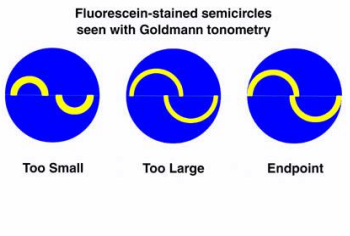
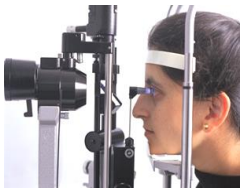
Goldmann Tonometry



Why Do We Check Eye Pressure?

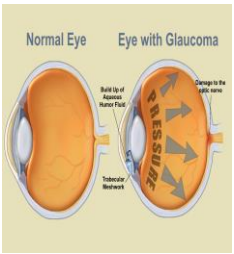
Tonometry: measuring **intraocular** pressure

Purpose: to *aid* in the detection of glaucoma. ↑ IOP puts you at **risk** for glaucoma, it *does not* mean you have the disease. Whether you get glaucoma depends on whether or not your optic nerve can tolerate the pressure you have in your eye.

What is Glaucoma ?

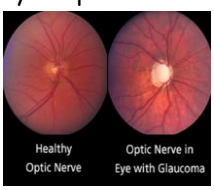
Glaucoma is diagnosed when a patient has the following (**3**) conditions occurring :

a.** ↑ IOP
b. optic nerve damage
c. visual field changes



visiquekapitieyecare.blogspot.com

Glaucoma *cannot* be cured, but in most cases it *can be* controlled by drops or surgery/laser procedures. The major problem with glaucoma is that it is a slow, painless disease that steals the patient's vision before they are aware of it.



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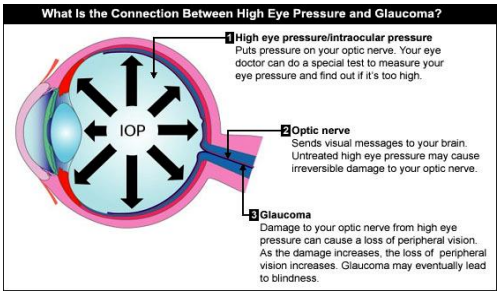
People At Risk

- African Americans have a 6-8% higher risk
- People over 60 y.o.
- POAG is hereditary
- Asians run an increased risk for angle closure
- Past Blunt Trauma Eye Injury may cause secondary glaucoma due to the blunt trauma
- Patients that are very nearsighted
- Diabetics
- Patients with high blood pressure
- Corneal thickness ≤ 0.5 mm

Normal eye pressure is considered to be between 12 - 21 mm Hg



While "the book states" that the normal eye pressure is between 10 – 20 mmHg, the number alone does not mean, or even indicate, that a patient has glaucoma! Without the other two factors (optic nerve changes and visual field changes), you cannot accurately diagnose glaucoma. You need to know what the "numbers" *are doing* to the eye structures.

Types of Glaucoma

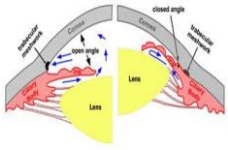
POAG: Primary Open angle Glaucoma

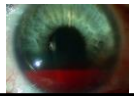
Angle Closure Glaucoma

Congenital Glaucoma

Secondary Glaucoma

Traumatic





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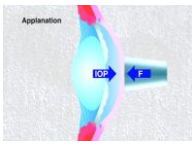
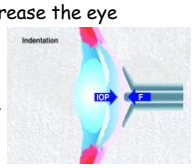
Ocular Rigidity

"Displacement of ocular coats "

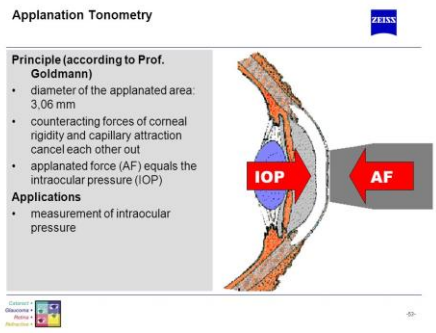


Applanation tonometry is the most efficient way of performing tonometry because it **does not indent the eye**, therefore there is **no artificial increase in pressure**. Nor does it increase the eye pressure due to any weight induced by the tonometer prism. Applanation also **minimizes** artificially low pressures in eyes that have low ocular rigidity (myopes).



