


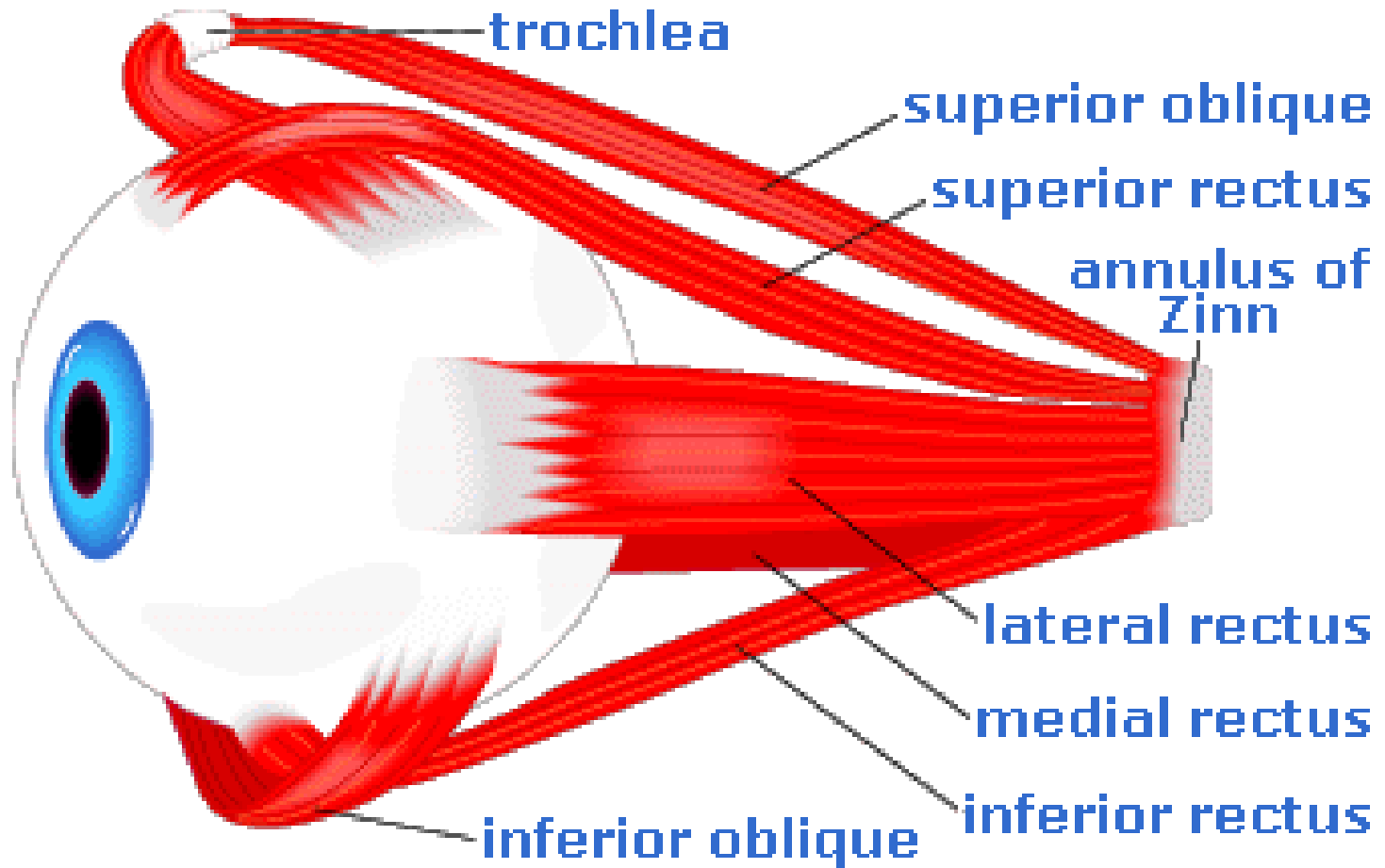
Strabismus

Done By:
Dr. Yacoub Zayadin
Dr. Ma'en Al Dabbas

Extraocular Muscles: ▶

- ▶ 1. Superior Rectus: moves the eye upwards and is innervated by the Oculomotor (CN3)
 - ▶ 2. Inferior Rectus: moves the eye downwards and is innervated by the Oculomotor (CN3)
 - ▶ 3. Medial Rectus: moves the eye medially and is innervated by the Oculomotor (CN3)
 - ▶ 4. Lateral Rectus: moves the eye laterally and is innervated by the Abducens (CN6)
 - ▶ 5. Superior Oblique: moves the eye downwards and outwards (abduction) and is innervated by Trochlear (CN4)
 - ▶ 6. Inferior Oblique: moves the eye upwards and inwards (adduction) and is innervated by Oculomotor (CN3)
- 

