Physiology practical

Neuropsychiatry block

Lecture three :

{ Visual experiment }

- **Objectives :**

➔ **Test for visual acuity :**
  - Distant vision
  - Near vision.

➔ **Test For Astigmatism.**

➔ **Test for accommodation :**
  - Determination of near point
  - SANSON-PURKINJE images

➔ **Test for color vision.**

➔ **Test for blind spot.**

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- **Recourses :**

Physiology practical boys & girls slides + Physiology practical handouts

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- **Recall informations:** (just to remind you for your better understanding) [1]

➔ **Fovea centralis:** is the place of the greatest visual acuity during daylight.
➔ **Mid-peripheral portion of the retina:** is the place of greatest visual acuity in dim light.

➔ **Myopia:** far object appear blurred. Occur if the eyeball is too long or the cornea has too much curvature. As a result the light entering the eye from a distance object isn't focused in the retina but focused on front of it. It can be corrected by concave lens.

➔ **Hypermetropia:** if the eye is smaller or the lens are weak the near vision is affected because the image from nar objec focused behind the ritana. The patient ned convex lens.

➔ **Astigmatism:** blurred vision due to the irregular shape of cornea or uneven curvature of the lens it prevent the light from focusing in the retina it occurs invision condition such as Hypermetropia and Myopia it is Treated by cylindrical lens.

➔ **Accommodation:** Focusing at near object by ciliary muscles contraction and then relaxed ligaments will increased anterior surface curvature of lens .

➔ **Trichromats:** have 3 cone pigments(normal or have slight weakness in detecting red or green or blue color)

➔ **Dichromats:** have only two cone pigments systems only so he is completely blind to red or green or blue (so they may have protanopia, deuteranopia or tritanopia) they get color by mixing only two

➔ **Monochromats:** have only one cone system or loss of all so see only black or grey or have no color perception.

➔ **Protanopia(red- blindness) :** no red cones system so person has shortened spectrum wave length, • if only weakness in red color vision is called protanomaly.

➔ **Deutranopia (green - blindness) :** no green cones system -so person see only long & short wave length) - if only weakness in green color vision is called deutranomaly.

➔ **Tritanopia (blue - blindness):** no blue cones system , if only weakness in blue color vision is called tritanomaly.

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[1] جميع المعلومات المذكورة في هذه الصفحة تم شرحها في الجزئية النظرية من المادة، اقرؤوها من باب الحيطة والمراجعة.

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- **Requirements to test vision:**

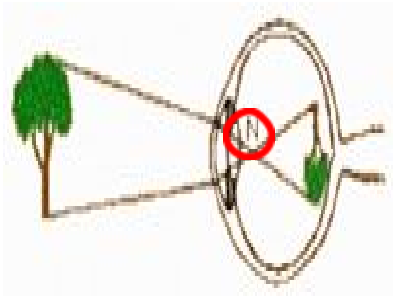
1.Snellen's chart.
2. Jaeger's chart.
3. Astigmatism chart.
4. Pins and rulers.
5. Candles and dark room.
6. Ishihara's colored plates.
7. Blind spot tester.

- **Visual acuity:**[2]

➔ It is the power to discriminate details or the shortest distance by which two lines can be separated and still perceived as two lines.

- **Depends on:**

1. Refractive ability[3] of the refractive media. mainly Cornea and lens.
2. The density of photoreceptors.
3. The visual angle



- **Visual angle:**

➔ It is the angle subtended at the nodal point by the light rays converging on the **nodal point**[4] of the eye.

➔ The average person can resolve two points and recognize their separation when the angle they subtend is **one minute** which is equal 1/60 of the degree The space on the retina is 4.5 µm or there is at least one unstimulated receptor between the two lines.[5]

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[2] Acuity means sharpness of vision, it is measured at distant or near point.

[3] Ability of eye to bend parallel rays of light coming from infinity to focus on the retina.

[4] The point that is immediately located behind the back surface of the lens.

