



Physiology of Vision

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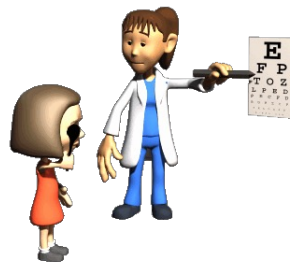
Faculty of Applied Sciences

Tishk International University

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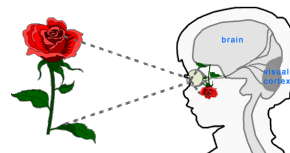
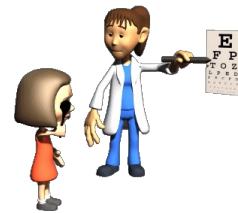
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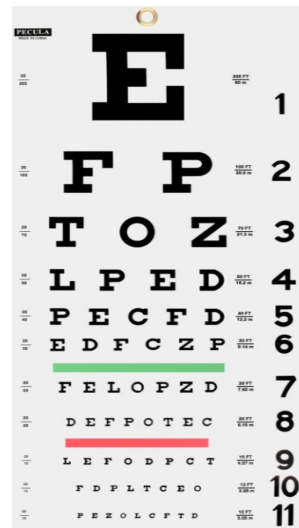
Contents:

- **Acuity of vision**
- **Visual reflexes:**
 - Corneal (blinking) reflex
 - Pupillary light reflex
 - Consensual light reflex
 - Accommodation reflex
- **Color vision**



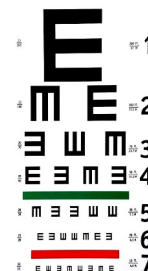
Acuity of vision (visual acuity):

- **Snellen's test type**, is a series of letters of different sizes, the top letter is visible to the normal eye at 60 m., and the subsequent lines at 36, 24, 18, 12, 9 and 6 m. respectively.
- The letters are in lines, each line has types of same size.
- The top row of types contains large letters/numbers/symbols and succeeding rows contain gradually smaller & smaller letters.



Acuity of vision (visual acuity) test:

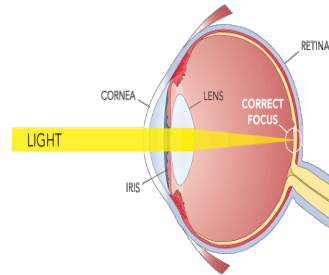
- It is a type of eye examination that measures the eyes' ability to see details at a specific distance **6 meters (20 feet)**.
- It is a **noninvasive test** and **don't involve any risks or special preparation**.
- The **visual acuity of each eye is determined separately**.



Acuity of vision (visual acuity) test:

■ Emmetropia (Ideal vision):

- Normal refractive status of the eye.
- The eyes can see an object of a **specific size** clearly at **6 M** (20 feet)
- **The cornea and lens focus the rays of light** from an object **perfectly on the retina**, creating a **sharp image**.
- **The focus** of the eye **is set** for distance vision **without the need for glasses or contact lenses**.



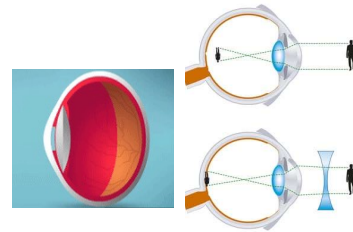
Acuity of vision (visual acuity) test:

■ Ametropia (Refractive Error):

- an abnormal refractive eye (**refractive error**) condition in which images fail to focus upon the retina.
- **In which light rays focus:**
 - in front of the retina (**myopia**) or
 - behind the retina (**hyperopia**) or
 - unevenly (**astigmatism**).
- Requires **corrective lenses** or **surgery** to move the focal point to the retina.

Ametropia:

- a **group of visual disorders** caused by **errors in the refractive power** of the eye (**refractive errors**)
- The eyes are **unable to refract light correctly**. It includes:

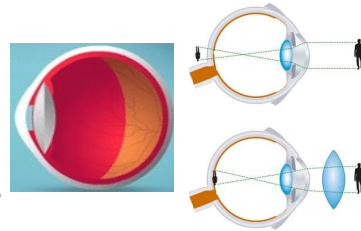


Myopia (nearsightedness):

- **Myopic eyes has:**
 - ✓ blurry distance vision and clear near vision.

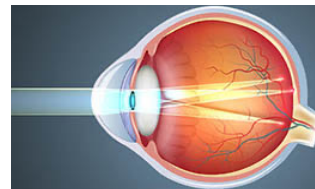
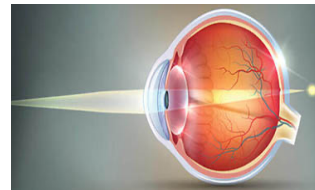
Hyperopia (farsightedness):

- Hyperopic people can see:
 - ✓ distant objects clearly, whereas nearby objects appear blurry.