Extra-ocular Muscles



Normal Vision

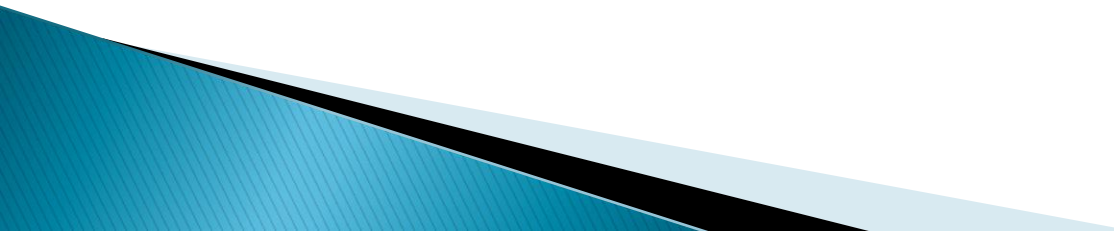
Binocular Single Vision:

It is vision in which two eyes are used together and are directed towards the same object of regard. This coordinated movement enables the image to fall on corresponding points of each retina so that they are fused centrally and are interpreted as a single image.

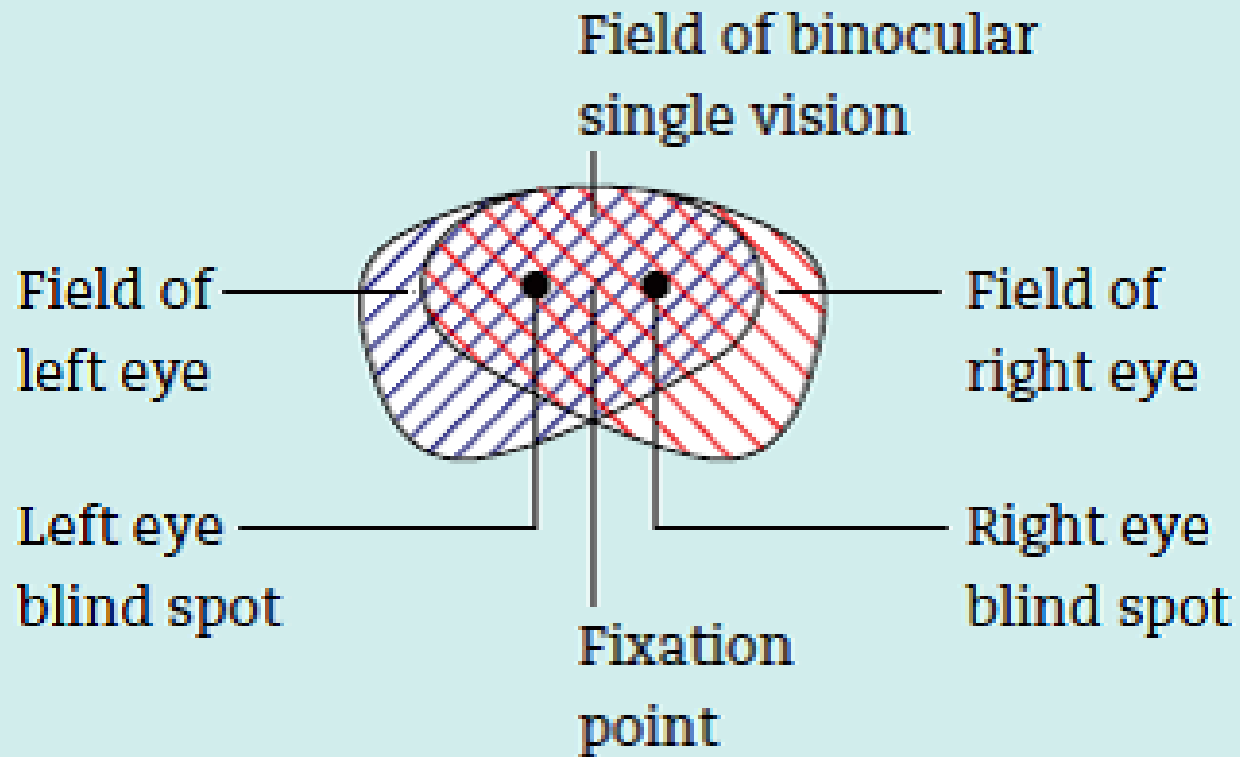
Stereopsis:

Since each eye views an object from a different angle, the retinal images do not fall on the exact same point on each retina. This gives us the ability to detect the depth of an image (i.e 3d vision). This phenomena is called stereopsis.