[5] 2 lines (2 light rays) converged on the nodal point then they will make an angle of **1 minute** (1minute = وحدة لقياس الزوايا). Each degree is further divided into 60 minutes and each minute is divided into 60 seconds.

The minimum surface of retina which should be stimulated is = 4.5 µm (It is the space occupied by 3 photoreceptors, 1 receptor at the middle is not stimulated "there is at least one unstimulated receptor between 2 lines").

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1) Visual acuity test:

➔ Function of the test:

Indicate of the function of the fovea which is used for central vision.

➔ It measured:

A. Distant vision by using Snellen chart test.[6]
B. Near vision by using Jaeger's chart test.

A. Distance vision:

Done by Snellen chart test

➔ Which can be done by either:

a. Snellen alphabet chart
b. Snellen E chart (more common and prefer in clinic)

- **Procedure:**

1. Snellen chart is placed at distance = 20 feet (6 m).
➔ This distance referred to as d[7]
2. Remove eye glasses or lens.
3. Cover one of a subject (patient) eye with an eye pitch.
4. Ask the patient to read the letters of each row by beginning from the top.
5. Find out the smallest letter the patient could see.
6. Note the distance of this line which is referred to as D[8].
7. Finally Repeat the test covering the other eye.

[6] Useful for children and elderly people who cannot read.Made up of 11 lines, they decrease in size line by line.
[7] The distance from where the subject (patient) is reading the chart.
[8] The distance from which a normal subject (person) can read that line.

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• Recording results

Interpretation: visual acuity (VD) = $\frac{d}{D}$

- ❖ Reference standard VD: $\frac{20}{20}$ in case that measured by feet.[9]
- ❖ Reference standard VD: $\frac{6}{6}$ in case that measured by meter.

➔ The larger number in the bottom is the poorer vision or acuity. For example, $\frac{20}{30}$.

➔ The less number in the bottom is the better vision or acuity. For example, $\frac{20}{15}$.

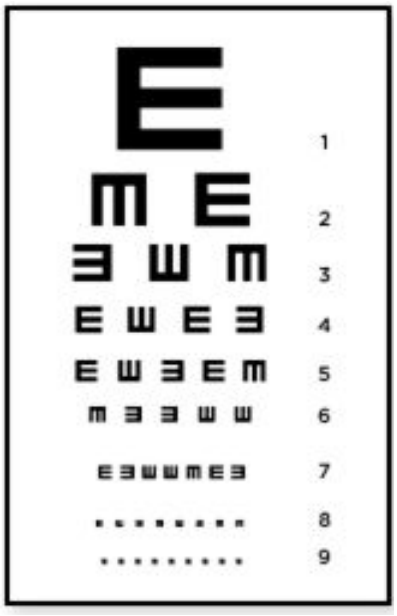
Example of Snellen's chart:

Suppose that the smallest letter that can be read by the patient (in 20 feet) is in the line which is mentioned in the chart 50 feet, then the Visual Acuity of that eye is:

(VD=$\frac{20}{50}$)

It means that the patient in 20 feet can read this line when he should be able to read it from 50 feet (normal distance vision),so his visual acuity for far vision is disturbed.

* *There is a number in each row which indicates the distance at which the normal person can read that size of letter.*



[9] *20/20 is just a reference standard, some people have better vision than this standard value.*

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B. Near vision:

➔ The near vision test is measuring your ability to read and see objects within an arm's distance from the body. This test is important to detect if you have hypermetropia or presbyopia
Done by Jaeger's chart test.

- **Procedure:**

1. Ask the subject to hold the Jaeger card at a distance of 36 cm (sometimes it's 30 depends on what is written in the card)
2. Select the test eye & cover the other eye
3. Ask him to read the smallest line or recognise the smallest picture
4. Repeat the test with the other eye

- **Interpretation:**

The jaeger type scale ranges from J1+ to J16. with J1+ being the smallest type. J1+ is considered the equivalent of 20/20 distance visual acuity at the reading distance indicated on the card 12-14 inches (30- 36 cm), so a person with normal near vision should be able to read up to this line.

