordering/manufacturing lenses. The information noted can vary depending on the patient's needs.

SPHERICAL/CYLINDRICAL/AXIS

- Spherical (SPH) – Indicates correction for nearsightedness or farsightedness is needed. The correction needed is spherical and equal in all meridians of the eye. If the number appearing under this heading is a minus sign (-), the patient is myopic (nearsighted); if the number has a plus sign (+) or is not preceded by a plus sign or a minus sign, they are farsighted.
  - 1st number listed on Rx
  - Example: -3.00sph or +2.00sph
- Cylindrical (CYL) – This indicated the amount of lens power for astigmatism and represents the difference in the greatest and weakest powers of the eye, usually separated by 90 degrees. If the column is empty, the patient has no astigmatism. When writing a prescription. Cylinder power always follows sphere power in an eyeglass prescription.
  - 2nd number listed on Rx and represents astigmatism
  - Example: -2.00 -1.00 x090 or -1.50 -0.25 x175
- Axis – If an eyeglass prescription includes cylinder power, it also must include an axis. The axis indicates the angle (in degrees) between the two meridians of an astigmatic eye. The axis is defined with a number from 1 to 180 degrees. The number 90 corresponds to the vertical meridian of the eye, and the number 180 corresponds to the horizontal
  - Can be from 1 to 180 degrees

DISPENSE/ADJUST/REPAIR EYEWEAR

Before you begin place the glasses on the patient and check the following:

- Are they straight? If no, decide which side needs to be raised or lowered.
  - For acetate/plastic (any sort), heat slightly to allow the material to give.
    - Gentle raise or lower the temple the necessary amount.
  - For metal using a Wide Jaw Angling Plier, carefully grip the barrel and hinge area, then apply pressure in the direction the temple needs to bend.
- Are they slipping down or too tight? Look behind their ears.
  - There should be a slight 2-3 mm gap between the ear and the temple tip.
  - If the gap is too big or too small heat the temple tip area and straighten to loosen or bend further down to tighten.

BASIC ADJUSTMENTS

- Fitting triangle – A picture representation of the pressure points between an eyeglass frame and the overhead view of the patient's head.
  - The goal during the adjustment process is to equalize the pressure of the frame over the bridge of the nose and the widest part of the head on each side of the ears.
- Frame height – Determined by the height of the frame ("B" measurement) and the way in which the frame rests on the wearer's nose.
  - If the frame has adjustable nose pads, the frame height can be altered somewhat. However, if the frame has a fixed bridge, the frame height is determined during the frame selection process.
- Vertex distance – Describes the distance from the back of the lens to the cornea.

        - Generally, we do not measure the vertex distance except in high prescriptions (more than 6 diopters), but when fitting the frame to the patient's face, you want to be certain both lenses rest an equal distance from the eye.
    - Face form – Describes the way the frame front follows the contour of the face.
        - Normally, the frame front protrudes slightly at the nose and is farther back near the temples. Some frames (such as wrap-around sunglasses) have a high degree of face form, with the bridge of the frame resting substantially forward of the hinge on the frame front.
        - The amount of face form can be assessed by taking the frame with the temple extended and placing a ruler against the back of the frame front from the outside edge of one eyewire to the outside edge of the other eyewire. The ruler will be straight and the amount of curve to the frame front will show the amount of face form.
    - Pantoscopic angle – The pantoscopic angle or pantoscopic tilt refers to the angle the temple of the frame makes with the frame front.
        - When the frame is on the wearer, the bottom of the eyewire should be closer to the cheeks than the top of the eyewire is to the eyebrows.
        - In rare cases, the bottom eyewire may protrude away from the cheek. This is called retroscopic angle or retroscopic tilt and is not desirable.
        - Generally, a small amount of pantoscopic tilt is needed for the wearer to achieve the proper optics through the lenses and have the widest possible field of view through multifocal lenses.
    - Temple adjustment – The temple bends should begin at the top of the ear. The end of the temple should be bent at a 45-degree angle and bent in so that its flat side touches the skull, behind the ear.

OPHTHALMIC BENCH TOOLS

- Interpupillary distance ruler (PD): used to make sure the frame front is even.
    - Lay your PD ruler across the ocular side of the frame front, just below the temples at the endpiece.
    - When the PD ruler is touching both endpieces, it should be equidistant from the frame at its two nasal points, just above the nose pads.
    - This is also known as vertical alignment or four-point touch.
- Temple-angling pliers: used if the temples are not even when viewed from the side.
    - If the endpiece is aligned with the hinge, then the temple hinge is bent and must be straightened.
    - The hinges themselves must be realigned.
    - This would be a cold bend (i.e., the frames are not heated), regardless of the frame material.
- Other tools: Fiber jaw pliers, needle nose pliers, nose pad pliers, straight cutting pliers and pin vice (screwdriver)
- Frame Warmer: used to heat the temples with hot air before bending frames, regardless of the frame material.
- Salt Pan: used to heat the temples with small, warm beads.
- Bench Alignment: Before dispensing the eyewear to the patient, it should be inspected and evaluated to make sure it is aligned.

Steps:

1. Place the eyewear on a flat surface upside down.
2. Both eyewires and the crest of each temple should rest on the surface.
3. Once the eyewear is turned over, both eyewires and temple tips should touch the surface.
4. The temples should be near parallel and the frame should have a slight face form.
5. The lenses should be in the same plane and the same height.
6. When the temples are closed, they should overlap and be near parallel with the top of the frame.
7. Align temple closure.
8. Align nose pads.

TEMPLE-ANGLING PLIERS

FIBERJAW PLIERS

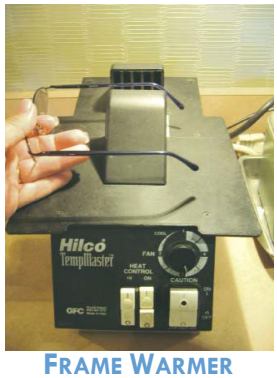
NEEDLE NOSE PLIERS

PIN VICE (SCREWDRIVER)

STRAIGHT CUTTING PLIERS

NOSE PAD PLIERS

SALT PAN



FRAME WARMER

TROUBLESHOOTING PATIENT'S PROBLEMS WITH EYEWEAR

A process that works to resolve concerns with adaptation and/or accuracy. This process involves ensuring that the order was:

- Written/entered correctly by the optician.
- Manufactured properly and that ANSI standards were maintained.
- Glasses were adjusted properly at dispensing.
- Patient adaptation and expectations are aligned to product modality.

If there are comfort or vision issues:

- Asking appropriate questions to discover root issue:
  - How do the frames feel on their nose, ears and temples?
  - Do they have blurred or distorted vision?
  - What improves their vision?
    - Tilting?
    - Turning their head a certain way?

