



Strabismus, Amblyopia & Leukocoria

[**Color index:** **Important** | Notes: **F1**, **F2** | Extra] [EDITING FILE](#)

Objectives:

➤ Not given.

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Resources: Slides + Notes + 434 team.

NOTE: F1& F2 doctors are different, the doctor who gave F2 said she is in the exam committee so focus on her notes

Amblyopia

- **Definition**

Decrease in visual acuity of one eye without the presence of an organic cause that explains that decrease in visual acuity. **He never complains of anything and his family never noticed any abnormalities**

- **Incidence**

The most common cause of visual loss under 20 years of life (2-4% of the general population)

- **How?**

Cortical ignorance of one eye. **This will end up having a lazy eye**

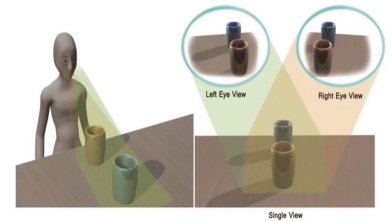
- **binocular vision**

It is achieved by the use of the two eyes together so that separate and slightly dissimilar images arising in each eye are appreciated as a single image by the process of fusion.

It's importance 1. Stereopsis 2. Larger field

If there is no coordination between the two eyes the person will have double vision and confusion so as a compensatory mechanism for double vision the brain will cause suppression.

The visual pathway is a plastic system that continues to develop during childhood until around 6-9 years of age. During this time, the wiring between the retina and visual cortex is still developing. Any visual problem during this critical period, such as a refractive error or strabismus can mess up this developmental wiring, resulting in permanent visual loss that can't be fixed by any corrective means when they are older



Why fusion may fail ?

1. significant anisometropia. **Most common cause**
2. significant aniseikonia (difference in image size)
3. Strabismus. **2nd common cause**
4. Higher cortical problems (head trauma, alcohol intake , drugs) **rare in children**

- **Diagnostic criteria**

The only way to discover lazy eye is to take your child to an ophthalmologist

- VA <20/40 OU (Latin term oculus uterque=both eyes) or in one eye.
- Family history
- History of visual deprivation during infancy

- **Classification**

1- Strabismic

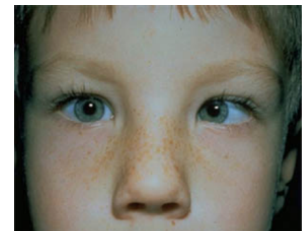
More details at the end of the lecture!



Alternating esotropia
this child is lucky he will not develop amblyopia
but we have to treat this child by surgery



Intermittent Exotropia
in the first picture the child looks fine but in the
second picture there is exotropia
this child will not have amblyopia
when it is fixed the child will develop amblyopia



Esometropia (the most common cause of
esometropia is Hypermetropia)

2- Deprivation amblyopia

Results in more severe visual impairment than strabismic or refractive amblyopia



Congenital cataract
That's why we have to treat it in the first 3 months of life



the cornea is sutured because of trauma
so this child developed cataract



Congenital ptosis
we have to do lid surgery otherwise
he will develop amblyopia



Capillary hemangioma
it is treated with beta-blockers



Corneal infection (abscess in the cornea)
he took 2 months to respond to treatment
so during this 2 months he developed amblyopia



3- Anisometropic amblyopia

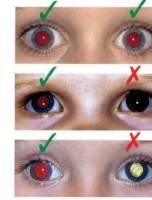
- Also called (Refractive amblyopia)
- The most common cause of amblyopia in children is difference in refraction more common with hypermetropic anisometropia
- For hypermetropia 1.5 diopter difference will cause amblyopia but for myopia 3 diopter difference will cause amblyopia

Treatment of amblyopia

1. Treat the cause of amblyopia:
correct the refractive error (optical correction), remove the media opacity surgically
2. The younger the child, the better out come of amblyopia therapy
3. The first five years of child age is the sensitive period where amblyopia can be reversed after that it become more difficult
4. Occlusive therapy (PTO: part time occlusion) patch the good eye for 3 hours daily
5. Defocusing (penalization: optically by adding +3 to +5 lens on top of full cycloplegic refraction (atropine every 1-3/7 in good eye)).
انتبهوا مره سألناهم عنها وما عرفوا يجاوبون نسويها اذا المريض رفض يحط باتش, ايش نسوي؟ نحط قطرات. سايكلوبليجك بالعين السليمه فتصير الرؤيه فيها مغبشه فكذا ينجر انه يناظر بالعين الثانيه