➔ If he has normal near vision he should identify line JO.1+: (at 36 cm away) which is 20/20

➔ If he can only read up to the line JO.3: (in 36 cm away)
as you can see in the picture it's 20/40 (double than the normal)
So the patient doesn't have a normal near vision;
The normal person should read JO.3 line up to 72 cm. (36+36).=72 cm

➔ **A hypertropic (farsighted) person** will have better Visual acuity chart at far than at near.
Detected by Jaeger chart[10]

➔ **A myopic (nearsighted) person** will have better Visual acuity chart at near than at far.
Detected by Snellen chart[11]

[10] Myopic patients will not doing well with *Snellen chart test* so we can easily detect that they have nearsightedness.
[11] Hypermetropic patients will not doing well with *Jaeger's chart test* so we can detect that they have farsightedness.

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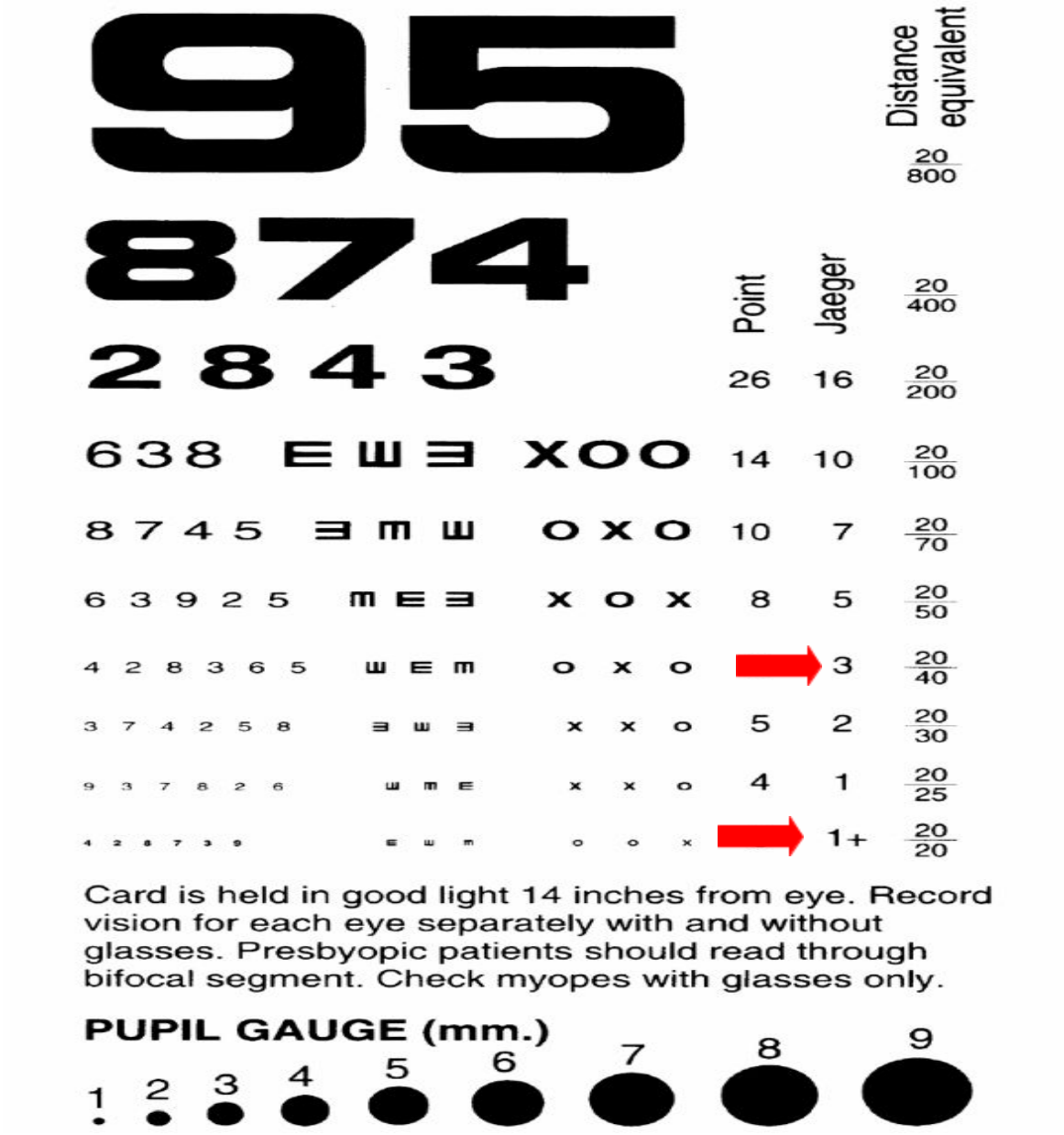