Ametropia:

- **Presbyopia** (age-related farsightedness):
 - ✓ is the gradual loss of the eyes' ability to focus on nearby objects.
 - ✓ They will need reading glass for better vision.
- **Astigmatism** (irregularly shaped cornea):
 - ✓ A type of refractive error in which **the eye does not focus light evenly** on the retina.
 - ✓ Occurs when the cornea or the eye lens has an abnormal shape, making light bend incorrectly when entering the eye.



Visual acuity:

$6m_{\text{Examined}} / 6m_{\text{Normal}} (=1 \text{ ideal/normal})$

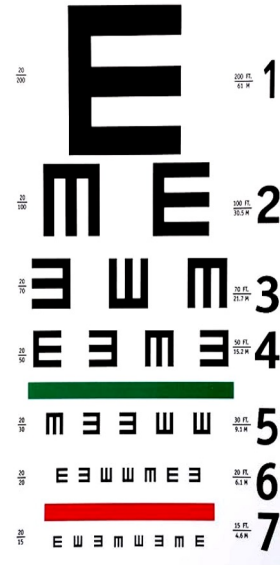
$20f_{\text{Examined}} / 20f_{\text{Normal}} (=1 \text{ ideal/normal})$

$6 / 6 (20/20) = 1 (=1 \text{ normal vision})$

$6 / 4 (20/13) = 1.5 (>1 \text{ super vision})$

$6 / 18 (20/60) = 0.33 \text{ abnormal } (<1)$

$6 / 9 (20/30) = 0.66 \text{ abnormal } (<1)$



Visual Pathway Disorders

Vision Blind area



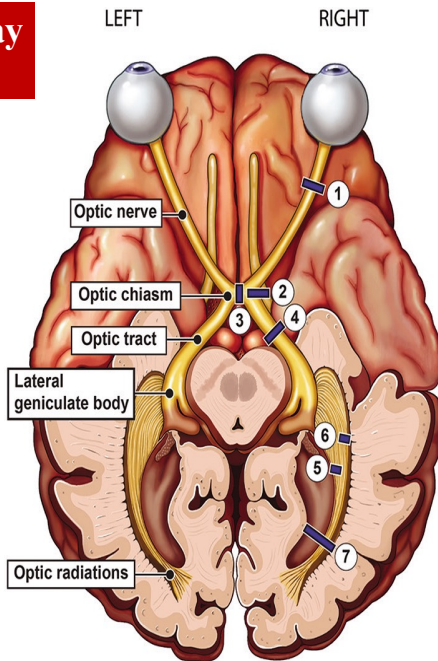
1. Total blindness of right eye



2. Right nasal hemianopia



3. Bipolar hemianopia



4. Left homonymous hemianopia



5. Left homonymous inferior quadrantanopia



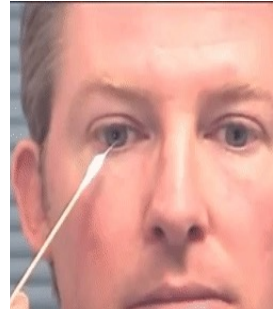
6. Left homonymous superior quadrantanopia



7. Left homonymous hemianopia

Visual Reflexes:

- **Corneal (blinking) reflex:**
- The corneal reflex is **an involuntary blinking of the eyelids** stimulated by tactile, thermal, or painful contact with the cornea.
- It is a **protective, rapid subconscious response** (<0.1 seconds) mediated by the **trigeminal (CN V)** and **facial (CN VII) nerves**, causing both eyes to close, even if only one is stimulated.

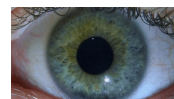


Visual Reflexes:

- **Pupillary (direct) light reflex:**

Procedure:

- Expose an eye to light and observe constriction of pupil in the same eye.



Consensual light (Indirect) reflexes:

Procedure:

- Keep one hand between the 2 eyes of the subject, and throw torch light into one eye and observe constriction of the pupil in the other eye.
- The consensual light reflex is due to **decussation** of the **optic nerve fibers in the optic chiasma** so that the impulses reach oculomotor nuclei of the two sides.



Accommodation reflex:

- This is the **ability of the eye to focus on objects at varying distances**.

How to do the test:

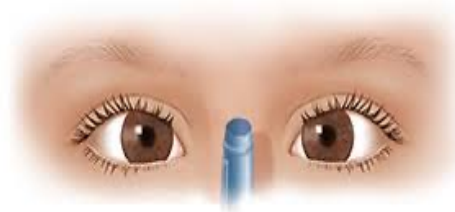
- Hold **one finger** at a distance of 25cm from the subject. Ask him to **first look at a distant object** and **then look at the finger**.