CONTACT LENSES (14.5%)

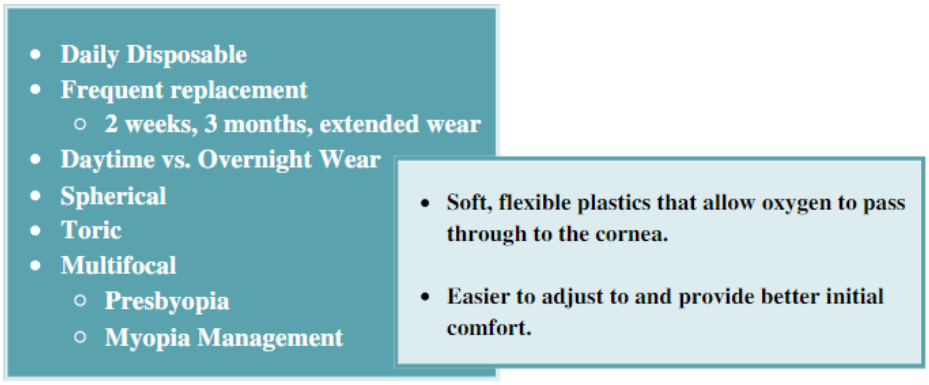
A corrective, cosmetic or therapeutic lens is usually placed on the cornea of the eye. Contact lenses usually serve the same corrective purpose as glasses.

- Overall Diameter (OAD): size of the lens when measured from edge to edge at the widest point.
- Optical Zone Diameter (OZD): central area or zone that provides optical correction.
- Back Vertex Power (BVP): the reference point for corrective power; the distance from where the glasses lens rests in front of the eye to where the contact lens rests on the eye.
- Base Curve Radius (BCR): the primary curve on the posterior or backside of the lens; the curve is designed to assess the shape of the cornea.
- Peripheral Curve: additional curves on the back surface of the lens that surround the optical zone to help tailor the contact lens fit to the patient.

CONTACT LENS OPTIONS & PLACING AN ORDER

UNDERSTAND TYPES OF AVAILABLE CONTACT LENSES

- Soft Contact Lenses:
  - Comprised of polymers capable of absorbing a substantial amount of water
    - Hydrogel - type of plastic polymer that absorbs and binds water into its molecular structure
    - Non-silicone hydrogel - oxygen permeability is dependent on the water content of the lens
  - Water-soluble substances may enter a hydrogel lens if they are smaller than the areas of interconnecting spaces in the plastic
  - Average diameter of spaces increases as the water content in the hydrogel increases



- Gas Permeable Contact Lenses (GP):
  - Made from polymers and plastic materials that are oxygen-permeable.
  - Provides oxygen to the cornea by direct transmission through the lens material
  - They are also known as rigid gas permeable
    - Permeability (Dk)- ability of the material to allow oxygen to pass through it
      - Higher Dk means oxygen can easily diffuse through
      - Dk/t - Thinner the lens, more oxygen will reach the cornea

- Single Vision
- Toric & Bitoric
- Multifocal
- Ortho-K
  - Vision Correction
  - Myopia Management

- Alternative to soft contact lenses.
- Made from a hard, oxygen permeable material.
- Less popular than soft contact lenses but gas permeable lenses last longer.

Rigid Gas Permeable (RGP)

- Significant benefits to visual acuity in people with astigmatism.
- Longer initial adjustment period and can be drier.

- Hybrid Contact Lenses:
  - Combines gas permeable (GP or "hard" lens) center with a soft skirt to give you the clear, crisp vision of a "hard" lens and the comfort and easy wear of a soft lens.
  - These can last up to six months.
  - Great for patients with corneal astigmatism or presbyopia with astigmatism.

- Scleral Contact Lenses:
  - Large-diameter gas permeable contact lenses that vault over the cornea and rest over the scleral.
  - Used on patients with irregular corneas due to trauma, infection, keratoconus, etc.
  - Once clear, zero the radioscope and return to the aerial image.
  - When the aerial image is in clear focus, read the BCR from the scale.

- Single Vision
- Multifocal

PLACING AN ORDER FOR CONTACT LENS PRESCRIPTION

The contact lens rule (as defined by the Federal Trade Commission) states that a prescription should contain the following items: patient name, examination date, issue date (date patient receives prescription), expiration date of prescription, brand/material of contact lens, power of the contact lens (OD and OS), base curve, diameter, and name, address, phone number, and fax number of the prescriber.

Additional items that can be included on the prescription are quantity, wear time, and additional parameters for specialty contact lenses such as hybrids and scleral.

PROPER CARE SYSTEM & HANDLING FOR CONTACT LENSES

Routine care includes cleaning, rinsing, and disinfecting. This routine care is usually done after the lenses are removed from the eye, not prior to insertion. It helps prevent infection and improves lens' comfort.

CARE PRODUCTS

- Multipurpose cleaners: most common, standard cases
- Hydrogen Peroxide Solution: peroxide-based solution that cleans and disinfects contact lenses.
  - Special case that includes neutralization disc.
  - Neutralizes over six hours.
  - Solution should not be place in the eye.

CLEANING PROCESS

- A cleaner is rubbed onto both sides of the lens to remove debris from the lens surface.
  - After cleaning, the lens is rinsed with the solution that is specified by the care system manufacturer to remove the cleaner and loosen debris from the surface of the lens.
  - The lens is placed in a lens storage case that has been filled with a soaking and disinfecting/conditioning solution.
  - The soaking and disinfecting solution keeps the lens hydrated and disinfects the lens surface.
  - The lenses have to stay in the solution for a specific period of time for disinfecting.
    - This amount of time depends on the disinfecting solution.
  - Before applying the lens, the soaking solution is rinsed off and fresh wetting solution is placed on the lens to ease its placement onto the eye.
  - A daily or weekly enzymatic cleaner may be added to this regimen if patients experience a buildup of protein on the surface of their lenses.
  - Note: It is also important to properly care for the contact lens storage case.
    - After contact lenses are removed from the case, all solution should be dumped from the case wells.
    - Then rub the case with clean fingers for at least five seconds, then wipe dry with a clean cloth.
    - Store the case upside down with lids off.

- Cleaning and conditioner solution is used for gas permeable lenses:
  - Put a few drops of the cleanser on the lens in the palm of your hand
  - Use a gentle back and forth motion to clean any debris off the lens, avoid rubbing a circular motion to avoid changing the power of the gas permeable lens

- Rinse with a sterile saline product or tap water
  - Do not use tap water if inserting contacts directly into eye after cleaning.
- Store in standard contact lens case with conditioning solution.

Note: conditioning solution is safe to put in the eye, but cleaning solution is not

EDUCATE PATIENTS ON CARE AND HANDLING

Patients have to be instructed on how to wear and care for their contact lenses. This education begins when the patient is in the office for a contact lens fitting and continues until they stop wearing contact lenses.

- The patient is instructed on how to apply and remove the lenses, handling procedures (always wash hands before handling the lenses, how to tell if the lens is inside out, right lens-right eye, etc.), and how to care for them at the dispensing visit.
- They are given a wearing schedule to follow in order to gradually build up the amount of time the lenses are in the eye.
- Patients are given a schedule of follow-up visits so the health of the eye and the contact lenses may be evaluated on a regular basis.
- Patients are asked and encouraged to adhere to, or comply with, the prescribed regimens.
  - A patient who does not adhere to the prescribed regimen of care and follow-up is considered a non-compliant patient.
  - Non-compliance and patient misunderstanding of contact lens care and handling is a common reason patients suffer complications or stop wearing their lenses.