Imbert-Ficke Principle

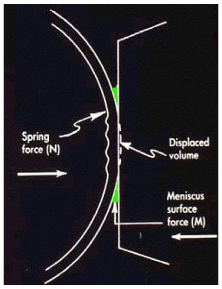
Goldmann applanation tonometry is based upon the Imbert-Ficke principle: such that the IOP measurement can be determined by the amount of force needed to flatten a fixed area of cornea. In this case, we are pushing on the eye with the blue-light applanator, and trying to flatten a round cornea surface with a diameter of 3.06 mm (that's the area that our variable-force scale is calibrated for).



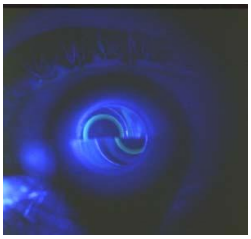
Because the tonometer **flattens** the cornea and **does not indent it**, the pressure can be measured within 0.5 mm Hg. Scleral rigidity is disregarded because less than 0.5mm of volume is displaced.

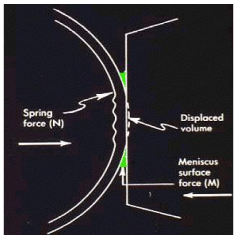
There also is minimal to no massage effect that can occur due to repeated measurements.

The prism tip has a **3.06 mm diameter**. This also prevents an artificial increase in intraocular pressure.



Tonometry is designed to be a *gentle* touch on the cornea.

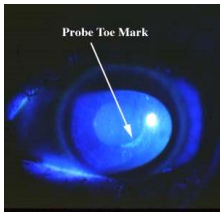




Signs of "aggressive" tonometry !

Abrasion due to alcohol on probe

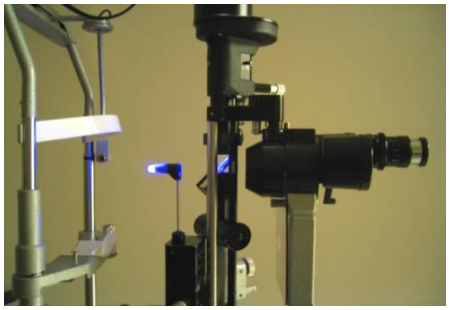
Abrasion due to repeated measurements



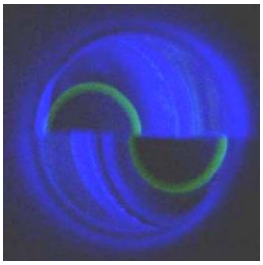
How to Perform

Using either a topical anesthetic and a flourescein strip or flourescein drops, place a drop in the eye.
The drop will give you the ability to **see the mires** as well as numbing the patient so they do not feel the tip on their eye!

45 - 60 ° angle so that tip is illuminated. Oculars and tip straight ahead, light source to the lateral side



Look through ***one*** eyepiece. Adjust the position of the mires by moving the joystick up or down until they *slightly* overlap.



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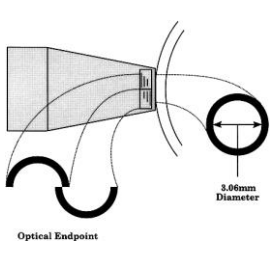
Patient seated comfortably at the slit lamp: forehead against the strap, chin firm on chin rest. Move tonometer probe to the cornea until it **gently** touches the cornea.