Advantages of normal vision

- ▶ Increase the field of vision.
 - ▶ Eliminate the blind spot.
 - ▶ Provide a binocular acuity which is greater than monocular acuity.
 - ▶ Provide depth perception.
- 

BINOCULAR VISUAL FIELD



Abnormal Vision

If the visual axis of the two eyes are not aligned (Squint), binocular vision is not possible which results in:

- ▶ Diplopia: double vision
- ▶ Visual Confusion: two separate and different object appear to be at the same point.

Strabismus

Is a condition in which the eyes are not properly aligned with each other.

It is a condition in which the visual axis of the eyes are not parallel and the eyes appear to be looking in different directions.

It is present in 3% of children.

It presents as a wandering eye, crossing eye, or poor vision.

It may be a sign of impaired visual acuity, and can be a sign of a life threatening disorder such as retinoblastoma.

Classification of Strabismus according to direction of deviation

- ▶ Convergence.....esotropia
- ▶ Inversion.....exotropia
- ▶ Upward.....hypertropia
- ▶ Downward.....hypotropia

Heterotropia: Apparent squint in a patient.

Heterophoria: Latent squint in a patient.



Strabismus



Normal



Hypotropia (eye turns down)



Hypertropia (eye turns up)



Exotropia (eye turns out)



Esotropia (eye turns in)

Classification according to Constancy

- ▶ Constant Strabismus
- ▶ Intermittent Strabismus

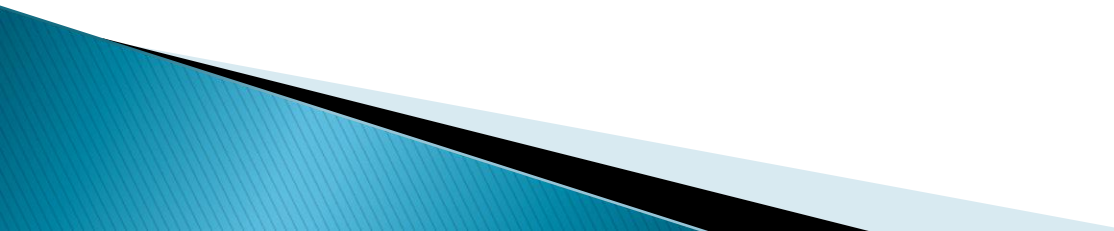
Classification of Strabismus according to cause

Paralytic Strabismus: it is strabismus caused by a disease in any of the cranial nerves supplying the extraocular muscles (CN3, CN4, CN6), or the extraocular muscles themselves.

Non-Paralytic Strabismus: it is strabismus in an otherwise normal eye. It is thought to be caused by an abnormality in the central coordination of eye movements.

Paralytic Strabismus

Clinical Features:

- ▶ Mostly in adults, acquired.
 - ▶ Present mainly with diplopia.
 - ▶ Greatest deviation in field of action of the weakened muscle.
 - ▶ Visual acuity is usually unaffected in either eye, unless CN II is involved.
- 

Causes

1– Cranial nerve palsy, for example

- *in diabetic autonomic neuropathy

- *tumor pressure

- *trauma

2– Muscular like in:

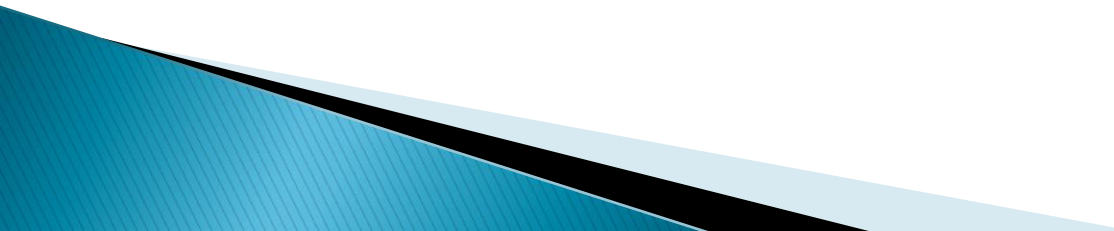
- *myasthenia gravis

- * thyroid disease

- *ocular myopathy

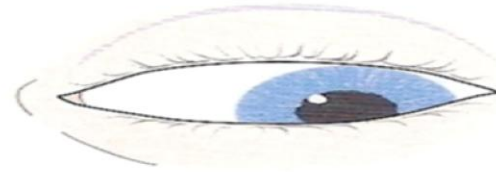
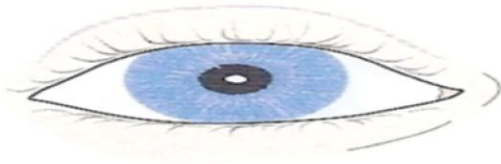
3– Acquired, like in a fracture and the bone entraps the muscles.