Normal and Abnormal Adaptive Symptoms (when to remove lenses):

Normal

- Tearing is natural response of the eyes
- Minor irritation or awareness sensation decreases over time
- Intermittent blurry vision is usually due to excess tears
- Sensitivity to sunlight is normal
- May experience minor irritation from wind, smoke, and dust
- May be mildly red from irritation

Abnormal

- Sudden pain or burning
- Severe or persistent haze or haloes around lights
- Severe redness or irritation
- Blurry vision through spectacles for more than one hour

INSERT AND REMOVE CONTACT LENSES

HYGIENE/HANDWASHING

- Hygiene:
  - Consider habits of patient
  - Cleanliness of patient's fingernails and hands
  - Consider patient's occupation
- Handwashing:
  - The goal of handwashing is to remove microorganisms from the hands, preventing their potential transfer. It is known that organisms survive and multiply on human hands, creating the opportunity to infect others. Although hands cannot be sterilized, most transient organisms can be removed by 30 seconds of proper scrubbing with soap and water.

- Proper scrubbing would include vigorous motion with the hands rubbing together and fingers working in between the finger web space on both sides of the hands.

RIGID GAS PERMEABLE

Note: To help keep the eyelids out of the way during insertion and removal, a finger on the opposite hand holds the upper eyelid up and a finger (usually the ring finger or middle finger) on the hand inserting the contact lens holds the lower lid down.

- Insertion:
  - Place the lens as if it were in a bowl position on a clean, dry fingertip.
    - It is easiest to use the pointer finger for insertion, but whichever finger is most comfortable for the patient is best.
  - With the eyes wide open, the finger comes close and places the contact lens on the cornea.
- Removal:
  - Patients use the lids to help break the lens suction on the eye.
  - With the patient looking straight ahead, place one pointer finger horizontally along the upper lid and another finger along the bottom lid. Push the fingers toward one another trying to keep the edges of the eyelids close to the globe.
  - Once the suction is lost, the lens pops off the eye.
  - Alternatively, many people simply pull the temporal corner of the eye towards the ear which narrows the palpebral fissure and breaks the suction of the contact lens on the eye.

SOFT

- Insertion:
  - With clean hands, place the soft contact lens on a dry fingertip with the contact lens in the bowl position.
    - It is important for the fingertip to be dry otherwise the lens will stay on the finger rather than stay on the eye.
  - Using both hands to open the eyelids, place the contact lens on the cornea.
    - It is sometimes helpful for the patient to look in the mirror while doing this and tell them to aim for the colored part of their eye.
    - Some patients don't enjoy watching a contact lens and their finger come close to their eye, in which case they may find it easier to look up and place the contact lens on the bottom part of their cornea.
  - Once the lens is on the cornea, it can sometimes settle better if they look around the room in different directions and blink.
- Removal:
  - Patient will take a clean pointer finger, place it on the contact lens and pull the lens down.
    - By pulling the lens down, it helps break the natural settled position of the lens on the eye and makes it easier to remove.
  - Then place the thumb on the lens really close to the pointer finger and pinch them together to remove the lens from the eye.

SCREENING PATIENT & TROUBLESHOOTING CONTACT LENSES

SCREENING PATIENTS AND THEIR EXPERIENCE WITH CONTACT LENSES

- Find out the patients history with contact lenses:
  - Wear
    - What is the brand and material?
    - How many days per week or hours per day?
    - What types of solutions are used?
    - How often are they replacing lenses?
    - Are they sleeping/showering in lenses?
  - Occupation
  - Hobbies
  - Contact Lens Hygiene
    - History of infection
    - History of sleeping in lenses
    - History of overwear
    - Poor replacement schedule
    - History of swimming/showering in lenses
    - Improper use of contact lens solution
- Patients goal/reasoning for wearing contact lenses

TROUBLESHOOTING CONTACT LENSES

- Comfort Issues
  - Verify proper fit first
  - Moves a lot or not centered; causes discomfort or feeling edge of lens
  - Too tight; red, irritated eye
  - Too dry/loose; lens may fall out
    - Ways to improve dryness:
      - Switch cleaning solutions
      - Contact lens materials
      - Switch modalities
      - Rewetting drops
- Vision Issues:
  - Perform trial lens over-refraction: start with spherical power first
  - Toric lens rotation
  - Fluctuation in vision may be due to dryness
- Redness:
  - Rule out the following first: ocular disease, improper fit, material or solution sensitivity.

PROFESSIONAL ISSUES (11.1%)

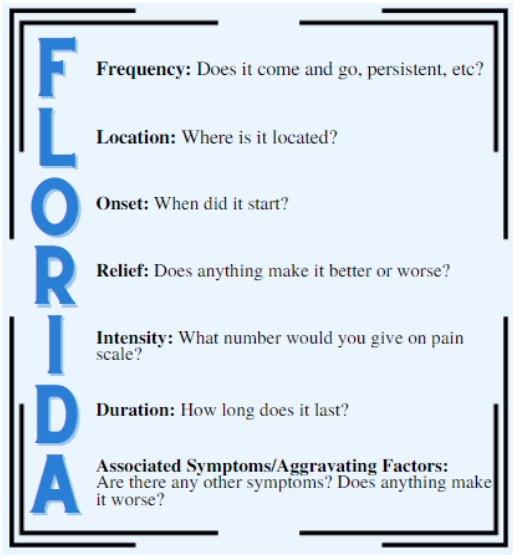
FRONT DESK

- Resolve Patient Complaints and Concerns
  - When receiving a phone complaint make sure you identify the office and say your name.
    - Make sure to get the patient's name, phone number and date of birth (for verification).
  - When a patient is complaining in the office do so away from other patients and in a quiet setting.
  - Listen to patient: gather and document all important details.
  - Have patience and understanding; do not place blame and offer solutions instead.
    - Speak clearly and slowly so the patient can understand.
  - If additional assistance is needed, convey all the information to the manager/doctor.
    - If the manager/doctor is unavailable, inform the patient you will take a message and have the appropriate person reach out.
  - Provide full documentation in patient's record/file.

INCOMING TELEPHONE CALLS

TELEPHONE TRIAGE

- A system of sorting and assigning priorities for medical treatment based on the urgency of the symptoms.
  - Determine patient needs by asking the following questions:
    - What kind of problem are you having? (pain, loss of vision, etc.)
    - How long has it been going on?
    - Is it getting worse?
    - How does it affect your vision?
    - Does anything make it better?
  - You may need to discuss the case with the doctor and then direct the patient based on the doctor's recommendation.
  - Triage categories:
    - Emergency - must be evaluated immediately.
      - Examples: pain or sudden loss of vision.
    - Urgent - must be seen within 12-24 hours.
      - Examples: flashes/floaters, worsening vision, redness and irritation in contact lens wearer.
    - Routine - to be seen at the next available appointment.
  - Important to remember - speak calmly and do not offer the patient a diagnosis or give an opinion.
  - Note: If the patient claims to have persistent pain in the eye and no other symptoms schedule their appointment immediately.



- Document Incoming Calls Appropriately
  - Patients, healthcare providers, and vendors/sales representatives
    - Make sure appropriate parties receive messages and information.
    - Record details in electronic health records, when necessary.