When you touch, whole cornea will glow **bright green.**

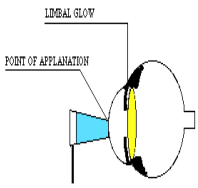


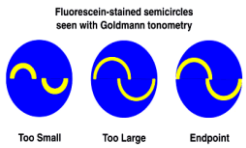
miamifittv.com

Goldmann applanation is designed to be a "butterfly kiss" to the front of the eye.
If you are indenting the cornea, you are pushing on the eye way to hard!

video-hned.com

Errors With Tonometry





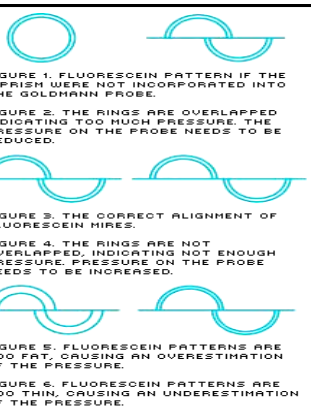


FIGURE 1. FLUORESCEIN PATTERN IF THE BIPRISM WERE NOT INCORPORATED INTO THE GOLDMANN PROBE.

FIGURE 2. THE RINGS ARE OVERLAPPED INDICATING TOO MUCH PRESSURE. THE PRESSURE ON THE PROBE NEEDS TO BE REDUCED.

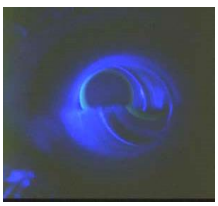
FIGURE 3. THE CORRECT ALIGNMENT OF FLUORESCEIN MIRES.

FIGURE 4. THE RINGS ARE NOT OVERLAPPED, INDICATING NOT ENOUGH PRESSURE. PRESSURE ON THE PROBE NEEDS TO BE INCREASED.

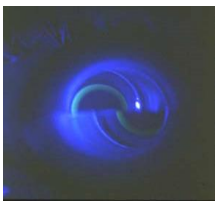
FIGURE 5. FLUORESCEIN PATTERNS ARE TOO FAT, CAUSING AN OVERESTIMATION OF THE PRESSURE.

FIGURE 6. FLUORESCEIN PATTERNS ARE TOO THIN, CAUSING AN UNDERESTIMATION OF THE PRESSURE.

Too low…move up and slightly to the right



Almost there !



Mires too wide: too much flourescein or prism not clean. Pressures will read *HIGH*.

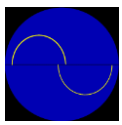
Mires too narrow: flourescein evaporated by the tear film. Pressures will read *LOW*.

Intermittent Contact: Patient's head not against the headrest.

Too much fluorescein will cause a reading error due to the mires being too thick. Have the patient gently blink a few times and then remove the residual with a Kleenex – carefully! Remember, the surface of the eye is numb, and you do not want them to scratch themselves.

(eyenet.com)

Too little fluorescein may result in a reading error being too thin. This is usually not a problem unless the is a long time period between fluorescein instillation and measurement, or the patient is tearing a lot.



(eyenet.com)

Lid contact with the tip will make the mires too thick. The lids can be held open with your fingertips but be careful to not to push on the eye while holding the lids as this will cause an artificial rise in IOP. Make sure to press the lids against the bone of the orbit and not against the eye.

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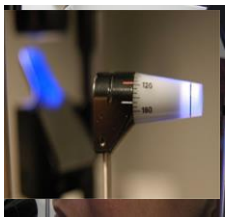
Patient holding breath, or tight collar:
Pressure reading will be *HIGH*

Holding lids and inadvertently pushing on eye:
Pressure reading will be *HIGH*

What If They Have Astigmatism?

Corneal astigmatism above **3 diopters** may cause a reading error due to distortion of the mires from the normal circular shape. This error can be compensated for by aligning the red line on the applanator tip with the number on the mount that corresponds to the minus cylinder axis of the astigmatism.



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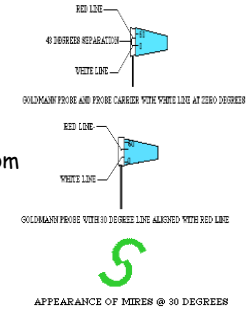
ASTIGMATISM (with astigmatism > 3.00)

The flattened area will become more elliptical in shape rather than circular. Set the prism head with tip axis at 43° from the minus cylinder axis of the astigmatism.