Cranial Nerve Palsy

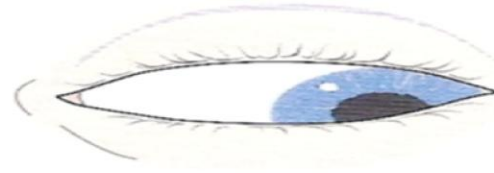
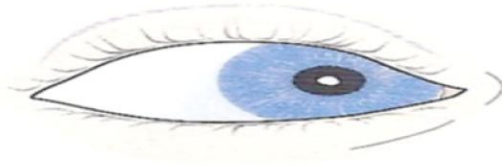
- ▶ Strabismus presents according to the nerve affected.
 - ▶ Each nerve may be affected at any point along its course.
 - ▶ In most cases there is no complete loss of activity of a muscle but partial loss.
- 

Third Nerve Palsy

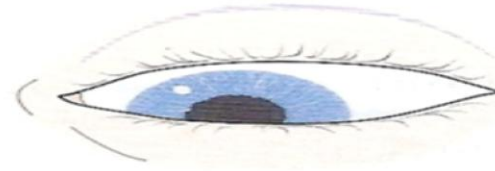
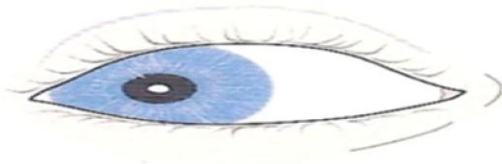
- ▶ A complete third nerve palsy will result in a characteristic down and out position in the affected eye.
- ▶ The affected individual will also have ptosis and dilated pupil in the affected eye.
- ▶ Causes:
 - ▶ Congenital Oculomotor Palsy
 - ▶ Acquired Oculomotor Palsy: (eg, Vascular disorder, tumor, inflammation, trauma...)



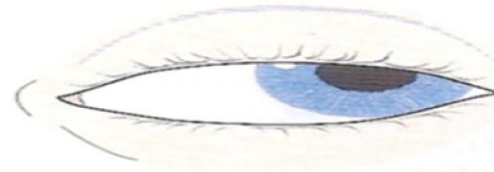
Primary position



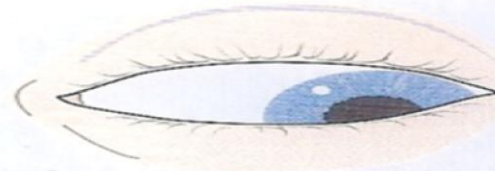
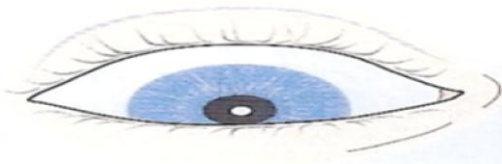
Left gaze



Right gaze



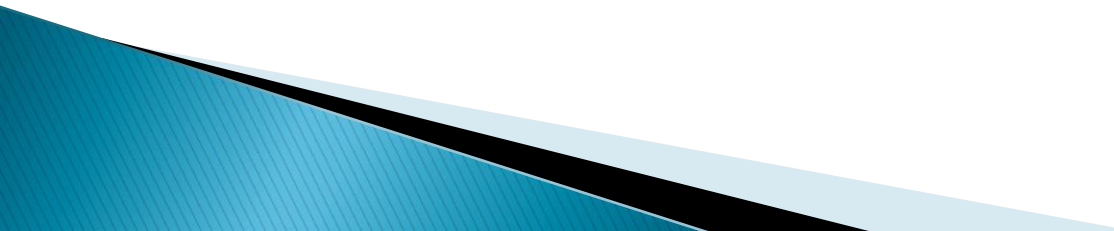
Upgaze



Downgaze


(a)