MANAGE PATIENT APPOINTMENTS

- Be familiar with your practice's specific scheduling template.
- Paraoptometrics should have a thorough understanding of the different types of appointments.
  - What type of testing does each appointment involve?
  - The amount of time required by both the optometrist and paraoptometric for each appointment.
    - Determine in advance the length of time required for specific types of appointments.
      - A comprehensive examination may require 30 to 45 minutes.
      - An uncomplicated follow-up may only require 15 minutes.
- Make sure when scheduling appointments that you inquire whether patients have insurance and remind them to bring the necessary documentation to the appointment.
  - It is particularly important that you know whether your office is a participant in the vision plans in your area and what regulations those plans have that must be followed.
  - Patient's insurance should be verified prior to their arrival.
- Confirm all appointments.
  - Make sure you are clearly stating the date and time to the patient.
- Provide documentation in the electronic health record (EHR) when canceling, rescheduling and/or scheduling patients.
  - Be sure to reference the cancellation list.

PURCHASING & INVENTORYING OPHTHALMIC EQUIPTMENT/SUPPLIES

Purchasing special equipment is an investment by the office for providing good patient care. When consulted about such a purchase, educate yourself. Research equipment companies, warranties, reviews from other users, and costs. Be prepared to present your findings to the doctor of optometry, manager or owner.

Having dependable suppliers is important. Most suppliers offer online catalogs, and some do send physical copies. Have updated suppliers' information on hand. Know what products you order and from whom, their return policy, shipping practices and of course, fees for products. Be familiar with the time frame of receiving products, so they may be ordered and received in a timely manner.

- Things to know/consider:
  - Who is in charge of ordering?
  - Where to order from?
  - Specific products needed.
  - Shipping practices and fees/pricing for supplies.
  - Manufacturer's representative contact information.
- Inventory Lists:
  - Office supplies, frames, contact lenses, OTC sales items, exam room supplies, ophthalmic and medical supplies

FEDERAL REGULATIONS

- Health Insurance Portability and Accountability Act (HIPAA) - federal law that requires the creation of national standards to protect sensitive patient health information from being disclosed without patient's consent or knowledge.
  - Requires a signed release of information to disclose records to another entity.
  - There are fines if breached.
    - Mandated to inform those whose information is/was compromised.

- Occupational Safety and Health Administration (OSHA) - ensures safe and healthful working conditions for workers by setting and enforcing standards.
  - Provides training, outreach, education and assistance.

- Merit-based Incentive Payment System (MIPS) - Medicare based program aimed at improving health care quality.
  - The Centers for Medicare and Medicaid Services (CMS)
  - Determines Medicare payment adjustments (directly influences Medicare reimbursement amounts)
    - Based on four performance categories: quality, resource use, clinical practice activities, and meaning use of EHR
    - May receive payment bonus, payment penalty or no payment adjustment.
  - Not all doctors of optometry are required to report for MIPS.
  - The requirements change on a yearly basis, so it is important to be aware of your practice's reporting obligations for the year as well as any program changes.
  - Four performance reporting categories:
    - Quality

- Assesses the quality of the care you deliver, based on performance measures. You pick the six measures of performance that best fit your practice and report those to CMS.

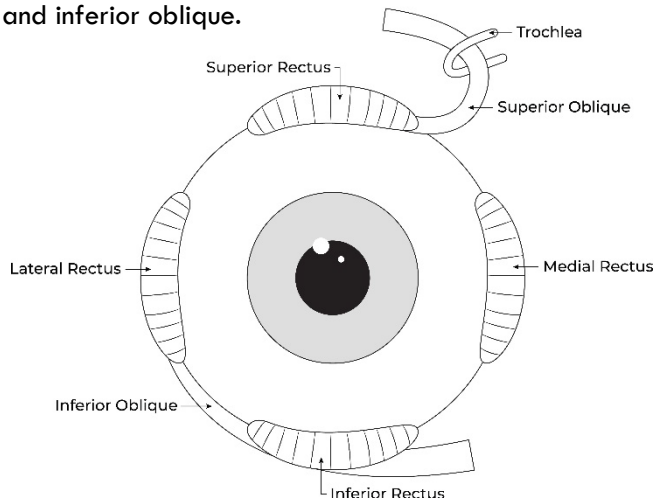
- Cost
  - Assesses the cost of the patient care you provide. CMS calculates cost measures, based on your Medicare claims, to determine the cost of the care you provide.
  - How much does it cost CMS for you to provide care?
- Improvement activities
  - Assesses practice engagement in improvement activities such as care coordination, beneficiary engagement, and patient safety.
  - Think about your role in overall public health.
- Promoting interoperability
  - Formally known as "Advancing Care Information" or think "Meaningful Use".
  - CMS indicated this performance category assesses how you improve your care processes, enhance patient engagement in care, and increase access to care. You choose the activities appropriate to your practice.

SCIENCE OF THE EYE (11.1%)

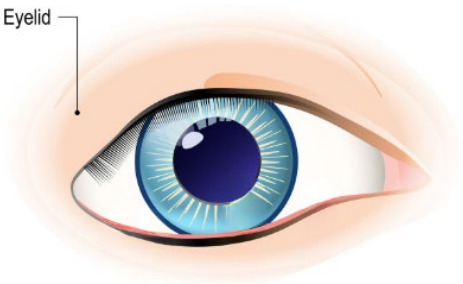
STRUCTURE OF THE EYE

- Orbit
  - The eye is nestled within a protective bony socket called the orbit.
  - The orbit houses the eyeball and provides structural support.

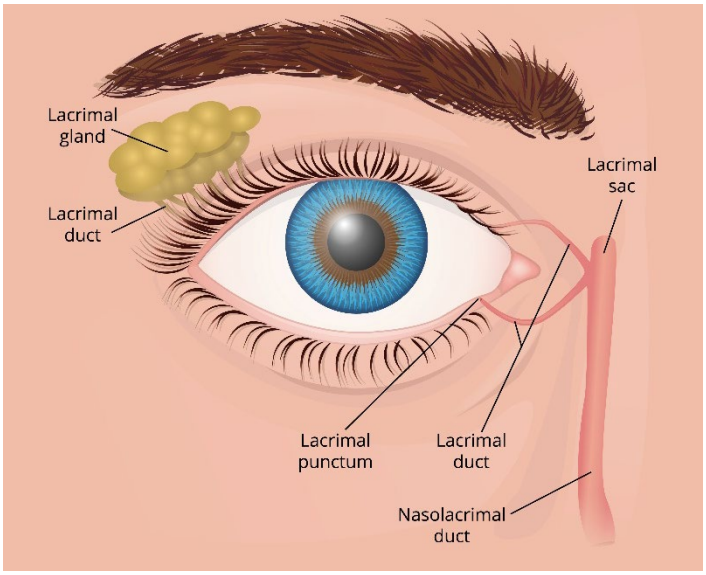
- Extraocular muscles *(reference Ocular Motility Testing)*
  - The six extraocular muscles are attached to the sclera from the bones surrounding the eyeball.
  - These muscles allow precise movement of the eye in different directions: up, down, side to side, and rotation.
  - The muscles include medial rectus, inferior rectus, lateral rectus, superior rectus, superior oblique, and inferior oblique.



- Lids
  - The eyelids serve as protective covers for the eyes. They consist of two layers: an outer layer of skin and an inner layer of conjunctiva.
  - The conjunctiva is a clear membrane that covers both the surface of the eye and the inner surface of the eyelids.
  - Blinking of the eyelids helps distribute tears across the eye's surface, keeping it moist and protecting it from debris.

