Pupils

Really isn't it just a hole!

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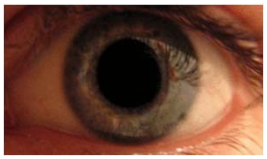
Disclosures

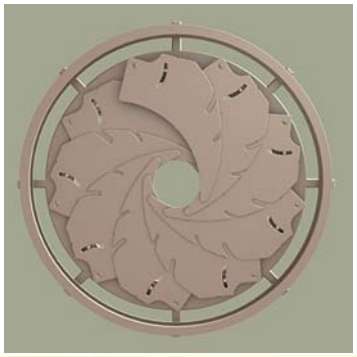
Nothing to disclose.



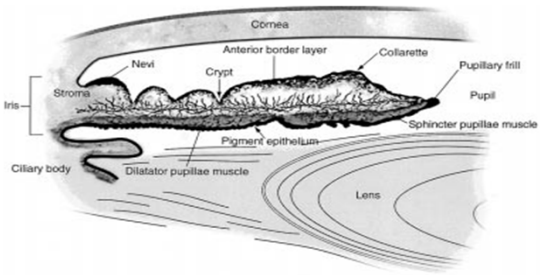
(Photo credit: Wikipedia)

Learning Objectives

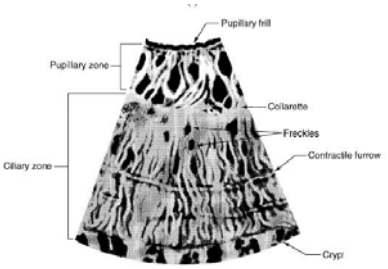
- Better understanding of Pupil structure and function
- Increase your ability to test pupillary function
- Understand how to record non normal pupil function



Anatomy



Anatomy



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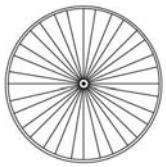
How does it work

- The Iris has two muscles the dilator muscle and constrictor muscle.
  - The dilator muscles is arranged radially much like spokes on a wheel
  - The constrictor muscle runs circularly around the pupil boarder.



When the Constrictor muscle is activated what happens to the pupil size?

When the Dilator muscle is activated what happens to the pupil size?

What happens to the pupil size when looking at a near object?

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How does it work

- Light activated **reflex** and accommodation activated **reflex** all wired through the mid brain, with fibers split between the Optic Nerve (CN2) and Oculomotor nerve (CN3).
- Fibers are part of the sympathetic and parasympathetic pathways.
  - Ready: Fight or Flight time!!!
- Sympathetic: Dilates the eye and gets you ready to fight or run!
- Parasympathetic: Constricts the pupil activates ciliary muscle for accommodation and settles you down.

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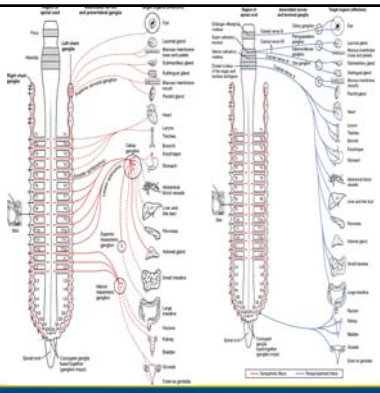

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How do you test it?

- First set the mood!
  - You want just enough ambient light in the room so that you can see both pupils. This means you will need a more light for a very dark iris and less light for a light iris.
- Second you need a Big Target "E"
- Third grab your favorite light! Choose wisely!
  - penlight, transilluminator, O scope, or the BIO.
  - You want something that will give you a concise circle of light with uniform illumination
  - So no flash lights to much spread.

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Lights!

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How do you test it?

- Hold your light within 25cm of the patient, do not block the line of sight.
- Have the patient remove there glasses and direct there gaze to the big E
- Shine the light into their right eye and observe the size and speed of the pupillary constriction. (Direct response)
  - Repeat twice
- Now adjust your observation to the left eye and shine the light into the right eye and observe the size and speed of the pupillary constriction. (Consensual response)
  - Again repeat twice
- For the left eye repeat all the same steps

How do you test it?