This distortion of the cornea can be compensated for by aligning the red line on the applanator tip with the number on the mount that corresponds to the minus cylinder axis of the astigmatism.

CCT (Corneal Central Thickness)

Central corneal thickness (CCT) that is above or below normal can cause an error in the applanation tonometer reading. Corneal thickness that is *significantly less than the normal 555* microns will cause an *underestimation* of the IOP.

Thickness significantly *greater* than normal will cause an *overestimation* of the IOP. Because of the CCT factor, pachymetry (measurement of corneal thickness) is an important reading to take in patients suspected of being at risk for glaucoma.

Pachymetry: Corneal Thickness

The Ocular Hypertension Treatment Study (OHTS) (2002) showed central corneal thickness (CCT) to be a strong indicator of glaucoma.

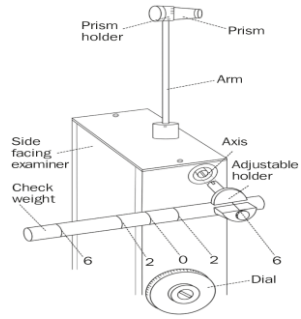
Average corneal thickness = 540 microns

Eyes with cornea thickness ***less than 555*** (thin corneas) were found to have a 3x **higher** risk of developing glaucoma and therefore, CCT under 555 should be seen as a ***potential* risk factor** for the development of glaucoma. So, the 540 *normal* CCT also falls into the potential risk category !

How Can We Use This Data ?

Thick cornea + NL IOP	---
Thick cornea + High IOP	+
Thin cornea + NL IOP	+/-
Thin cornea + High IOP	++++
Average cornea + NL IOP	--
Average cornea + High IOP	++

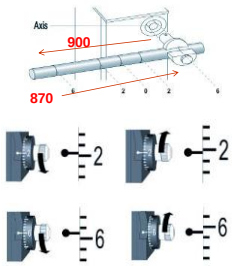
Parts of the Tonometer Housing



Cybersight.com

Calibration of Tonometer

For the Haag Streit, the bar is positioned as in the picture. Measure at **0**, **2**, **6**. Make sure tonometer tip is in the holder! This correlates to 0,20,60. Slowly turn the tonometer dial to approach these numbers.



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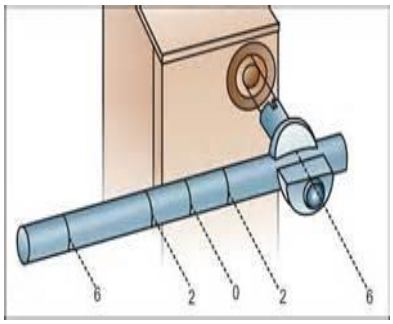


jaypeejournals.com

Calibration

Attach the calibration bar to the body of the tonometer. The bar has (5) markings, with the central marking calibrated for 0 mmHg.

Calibration

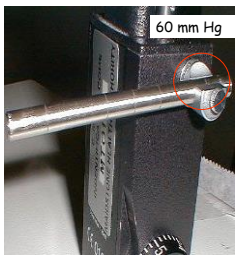
Calibrate at:

"0"

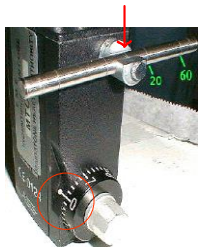
"2" = 20mm

"6" = 60mm

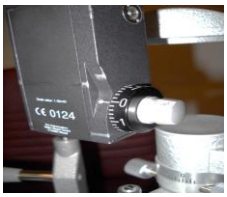
Make sure to look for the slight "bob" each time.