Card is held in good light 14 inches from eye. Record vision for each eye separately with and without glasses. Presbyopic patients should read through bifocal segment. Check myopes with glasses only.

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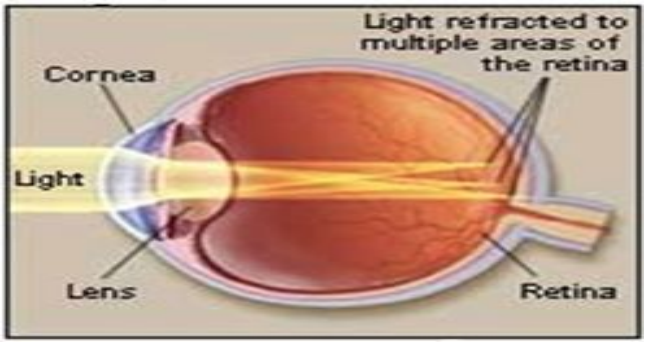
2) Test For Astigmatism :

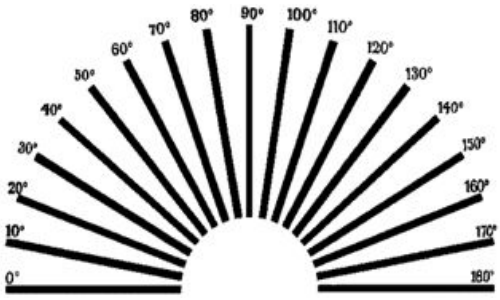
➔ **Astigmatism:**[12] irregular curvature of one or more surfaces of the cornea or lens ; So there is no distinct point of focus inside the eye, but rather smeared or spread out focus.

➔ Objects at any distance appear blurry & distorted



- **Procedure :**

1. Subject stands at 6m (20 ft) from an astigmatism chart
2. Covers one eye.
3. This chart consists of a numbers of dark lines radiating from a central point.
4. If astigmatism is present , some of the spokes appear sharp & dark ; others appear blurred and lighter.



- **Equipment: Astigmatism Chart**

[12] Astigmatism is the most common refractive error.

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3) Test for accommodation :

a. Determination of near point
b. Sanson-purkinje image

- **What is Accomodation ?**

➔ Is the process by which the refractive power of the lens is increased by increasing the curvature of the anterior surface of the lens for viewing near objects.

a) Determination of Near Point :

The distance from the eye to the nearest object that can be focused clearly.

➔ The near point of vision increase with age due to :
loss of elasticity of lens & weakening of cilliary muscles which control lens focusing
A condition called : **presbyopia**

➔ **At age 10: NP= 8cm .**

➔ **At age 70: NP= 100cm.**

- **Procedure:**

1. Place one hand over one eye.
2. Focus on a pin held at arm length.
3. Gradually bring the pin closer focusing continually until the pin begins to blur.
4. Measure the distance from the eye to the pen at the point of blurring; this is the near point of vision
5. Repeat with the other eye.

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b) sanson purkinje images:

Are reflections of objects from the structure of the eye.