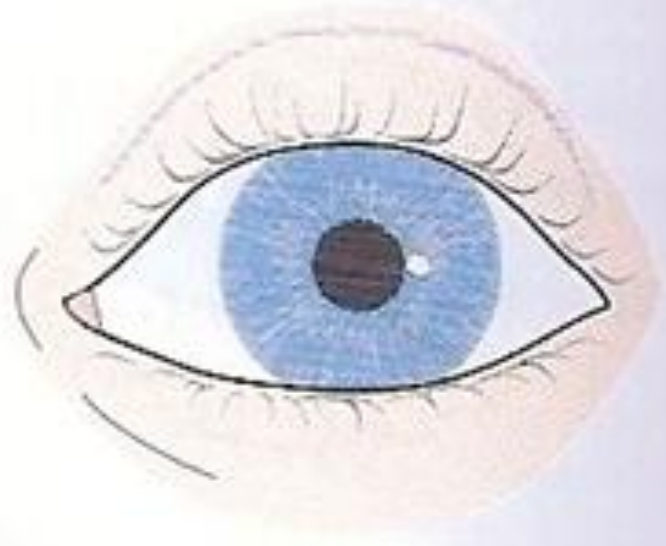
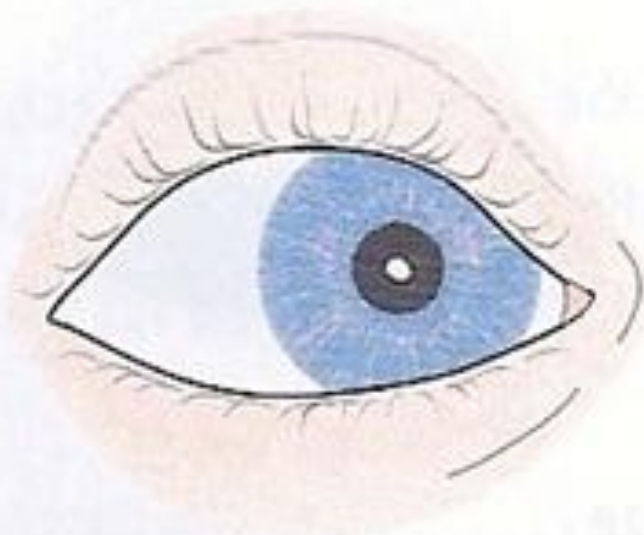
Fourth Nerve Palsy

- ▶ Causes paralyse of the superior oblique muscle.
 - ▶ The defect is maximal when the patient tries to look downwards and outwards.
 - ▶ Causes vertical diplopia in which there are 2 visual fields separated vertically.
 - ▶ The most common cause of acute fourth nerve palsy is head trauma.
- 



Sixth Nerve Palsy

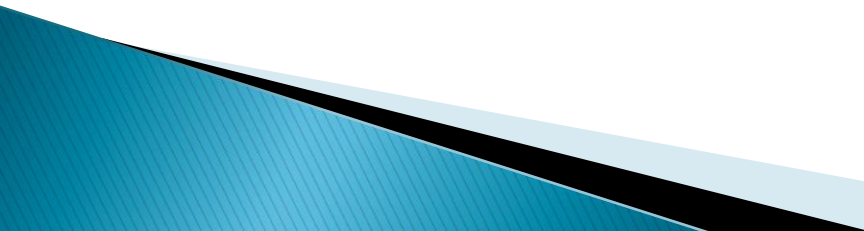
- ▶ Causes paralyse of the lateral rectus muscle.
 - ▶ The affected individual will have an esotropia or “convergent squint” on distance fixation.
 - ▶ Happens usually unilaterally.
 - ▶ Patient may suffer from horizontal diplopia in which there are 2 visual fields separated horizontally.
 - ▶ In the long term it can lead to a lack of appropriate development of the visual cortex giving rise to permanent visual loss.
 - ▶ It is the most common isolated nerve palsy
- 



(c)

Left gaze

Non-paralytic Strabismus

- ▶ Concomitant strabismus (deviation is equal in all directions of gaze).
 - ▶ No restriction in range of eye movements.
 - ▶ Could be: monocular, alternating or intermittent.
 - ▶ Usually begins in infancy, up to 8–10 yrs.
 - ▶ No diplopia.
- 

Cause:

Congenital (family history in 60% of patients)

Associated ocular disease:

- ▶ Refractive Error: most common.
- ▶ Opacities in the media of the eye (cornea, lens).
- ▶ Abnormalities of the retina preventing the translation of a correctly formed image into neural impulses.
- ▶ In a child with equal degree of hypermetropia in both eyes a convergent squint may develop due to increased accommodative effort required to focus on a distant, and particularly near object.