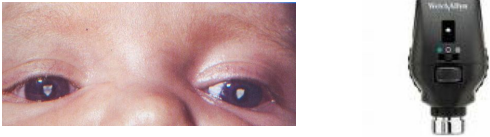
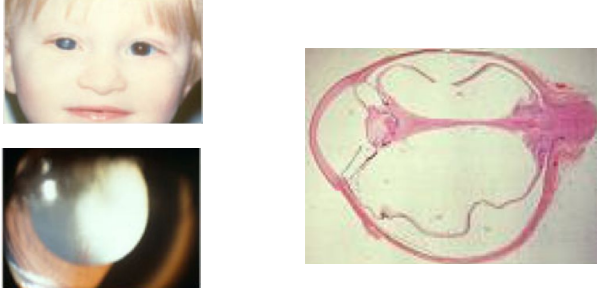
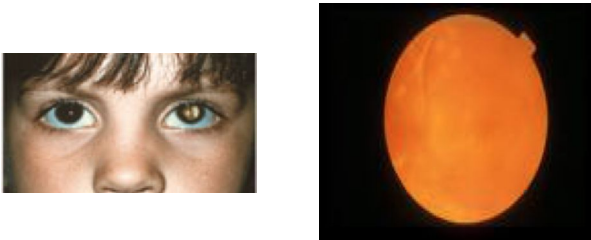
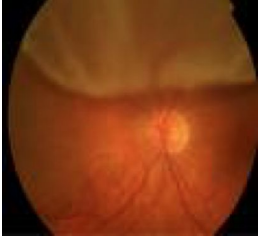
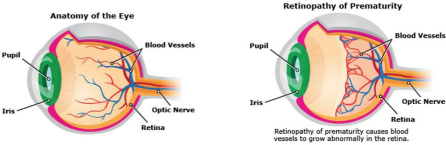
Leukocoria [EXAM]

- **Definition:** White opacity of the pupil
- If there is opacity and you can't examine the fundus you have to do ultrasound
- The red reflex comes from the retinal pigmented layer
- If you have any problem in the eye starting from cornea, anterior chamber, lense, vitreous and retina you will have Leukocoria



- Normal reflex → No action required
- Red reflex absent → See your GP urgently
- Red reflex abnormal → See your GP urgently

اقولكم ايها من الحين 100% لو كوكوريا بتجي بالإختبار بيطلب منك تعريفها وهاتي 3 اسباب لها *ساك والله اعلم*

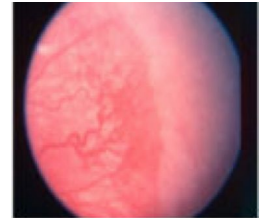
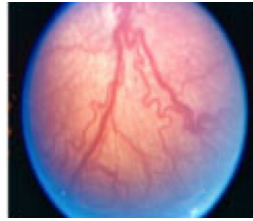
Cause	Description
<p>Cataract can be congenital or acquired, usually causes blurred vision and glare Use the ophthalmoscope to see the red reflex</p>	
<p>Persistent hyperplastic primary vitreous is a congenital condition caused by failure of the normal regression of the primary vitreous. It is usually associated with unilateral vision loss There is a connection between the optic disc and the lens during development and this connection used to supply blood vessels to the lens and it should go away this will cause:</p> <ol style="list-style-type: none"> 1. Leukocoria 2. The globe will shrink (Small eye compared to the other) 	
<p>Organized vitreous hemorrhage is usually secondary to a neovascular membrane or to a retinal tear. Patients may complain of a red haze, blurred vision, or floaters. As it starts to resolve, color changes to yellow then white and some fibrous sheets may persist. A B-scan (Brightness scan) is usually diagnostic and vitrectomy is usually required The most common cause of vitreous hemorrhage in babies is birth trauma</p>	
<p>Retinal detachment risk factors include trauma and surgery, vitreous detachment, high myopia, retinal breaks or tears, retinal vascular disease, and history of detachment in the other eye. symptoms include flashes of light, floaters, curtain-like decrease in vision The retina is composed of many layers, the neuro-sensory retina will be separated from the retinal pigmented epithelium so you will not see the color of the retinal pigmented epithelium this will result in white opacity if it is big enough it will give you leukocoria</p>	
<p>Retinopathy of prematurity occurs in premature, low-birth-weight infants maintained on oxygen therapy. Signs include neovascularization, fibrous bands, retinal detachments and vitreous hemorrhage.</p>	

When advanced leukocoria can be present

Prematurity in ophthalmology means that the child weight is 1.5 kg or less and the GA is 25 weeks or less

The retina does not have enough time to have complete blood supply (the vessels will keep growing during pregnancy until 37 week) so ischemia will occur and the body react to ischemia by formation of new blood vessels but these vessels are fragile so they will bleed and when they bleed they cause fibrosis and fibrosis will pull the retina and causes detachment