They are also known as Purkinje reflexes and as Purkinje-Sanson images.
At least **four** Purkinje images are usually visible. (They mentioned only 3 in this lecture)

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The purkinje image	Befor accommodation	After accommodation
P1[13] (from cornea)	Bright, small and upright from cornea	Image does not change (corneal curvature unchanged)
P2[14] (from anterior surface of lens)	Dim, large and upright from anterior surface of lens	Image become smaller and moves toward the upright image (due to increase in curvature on anterior surface of lens)
P3[15] (from posterior surface of lens)	Small and inverted from posterior surface of lens	Changes very little (the curvature of the posterior lens surface changes very little)

- **Procedure:**

➔ **Far vision (before accommodation)**

1. the subject (patient) looks at a distant object in a dark room.
2. we place a candle light in front of and a little to the side of the subject's eye.
3. look into the subject's eye from the side opposite to the candle.
4. before accommodation, when the eye is in relaxed state, observe how many clear images of the candle light are reflected in the subject's pupillary area.
5. take note of the relative size and position of the images.

[13] **first Purkinje image (P1)** is the reflection from the outer surface of the cornea
[14] The **second Purkinje image (P2)** is the reflection from the inner surface of the cornea.
[15] The **third Purkinje image (P3)** is the reflection from the outer (posterior) surface of the lens.

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➔ **Near vision (accommodation)**

1. now ask the patient to focus on an object nearby.
2. observe the changes that are produced in the size and position and brightness of the three images (images on purkinje).

- **Conclusion :**

➔ The increased convexity occurs mainly in the ANTERIOR surface of the lens.

Errors of refraction

The error	Myopia	Hypermetropia	Astigmatism	Presbyopia
Corrected by	Concave lenses	Convex lenses	Cylindrical lenses	Bifocal lenses

4) Test for color vision:

- **Ishihara's coloured plates:**

➔ Are made up of **coloured** numbers or spots on a background of identical shaped colored spots.

➔ The figures or numbers are intentionally made up of colors that are likely to look the same as the background to an individual who is color blind.

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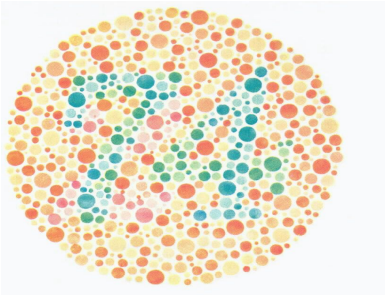
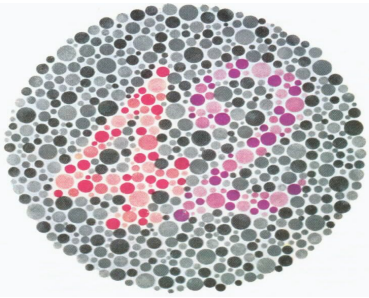
- **Procedure :**

1. select the eye to be tested and close the other eye.
2. ask the subject to read the number in several plates or ask them to trace the zigzag pathway with his index finger.
3. note if the subject has difficulty ot fails to read the number or trace the path in the plates.
4. survey all members of your group for color blindness.
5. record the data in the table provided.





5) Demonstration of blind spot:

The blind spot also know as scotoma is the place in the visual field where an object can not be seen keeping one eye closed. Its due to lights rays from the part of the visual field focus on the optic disc of the retina which lacks the light-detecting photoreceptor cells.

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The optic disc Of the retina is located medial to fovea centralis[16] and the part of retina through which the optic nerve and blood vessels pass.

Since there are no photoreceptors to detect light on the optic disc a part of the field of vision is not perceived. The brain fills in the blind spot with surrounding details and there is also informations from the other eye. so the blind spot is not normally perceived when both eyes are open.

➔ One of the most dramatic experiments to perform is the demonstration of the blind spot. The blind spot is the area on the retina without receptors that respond to light. Therefore an image that falls on this region will NOT be seen. It is in this region that the optic nerve exits the eye on its way to the brain. Video

- **Procedure:**

1. hold the card 20 inch from your face
2. cover the right eye, focus the left eye on the +
3. slowly bring the card closer until the dot disappears
4. continue to move the image closer until the dot re-appears
5. cover the left eye; focus on the dot with the right eye
6. move the image slowly closer to you and the plus should disappear.

[16] The place of greatest visual acuity during the daylight