Pathophysiology

- ▶ Deviation of the visual axis of the deviating eye causes objects to be projected to non-corresponding points on the retina. One would expect these patients suffer from constant double vision because the left and right eyes supply different information to the brain but a central inhibiting mechanism suppresses the visual stimuli from the deviating eye.
- ▶ So instead of seeing two different images or double vision (diplopia), the brain suppresses the blurrier image. The inhibition process (suppression) can result in a permanent decrease in the vision in the blurry eye that can not be corrected with glasses, lenses, or lasik surgery. This will lead to Amblyopia.

▶ **Accommodative**

Normal response to approaching object is the triad of the near reflex: convergence, accommodation and miosis.

Hypermetropes must constantly accommodate (excessive accommodation may lead to esotropia)

Average age of onset is 2.5 years.

Usually reversible with correction of the refractive error.

▶ **Non accommodative**

Accounts for 50% of childhood strabismus

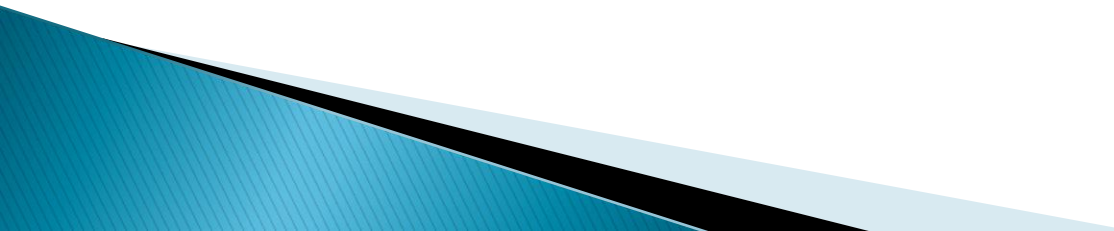
Most are idiopathic

May be due to monocular visual impairment (cataract, corneal scarring, retinoblastoma) or divergence insufficiency.



Diagnosis

Strabismus Testing:

- ▶ Corneal inspection
 - ▶ Hirschberg corneal light reflex test
 - ▶ Cover–uncover test
- 

Corneal Inspection

- ▶ Be careful as a wide nasal bridge, epicanthal folds, or an eyelid abnormality may falsely convey the impression of ocular misalignment.
- ▶ Have the patient look at the six positions of gaze.

Hirschberg corneal light reflex

- ▶ Or just Hirschberg test.
- ▶ A screening test that can be used to assess whether a person has strabismus (ocular misalignment).
- ▶ Objective assessment of ocular alignment.
- ▶ Indications: Differentiate true deviation from pseudostrabismus. In uncooperative child or newborn, it is the only test of alignment.
- ▶ Normally the light is reflected on each cornea symmetrically and in the same position relative to the pupil and visual axis on each side.

Technique:

- ▶ It is performed by shining a light (33cm distance with a pen torch) in the person's eyes and observing where the light reflects off the corneas.
- ▶ In a person with normal ocular alignment the light lands on the centre of both corneas.
- ▶ For an abnormal result, based on where the light lands on the cornea, the examiner can detect if there is an exotropia, etc.
- ▶ Question: what is the type of squint seen in the next example?

Example



Answer:

- ▶ **Positive Hirschberg sign:** the light falls on the centre of the right pupil, but is medial to the centre of the left pupil; therefore, the person in the picture has an exotropia in the left eye.

Cover Test

Indication: testing for esotropia/exotropia.

Technique:

1. Child fixates on a point e.g. light or small toy.
2. Cover one eye and observe movement of uncovered eye.
3. Cover other eye and repeat test.

How to interpret???

Normal: uncovered eye maintains current position

Exotropia/divergent squint: Eye moves inward to pick up fixation

Esotropia/convergent squint: Eye moves outward to pick up fixation



- ▶ Beware of false positives due to inattention of child.
- ▶ Repeat test if unsure to prevent unnecessary work ups.

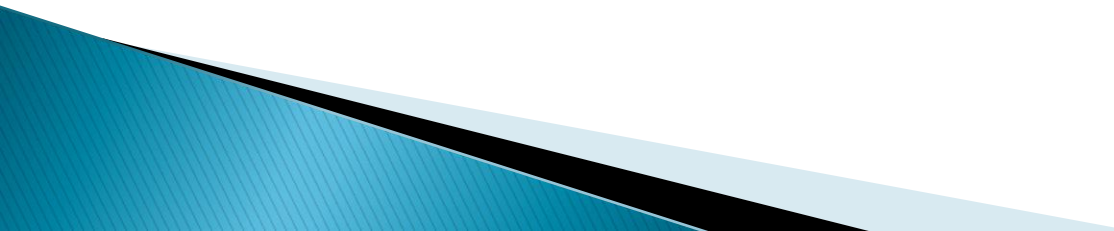
Prognosis

- ▶ When strabismus is congenital or develops in infancy, it can cause amblyopia, in which the brain ignores input from the deviated eye. The appearance of strabismus may also be a cosmetic problem. One study reported that 85% of adult strabismus patients "reported that they had problems with work, school and sports because of their strabismus." The same study also reported that 70% said strabismus "had a negative effect on their self-image."