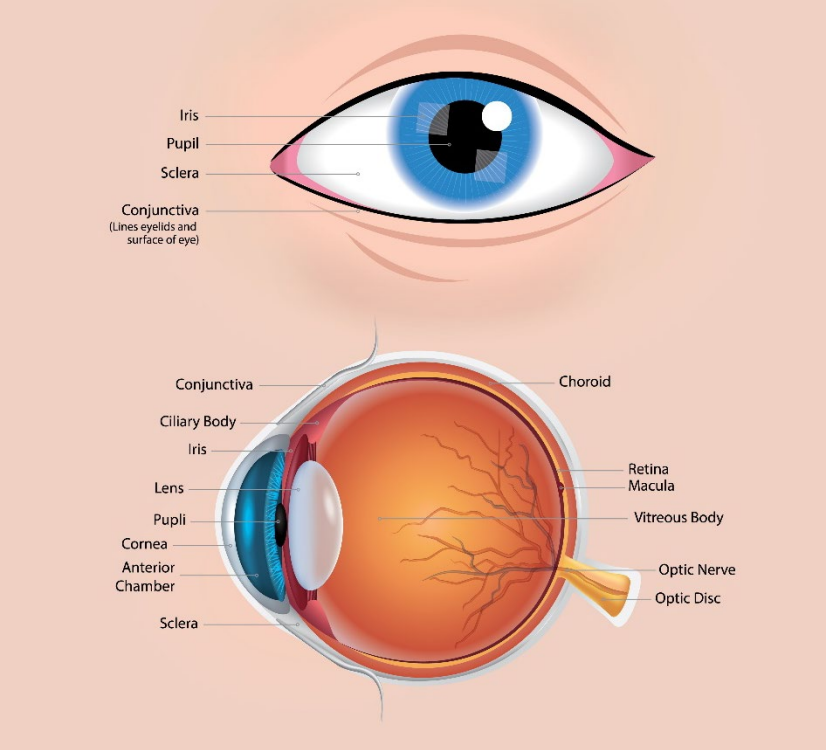


- Lacrimal system
  - The lacrimal system is responsible for tear production, distribution, and drainage.
    - Lacrimal gland – a bilobed, tear-shaped gland that produces fluid that cleans and protects the surface of the eyelid.
    - Lacrimal duct – transmits tears from the surface of the eye to the nasal cavity.
    - Lacrimal sac – inside corner of the eye that collects tears that drain out of the eye at the lacrimal punctum.
    - Lacrima punctum – the area/opening that pumps tears out of the eye.
    - Nasolacrimal duct – tubelike areas that tear fluid travels through, this is considered the final part of the lacrimal system.



  - Tears are essential for maintaining eye health and clarity. They consist of three layers:
    - Mucous: Produced by the conjunctiva, it helps the tear film adhere to the eye's surface.
    - Water: Produced by the lacrimal gland, located under the outer edge of the eyebrow. It provides moisture and nutrients to the eye.
    - Oil layer: Produced by the meibomian gland, contributing to tear stability, and preventing excessive evaporation.
  - Tears drain from the eye through the tear duct (also known as the nasolacrimal duct)

Reference Image Below for the Following Structures of the Eye:



- Conjunctiva & Sclera
  - The conjunctiva is a clear membrane covering the surface of the eye and the inner surface of the eyelids.
  - The sclera is the tough, white outer layer that covers most of the eyeball.
  - Together, they protect and maintain the integrity of the eye.
- Cornea
  - The cornea is the transparent, dome-shaped front portion of the eye.
  - The cornea is the most powerful refractive medium of the eye, with its shape directly affecting where the incoming light focuses on the retina.
  - There are five layers to the cornea: epithelium, Bowman's layers, stroma, Descemet's membrane, and endothelium.
  - The cornea is avascular which means it has no blood vessels.
- Anterior chamber
  - Behind the cornea lies the anterior chamber, a fluid-filled space.
  - This chamber contains aqueous humor, which helps maintain eye pressure.
  - Aqueous humor is continuously produced and drained to regulate pressure.
- Iris/Pupil
  - The iris is the colored part of the eye.
  - It surrounds the pupil, the dark central hole.
  - Muscles in the iris control the pupil size, regulating the amount of light entering the eye.

- Lens
  - Directly behind the pupil sits the lens.
  - The lens focuses light onto the retina at the back of the eye.
  - It can change shape to adjust focus for near or distant objects.
- Vitreous
  - The vitreous is a gel-like substance filling the space between the lens and the retina.
  - It helps maintain the eye's shape and supports the retina.
- Retina
  - The retina lines the back of the eye.
  - It contains specialized cells (photoreceptors) that capture light and convert it into electrical signals.
- Optic nerve
  - The optic nerve transmits these electrical signals from the retina to the brain.
  - It is essential for vision and visual processing.
- Macula
  - The macula is a small area within the retina.
  - It contains a high concentration of photoreceptor cells and is responsible for central vision and fine details.

TYPES OF REFRACTIVE DISORDERS

- Hyperopia (Farsightedness)
  - Occurs when the eyeball is too short, or the cornea is too flat.
  - As a result, light entering the eye focuses behind the retina instead of directly on it.
  - People with hyperopia can see distant objects clearly, but nearby objects appear blurry.
  - Corrective lenses (glasses or contact lenses) with a convex shape are used to bring the focus forward onto the retina.
- Myopia (Nearsightedness)
  - Characterized by an elongated eyeball or a cornea that is too steep.
  - Light entering the eye focuses in front of the retina, causing distant objects to appear blurry.
  - Individuals with myopia can see nearby objects clearly.
  - Corrective lenses with a concave shape (diverging lenses) are used to shift the focus backward onto the retina.
- Astigmatism
  - Astigmatism results from an irregularly shaped (football shaped) cornea.
  - This leads to blurred vision at all distances because the light hits two spots of the cornea instead of one.
  - It can be corrected with spherocylindrical glasses or with toric contacts.
- Presbyopia
  - Presbyopia is a normal part of aging. The term "presbyopia" comes from a Greek word which means "old eye."
  - As people age, the lens inside the eye becomes less flexible and loses its ability to focus on close objects.
  - Bifocal, trifocal, or progressive glasses, or multifocal contacts are commonly used to address presbyopia.