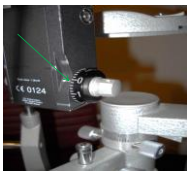


With the bar on "0", align the knob to read "0". The tonometer tip should "bob" forward +/- 0.1g



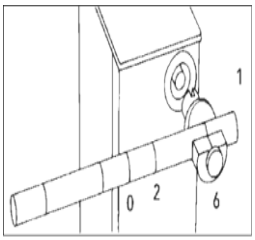
At 0, the arm should be free of movement. If you turn the dial slightly back wards, the arm should fall towards the tech. When you turn the dial slightly forward, the arm should fall towards the patient. IF it does not bob in the following manner – the tonometer is inaccurate and needs to be sent in for evaluation. Repeat for 2 (20) and 6 (60).





Calibration

The next markings (on either side) are for calibration at 20mm Hg. The last mark closest to the end is for calibrating at 60mm Hg.



- Line up the bar with index mark 2 on the weight. With the longer end of the bar facing you, slide it into the axis on the side of the tonometer and push it all the way in
- Repeat the above steps (for dial position 0), with the dial now at position 2. This time, turn the dial backwards to the equivalent of 1.95 and forwards to the equivalent of 2.05

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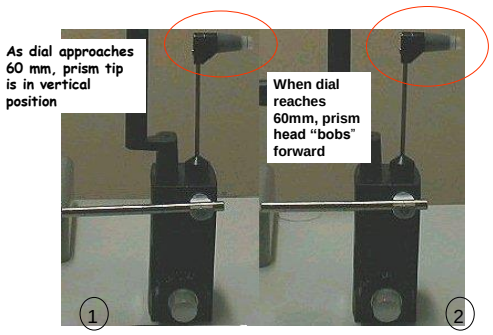


Cleaning Prism Tip

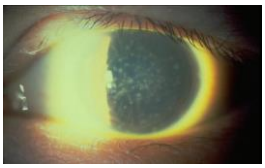
The prism tip needs to be cleaned between

each patient with either:

- *hydrogen peroxide
- *bleach
- *alcohol

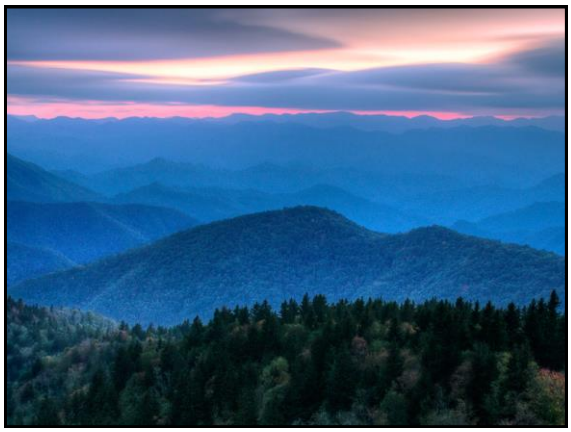
The cleaning agent you use will depend on your facility and practice guidelines.

Soaking the tonometer head for 5 minutes in 3% hydrogen peroxide or 0.5% sodium hypochlorite (bleach) or 70% isopropyl alcohol meets the guidelines published by the Center for Disease Control and Prevention (CDC) and the American Academy of Ophthalmology (AAO). *However, wiping the tip with a 70% isopropyl alcohol swab is also described as being as effective in virus elimination as disinfectant immersion* (Smith & Pepose 1999).



Epidemics of adenoviral keratoconjunctivitis (EKC) have been known to happen by using tonometers. Viruses, including the human immunodeficiency virus (HIV), and hepatitis B & C, may be even more of an issue because of the extreme contagiousness of the diseases and the increasing number of people with it. Tears can spread hepatitis B infection.

Hepatitis B and Hepatitis C viruses are far more prevalent in the population than HIV and can cause chronic hepatitis. It has been shown that hepatitis B infection *can* be transmitted after infectious exposure of the ocular surface alone. Finding hepatitis C virus in tear fluids and aqueous humor raises the possibility of a potential transfer of hepatitis C virus during an eye exam using Goldmann tonometry or the use of trial contact lens fitting.



Tech "Angles" = AC depth