Amblyopia

- ▶ Amblyopia, also known as lazy eye, is a disorder of the visual system that is characterized by a vision deficiency in an eye that is otherwise physically normal eye.
- ▶ It has been estimated to affect 1-5% of the population.
- ▶ Amblyopia means that visual stimulation either fails to transmit or is poorly transmitted through the optic nerve to the brain for a continuous period of time. It can also occur when the brain "turns off" the visual processing of one eye, to prevent double-vision, for example in strabismus (crossed-eyes). It often occurs during early childhood, resulting in poor or blurry vision.

Amblyopia continued...

- ▶ Detecting the condition in early childhood increases the chance of successful treatment, especially if detected before the age of five.
 - ▶ The earlier it is detected, and the underlying cause corrected with spectacles and/or surgery, the more successful the treatment in equalizing vision between the two eyes.
- 

Types of Amblyopia

- ▶ **Strabismic amblyopia:** This occurs due to suppression of the visual images of one of the eyes in a strabismic patient, thus interrupting normal development of the brain causing one eye to be weaker than the other.
- ▶ **Refractive amblyopia:** Refractive amblyopia may result from anisometropia (unequal refractive error between the two eyes). The eye which provides the brain with a clearer image typically becomes the dominant eye. The image in the other eye is blurred, which results in abnormal development of one half of the visual system.

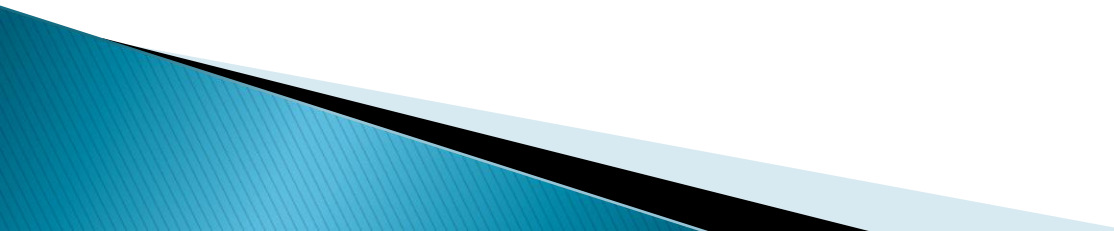
Types of Amblyopia continued...

- ▶ **Form-deprivation and occlusion amblyopia:** Form-deprivation amblyopia results when the ocular media become opaque, such as is the case with cataracts or corneal scarring from forceps injuries during birth. These opacities prevent adequate visual input from reaching the eye, and therefore disrupt development.

TREATMENT

A non-paralytic squint with no associated ocular disease is treated as follows:

- Any significant refractive error is first corrected with glasses.
- If amblyopia is present and the vision does not improve with glasses the better seeing eye is patched to try and stimulate the amblyopic eye thereby increasing its visual acuity.

- ▶ Prevention is the best medicine
 - ▶ Treatment rarely successful after age 8–10 years, but trial should be given despite the age
 - ▶ Prognosis : 90% will have good vision & maintained if treated < 4 years old
 - ▶ Early recognition and treatment of amblyopia in children can help to prevent permanent visual deficits.
- 

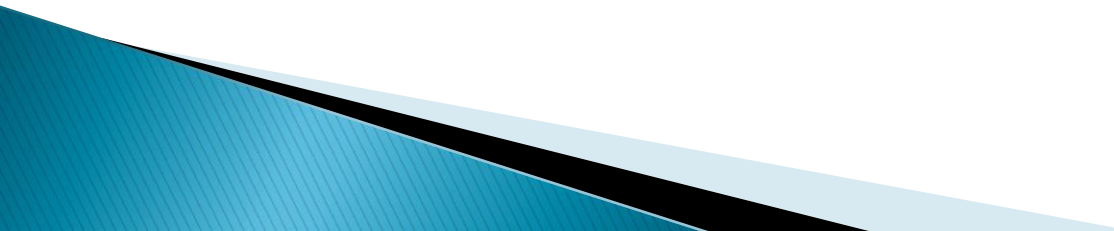
Surgery: surgery procedures is done in cases of strabismus (in order to force the eyes into alignment). In cases of cataract or other causes of blockage of the cornea surgery is needed.