AMBLYOPIA & STRABISMUS

AMBLYOPIA

- A condition in which one eye with lowered visual acuity exists even with best visual acuity; loss or lack of clear vision in one or both eyes due to impaired visual development.
- Types of Amblyopia:
  - Refractive Amblyopia- large difference in the degree of myopia, hyperopia, or astigmatism between the two eyes that leads to decreased visual acuity
  - Strabismic Amblyopia- misalignment of the eyes in which the brain ignores input from one of the eyes that leads to decreased visual acuity

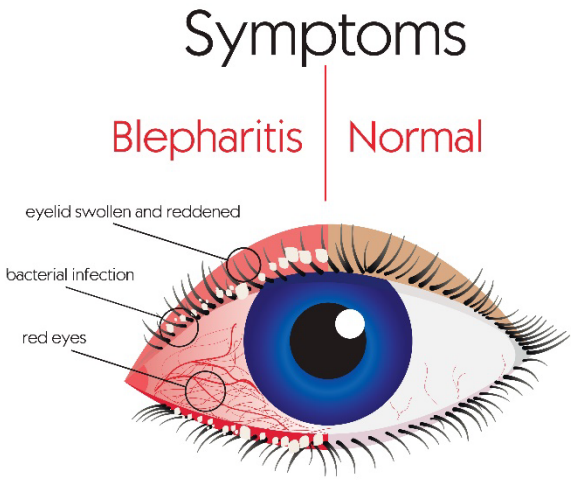
STRABISMUS

- A condition in which the eyes do not look at the same place at the same time.
- Types of Strabismus:
  - Esotropia- eye(s) turns inward
  - Exotropia- eye(s) turns outward
  - Hypertropia- eye turns upward
  - Hypotropia- eye turns downward

BLEPHARITIS

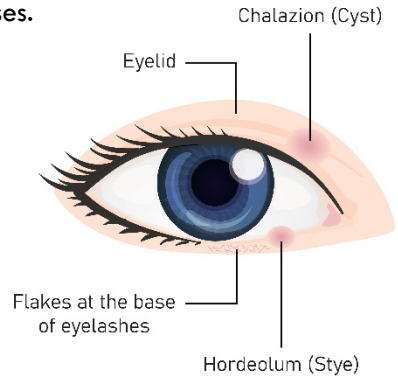
Blephar - means eyelid. -Itis means inflammation. Meaning blepharitis is a chronic eyelid inflammation.

- Patient symptoms - patients experience watery, red, gritty, burning, crusty eyes.
- Examination signs - the doctor can see an overgrowth of bacteria characterized by a crusting of the eyelashes.

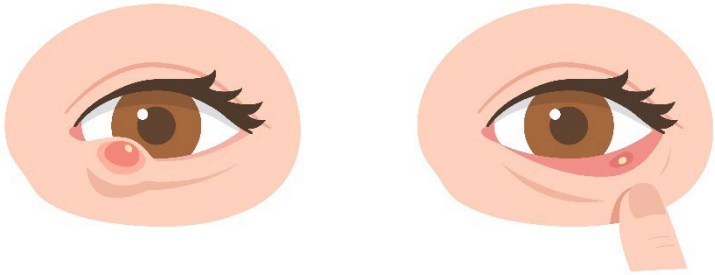


HORDEOLA & CHALAZIA

While both hordeola and chalazia are bumps on the eyelid, the key differences lie in their pain level, location, and underlying causes.



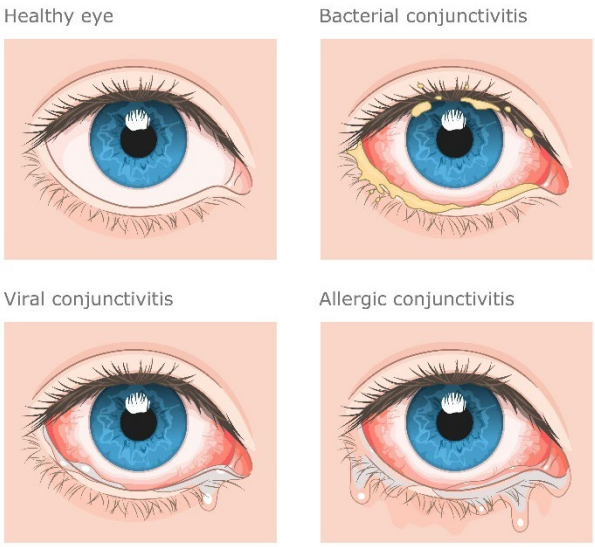
- Hordeola (Styes): a red, painful bump that typically appears near the edge of the eyelid.
  - Most styes are caused by a bacterial infection.
  - An external hordeolum begins at the base of an eyelash and is often caused by an infection in the hair follicle, often looking like a pimple.
  - An internal hordeolum occurs inside the eyelid as result of an infection in the oil glands in the eyelid.
  - Patient symptoms include light sensitivity, a scratchy sensation in the eye, redness, and a tender eyelid.



- Chalazia (Cyst) - an enlargement of an oil producing gland in the eyelid.
  - It appears as a swollen bump on eyelid.
  - As it grows, the eyelid can become red, swollen, and tender.
  - It is different from a stye because it is not usually painful. It develops further back on the eyelid than a stye. It rarely causes the entire eyelid to swell.

CONJUNCTIVITIS VERSUS SUBCONJUNCTIVAL HEMORRHAGE

- Conjunctivitis- inflammation of the conjunctiva, "pink eye;" can be caused by bacterial, viral, allergy or fungal.
  - Bacterial conjunctivitis- an infection most often caused by staphylococcal or streptococcal bacteria from your own skin, or respiratory system.
    - Can be caused from poor hygiene, physical contact, insects, using contaminated eye products such as facial lotions or makeup, and contact lenses.
    - Symptoms- mucous discharge, redness, irritation, redness and swollen eyelids, crustiness
    - Treatment- antibiotics, artificial tears

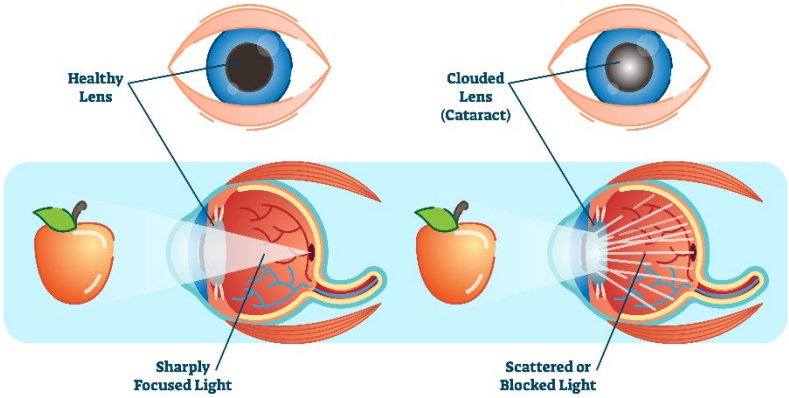


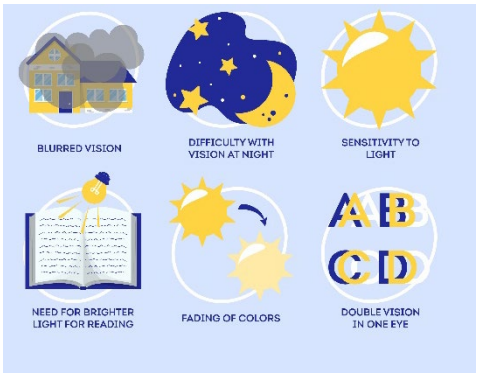
  - Viral conjunctivitis- an infection most often caused by contagious viruses associated with common cold; can also occur as the virus spreads along the body's mucous membranes which connect the conjunctiva, lungs, nose, tear ducts, and throat.
    - Develop through exposure to coughing or sneezing of someone with upper respiratory infection.
    - Symptoms- redness, painful, irritation, watery discharge, itchiness, redness, swollen eyelids, crustiness
    - Treatment- cool compresses, proper hygiene, artificial tears
  - Allergic conjunctivitis- inflammatory response of the conjunctiva to an allergen or irritant.
    - Symptoms- redness, itchiness, redness, swollen eyelids
    - Treatment- remove irritant, cool compresses, antihistamine, artificial tears, anti-inflammatory.
  - Fungal conjunctivitis - a rare disorder because of its low incidence and its unspecific clinical findings.
    - Candida species (yeast) are the major pathogens of fungal conjunctivitis. Caused by an overgrowth of yeast in your body.
    - Sporothrix app is a fungus that causes sporotrichosis (an infection under the skin caused by different species of the fungus sporothrix). The name means spores or threads. It exists as yeast or as mold.
    - Symptoms – blurry vision, photosensitivity, and ocular pain.
    - Treatment – topical antifungal agents or oral antifungal medication.
- Subconjunctival hemorrhage - accumulation of blood underneath the conjunctiva
  - Causes - blood thinners, increasing pressure in the head from straining, coughing, sneezing, vomiting, blood clotting disorder, idiopathic
  - Symptoms - mild irritation, none
  - Treatment - artificial tears

CATARACTS

A clouding of the lens of the eye (the part that helps focus light).