Accommodation reflex:

Accommodation consists of three associated events:

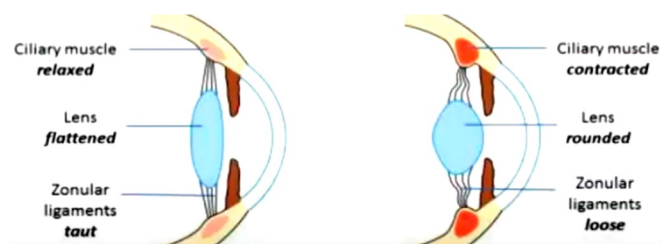
1. Eyes **converge** toward the near object.
2. Pupils **constrict**.
3. The **optical power** of the lens **is increased**.



Accommodation reflex:

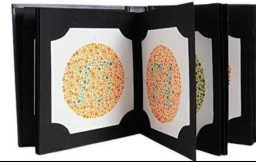
The mechanism of increased optical power of the lens includes:

- ① The **ciliary muscles** on both sides **contract**.
- ② The **suspensory (zonular) ligament** of the lens is **relaxed (loose)**.
- ③ The **anterior surface of the lens** becomes **more convex**, which **increases its focusing power**.



Color Vision:

- The Cones are responsible for perception of **Color**.
- The Rods are for the perception of intensity of **light**.
- Color vision is tested by **Ishihara's charts**.
- The charts consist of numerals constituted by dots of different colors.
- A normal person can read the numerals, whereas a color blind cannot.
- The subject (examined person) should be asked to read each plate from a distance of 75cm, within 30sec.

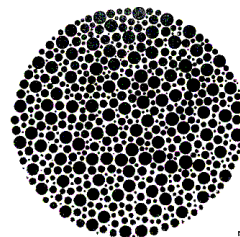


Color Vision:

- Abnormalities of color vision known as **color-blindness**.
- **Color-blindness** is common in men ~8% but much less common in women ~0.4%.
- The common abnormalities are inherited as **X-linked recessive characters** and result from absence of appropriate color genes in the **X-chromosome**.

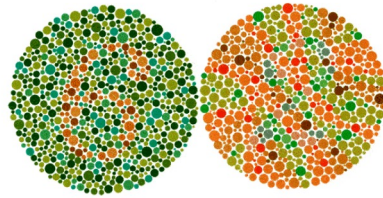
8%_{men} : 0.4%_{women}

20_{men} : 1_{women}

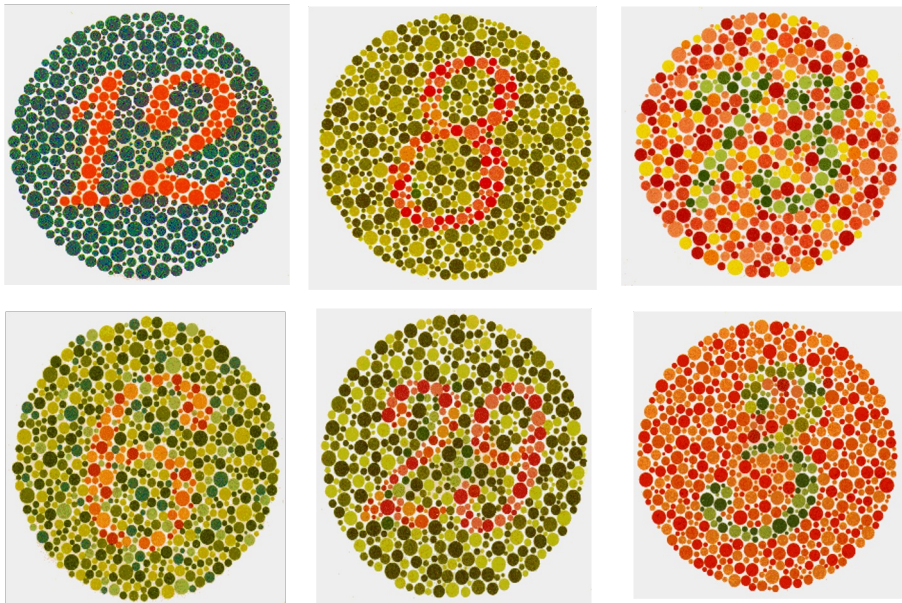


Color Vision:

- **2%** of all men are **red color** blind (**protanomaly**).
- **6%** are **green color** blind (**deuteranomaly**).
- Blindness to **blue color** (**tritanomaly**) is very rare.
- Ishihara's charts are used to test color vision.



What numbers do you see revealed in the patterns of dots below?



Questions/Comments