- Swinging Flashlight test
  - Move the light between the eyes rapidly (watch out for the nose) spending about 3-5 seconds on each eye.
  - Observe the response (dilation or constriction) and the size of each pupil at the moment when light first arrives and during the 3-5 second observation period
- Make sure you are directing the light onto the same part of the retina in each eye and that the light is of equal intensity.
- Repeat for two to three complete cycles.

What are you looking for?

- Are the pupils round?
- Are the pupils equal in size?
- Is there a Direct and Consensual response?
- Is there any pupillary escape?

- If are normal record as Pupils Equal Round Reactive to Light, no Relative Afferent Pupillary Defect or PERRL-RAPD

Pupils of unequal size

- Perform a Dim/Bright Pupillary test.
  - Tools: Big "E" for patient fixation
    - Ophthalmoscope with largest round beam.
    - Lights off in the room.
  - Sitting 1 meter away shine the light onto the patients face so that both eyes are illuminated.
    - Measure the pupil size (bright)
    - Gradually reduce the illumination to lowest that allows you to see the red reflex.
      - Again measure the size (dim)
  - Repeat twice to confirm

Pupils of unequal size

- You find that there is a 1mm difference between the eyes in dim and bright light. Great record as "anisocoria equal in dim and bright OD>OS by 1mm" (old photos back it up as well)
- You find that there is as difference in pupil size depending on the light, you have more to do!
  - Have the patient look straight ahead and measure the palpebral aperture, note the position of the lids relative to the limbus.
  - Now have the patient follow your finger to up-gaze, observe when the limbus clears the lower lid and measure the palpebral aperture in up-gaze.
- Record Pupils in bright OD=3.5mm, OS 3mm/in dim OD=7.0mm, OS 4.5mm/+ptosis upper lid OS

What Does it mean?

- Anisocoria more pronounced in dim light with mild ptosis of the upper and lower lid in the eye with the smaller pupil.
  - This is Horner's Syndrome and the most likely location for the issue is where?
  - Upper chest lesion

Photo credit: Steve Kofron

What Does it mean?

- Anisocoria more pronounced in bright conditions with a ptosis in the eye with the larger pupil.
  - This is CNIII lesion, the affected eye is most likely pointed down and out.

Photo Credit: Richard Jamara, OD

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Those pupils are failing all these tests, what now?

- Accommodative testing:
  - Tools:
    - Big "E"
    - Near target (something containing fine visual detail)
- Starting with the patient looking at distance and holding the near target at 10cm.
  - Have them look at the near target, observe the pupil measuring briskness of response and magnitude.
  - Have them look back at distance to check for dilation
  - Repeat to confirm
  - Record by adding and A the PERRL (PERRLA)
    - or OD unresponsive to light direct and consensual; both pupils constrict to near; OS responds to light D&C.

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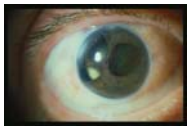
That pupil does not look normal.



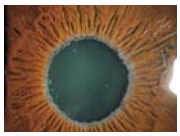


Photo Credit: Dr. Tim Root, MD

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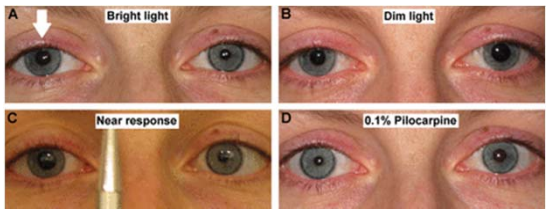
How would you record these finding?



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Congratulations you have now completed pupil testing!

Photo credit: National Geographic

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- Recommended reading resource: "Clinical Procedures for Ocular Examination" by N. Carlson and D. Kurtz.

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MEDICINE of THE HIGHEST ORDER