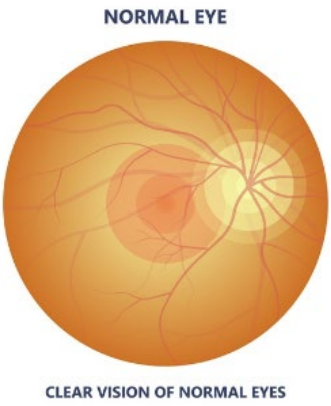
- Symptoms: blurry, cloudy, and/or decreased vision, sensitivity to light and glare (including haloes around or starbursts), fading or yellowing of colors, difficulty seeing at night, double vision and changes in refractive error.
  - Refractive change also known as refractive error – caused by a change in the lens refractive index (can amount to several diopters).



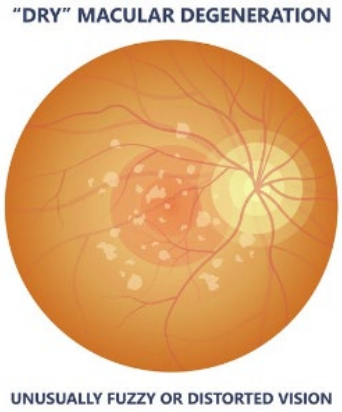


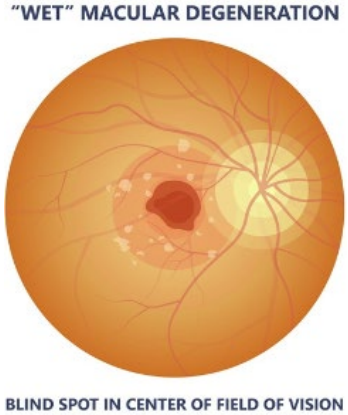
MACULAR DEGENERATION

- Macular Degeneration also known as age related macular degeneration (AMD) – a common eye disease that affects the macula, the center of the retina.
  - Affects vision by causing blurry and/or decreased vision, reduced color contrast, scotomas (blind spots), metamorphopsia (straight lines appear curved or wavy), shape of objects are distorted and loss of central vision.
    - Difficulty recognizing familiar faces, reading, driving or doing close-up work.
  - Dry Form – occurs when the macula's celld gradually deteriorate due to the formation of tiny yellow protein deposits called drusen.
    - These protein deposits dry out and thin the macula, which causes the retinal cells that process light to die.
    - Affects 85-90% of AMD patients



  - Exudative Form (Wet AMD) – an advanced form of the disease that occurs when abnormal blood vessels develop under the retina and macular, leaking blood and fluid.
    - Leads to a bulge in the macula, dark spots and blurriness.
    - If left untreated can lead to a disciform scare which affects the central vision and can lead to blindness.

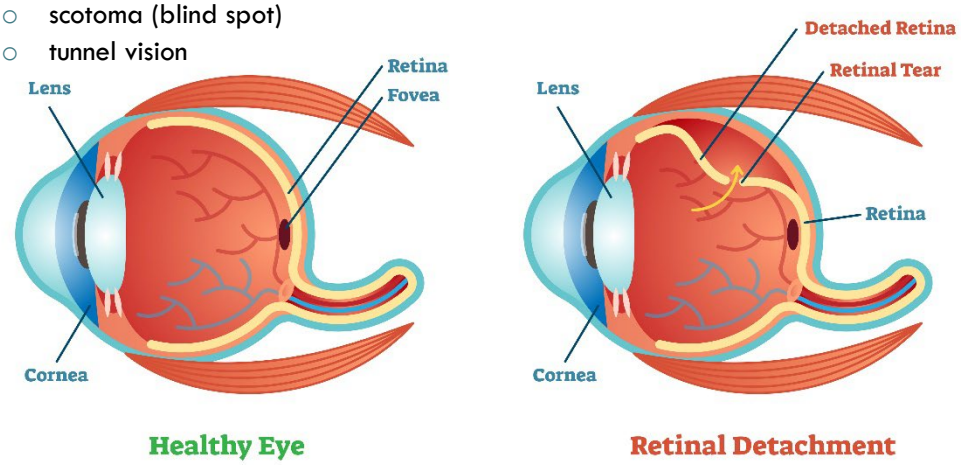




RETINAL TEAR OR DETACHMENT

A retinal tear occurs when the back lining of the eye gets a small hole or break in it. The tear can then lead to a retinal detachment. A retinal detachment is a emergency situation where the back lay of the eye becomes detached from the underlying tissue. It is important to note that neither a tear or detachment will cause pain.

- Common symptoms of a retinal tear or detachment are the same. They include:
  - blurred vision
  - decreased and/or hazy vision
  - gray curtain or veil over vision
  - light flashes
  - dark or irregular floaters
  - decrease in peripheral vision
  - scotoma (blind spot)
  - tunnel vision



BASIC TOPICAL AGENTS FOR THE EYE

- Anesthetics - causes temporary numbing of a nerve, which results in loss of feeling in the surrounding area.
  - Uses - foreign body removal, gonioscopy, surgery, and tonometry
  - Examples - proparacaine, lidocaine, tetracaine
    - Injectable anesthetics, such as lidocaine (Xylocaine), are used to anesthetize the eyelids, globe, and ocular muscles. These agents may be combined with epinephrine to cause constriction of the blood vessels, resulting in a decrease in bleeding.
  - Side effects- burning/stinging sensation, corneal irregularities, convulsions, restlessness
- Diagnostic:
  - Mydriatic - drop used to relax the iris sphincter and promotes dilation; inhibits parasympathetic pathway to the iris sphincter or by promoting sympathetic pathway to the iris dilator.
    - Action - dilates pupil
    - Examples - Phenylephrine, Epinephrine, Hydroxyamphetamine
    - Side effects - blurriness, loss of accommodation, photophobia, redness
  - Cycloplegic- drop used to paralyze accommodation by inhibiting the ciliary muscle