Procedure: either:

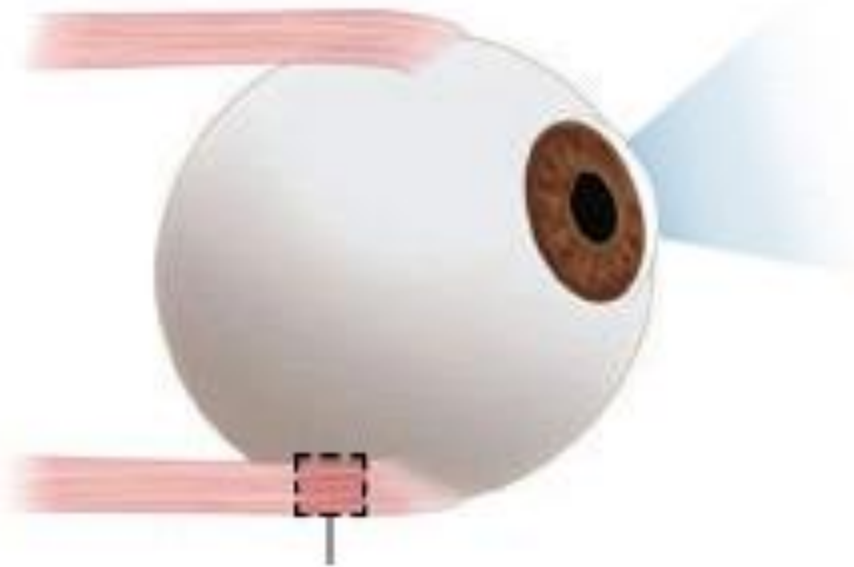
- ▶ Recession (weakening) : moving muscle insertion further back on the globe
- ▶ Resection(strengthening) : shortening the muscle

Patching(occlusion therapy): covering the good eye which force the patient to use the amblyopic eye. This make the weaker eye more stronger by more use.

- ▶ Botulinum toxin could be used for single muscle weakening.

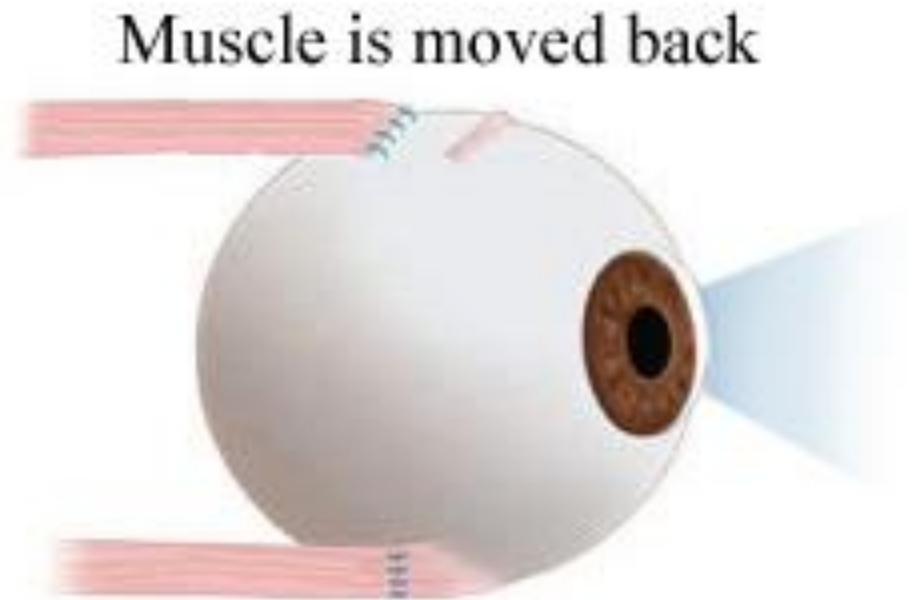
- ▶ The principle of surgery is to realign the eyes by adjusting the position of the muscles on the globe or by shortening the muscle. Access to the muscles is gained by making a small incision in the conjunctiva.
 - ▶ Moving the muscle insertion backwards on the globe (recession) weakens the muscle.
 - ▶ Removing a segment of the muscle (resection) strengthens the action.
- 

Before



Section of eye muscle
to be removed

After



Before Eye Muscle Surgery



After Eye Muscle Surgery



Thank You