        - Actions - dilates pupil, paralyzes accommodation, relieves ciliary muscle spasm, prevents posterior synechiae
        - Examples - Atropine, Cyclopentolate, Homatropine, Tropicamide
        - Side effects - blurriness, loss of accommodation, photophobia, rapid pulse, redness
- Prescribed:
    - Antibiotic - drop used to kill bacteria or inhibit bacterial growth
        - Used to treat - blepharitis, corneal ulcer, cellulitis, conjunctivitis, dacryocystitis, endophthalmitis, meibomitis
        - Examples - Moxifloxacin, Ciprofloxacin, Tobramycin, Trimethoprim/Polymyxin, Erythromycin, Vancomycin, Gentamicin, Bacitracin, Neomycin
        - Side effects - burning, irritation, redness, skin rash
    - Corticosteroid- drop used to reduce inflammation by reducing irritation, redness, swelling
        - Used to treat- blepharitis, contact dermatitis, episcleritis, chemical burns, iritis, scleritis
        - Examples- Dexamethasone, Difluprednate, Loteprednol, Kenalog, Prednisolone, Triamcinolone
        - Side effects- delayed healing, proliferation of virus, cataracts, increased IOP, overgrowth of fungus
- OTC:
    - Lubricants - provide moisture and relief for dry eyes
        - Examples - artificial tears, gel, ointment
        - Side effects- burning/stinging sensation, discomfort, redness, temporary blurriness
    - Allergy - used to alleviate discomfort, irritation, and redness from contaminant or irritant
        - Examples - alcaftadine, olopatadine, ketotifen fumarate, naphazoline hydrochloride, naphazoline, epinastine
        - Side effects - burning/stinging sensation, discomfort, redness, temporary blurriness
- Other:
    - Miotic - drop used to promote the parasympathetic pathway to the iris sphincter or inhibit the sympathetic pathway to iris dilator
        - Action - constricts pupil, improves aqueous outflow, withdraws congestion of iris tissue, reduces accommodative effect
        - Example - pilocarpine
        - Side effects - ciliary spasm, decreased vision, headache
    - Ophthalmic Dyes/Stains - used to stain different ocular structures
        - Action- outlines defective areas of the cornea, highlights defects in the blood vessels and retinal structures when injected intravenously
        - Example- sodium fluorescein (available in liquid form or impregnated on dry, paper filter strips); liquid fluorescein (mixed with anesthetic for convenience in performing applanation tonometry)

Ophthalmic Therapeutic Drug Categories

Type of Drug	Action
Glaucoma Medication	Reduction of intraocular pressure
Antibiotics	Used to treat bacteria caused ocular infections
Antivirals	Used to treat virus caused ocular infections
Antifungals	Used to treat ocular fungal infections
Corticosteroids (steroids)	Reduce inflammation
Nonsteroidal Anti-Inflammatory Drugs (NSAIDS)	Treatment of inflammatory conditions and ocular allergies without the side effects associated with steroids
Decongestant	Constricts conjunctival blood vessels to reduce eye redness
Antihistamines	Relief of seasonal or allergic conjunctivitis symptoms
Mast Cell Stablizers	Relief of seasonal or allergic conjunctivitis symptoms
Low-Dose Atropine (0.01% or 0.05%)	Myopia control

Commonly Used Cycloplegics, Mydriatic, and Topical Anethetics

Generic Name	Example of Trade Name	Concentration	Onset/Duration of Action
Cycloplegics and Mydriatics			
Phenylephrine	AK-Dilate	2.5% and 10% solutions	30-60min/3-5 hrs
	Mydfrin	2.5% solution	
	Parenyd	1% solution	15-60min/4 hrs
Hydroxyamphetamine			
Tropicamide	Mydriacyl	0/5% and 1% solutions	20-40min/4-6 hrs
Cyclopentolate	AK-Pentolate	1% solution	30-60min/2 days
	Cyclogyl	.05%. 1% and 2% solutions	
Homatropine	Isopto-Homatropine	2% and 5% solutions	30-60min/3 days
Scopalomine	Isoto-Hyoscine	.025% solution	30-60mins/4-7 days
Altropine	Isopto-Atropine	.05%, 1%, 2%, and 3% solutions	45-120min/7-14 days
Topical Anesthetics			
Proparacaine	Ophthetic, Alcaine	.05%	10-30sec/15-20 min
Tetracaine	Tetracaine	.05%	
***Cycloplegics and mydriatics are used for pupil dilation and ciliary muscle suppression**			

- **Note**: Every effort has been made to ensure that the drug dosage schedules within this text are accurate and conform to standards accepted at time of publication. However, as treatment recommendations vary in the light of continuing research and clinical experience, the reader is advised to verify drug dosage schedules herein with information found on product information sheets. This is especially true in cases of new or infrequently used drugs.

COMMONLY USED TERMS IN OPTOMETRY

Abbreviation	Meaning
VA	Visual Acuity
FC or CF	Finger Counting
HM	Hand Motion
LP	Light Perception
NLP	No Light Perception
IOP	Intraocular Pressures
Pachs	Pachymetry
OCT	Optical Coherence Tomography
Seg Height	Segment Height
DBL	Distance Between Lenses
OAD	Overall Diameter
OZD	Optical Zone Diameter
BVP	Back Vertex Power
BCR	Base Curve Radius
GP	Gas Permeable
RGP	Rigid Gas Permeable
MIPS	Merit Based Incentive Payment System
CMS	Centers for Medicare and Medicaid Services
EHR	Electronic Health Record
ARMD or AMD	Age Related Macular Degeneration
CPR	

Acronyms	Meaning
SAFE	Smooth, Accurate, Full, Extensive
PERRLA	Pupils, Equal, Round, Reactive to Light, Accommodation
FCF	Finger Counting Fields Full to Confrontation
ANSI	American National Standards Institute
FOLDAR	Frequency, Onset, Location, Duration, Association, Remedies
FLORIDA	Frequency, Location, Onset, Relief, Intensity, Duration, Associating Symptoms
HIPAA	Health Insurance Portability and Accountability Act
OSHA	Occupational Safety and Heath Administration
HPI	History of Present Illness

Directional	Meaning
Anterior	located on or near the front of an organ
Posterior	Located on or near the back of an organ
Superior	Situated above or directed upward
Inferior	Situated below or directed downward
Medial	Pertaining to the middle of the midline
Lateral	Pertaining to the side of a position farther away from the midline
OD	Latin abbreviation for oculus dexter, which means right eye
OS	Latin abbreviation for oculus sinister, which means left eye
OU	Latin abbreviation for oculus uterque, which means both eyes

Prefix	Meaning
a-, an-	without
ab-	away
ad-	to, toward
anisio-	different
anti-	against
bi-	two
di-	two
ex-	away from, out of
hyper-	excessive, above, over
hypo-	under, below
intra-	within
para-	beside, beyond, around
peri-	surrounding
retro-	backward
sub-	under, below

Root Word	Meaning
blephar	eyelid
chrom	color
conjunctiv	conjunctiva
cor, core, pupil	pupil
corne, kerat	cornea
dipl	two. double
irid, iri	iris
ocul, ophthalm	eye
opt	vision
ortho	straight
papill	optic nerve head
path	disease
phot	light
retin	retina
scler	sclera
ton	tension, pressure

Suffix	Meaning
-ectomy	cutting out, excision
-eme	condition
-ia	diseased or abnormal state
-itis	inflammation
-meter	measurer
-ologist	one who studies or practices
-ology	study of
-oma	tumor, swelling
-opia	vision condition
-osis	abnormal condition
-pathy	disease
-phobia	abnormal fear of or aversion to specific things
-scope	instrument used for examination
-tropia	to turn
-al, ic, ious	pertaining to