The treatment is easy just go and kill this demand by burning the retina by laser to save the fovea and macula and definitely the visual field of this child will be affected



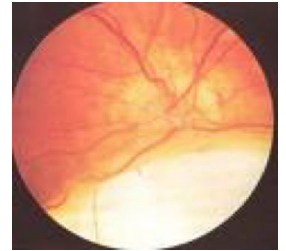
Coloboma congenital condition caused by incomplete closure of the fetal fissure. Degree of visual loss to area affected (iris, retina, choroid, or optic nerve head)

The child is born without retina and retinal blood vessels are also absent just sclera

Does coloboma causes problems? It depends if the macula and fovea are involved this will result in poor vision if it happens away from the macula and fovea the effect will be less

Coloboma can affect the iris as well and will result in "keyhole" or "Cat eye" appearance

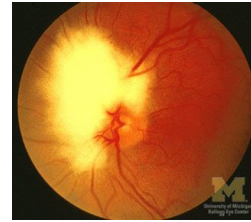
In funduscopy we see the sclera (white area)



Medullated nerve fibers congenital anomaly caused by myelination of the retinal nerve fibers and usually asymptomatic. When large areas are involved it can cause leukocoria

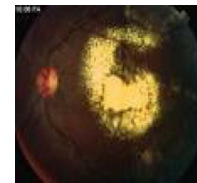
In the retina the nerve fibers are not myelinated to allow the passage of light

"Cat fur appearance"



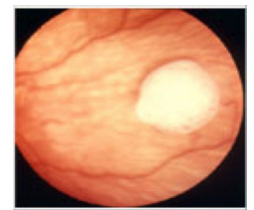
Coat's disease typically a unilateral condition found in young boys. It is characterized by retinal telangiectasia and aneurysms that may cause exudative retinal detachment

If we discover it early we can go and close the blood vessels by laser, the diagnosis is not by examining the retina only we inject the fluorescein stain



Retinoblastoma most common primary, malignant, intraocular tumor of childhood but still a rare tumor. Vast majority become apparent before age of 3yrs. It results from malignant transformation of primitive retinal cells before final differentiation. Presentation is most commonly (60%) with leukocoria and strabismus

When you see Leukocoria always assume that this child is having retinoblastoma until proven otherwise (You should send the patient for B-scan ultrasound)



Strabismus

- **Ocular misalignment due to extraocular muscle imbalance**
 - **Strabismus occurs in approximately 3% of children under 3 years of age**
 - **Males and females equally affected**
- Strabismus is bad not only because of cosmesis it is related to amblyopia

- Tropia: الحول واضح ينشأ misalignment that is always there, even when both eyes are open and attempting to work together. Large angle deviations are obvious. If small angle, you can detect it with the Cover-Uncover test.
- Phoria: الحول موب واضح مايبين لك الا من الاقزامنيشن misalignment that only occurs some of the time, usually under conditions of stress, illness, fatigue or when binocular vision is interrupted i.e. when the two eyes are no longer looking at the same object such as when the synchronization between the eyes is broken by covering one eye. You can “break fusion” using the Cross-Cover test.

● Causes:

- **Inherited** pattern (Most patients fall under this category, so it is important to ask about family history)
- **Idiopathic**
- **Neurological** conditions (cerebral palsy, hydrocephalus & brain tumors).
- **Down syndrome**
- A **congenital** cataract, eye tumor

● Tests for deviation (how to test strabismus): F2 notes!

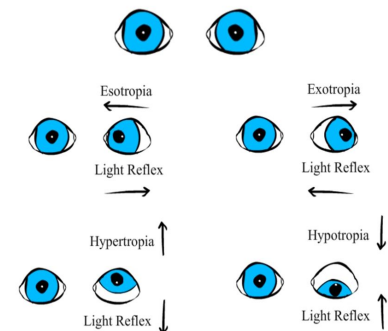
1- Hirschberg test (Corneal light reflex) please know how to do it very well because you will have it in the **osce**
 A test used to assess alignment of the eyes by shining a light in the person's eyes “1 meter away” and observing where the light reflects off the corneas. **Every millimeter the corneal light reflex is off center, equals approximately 15 diopters of prism or 7 degrees** مهمه هالنتظه احفظوها

Note: roughly if corneal reflex is:

- At the pupil edge = 30 PD (15°)
- Midway between pupil and limbus = 60 PD (30°)
- At the limbus = 90 PD (45°)

When the corneal reflex is:

- in the center we call it orthoptic and that's the normal case.
- Light is shifted temporally or laterally → esotropia (inward deviation).
- Light shifted nasally → exotropia (outward deviation).



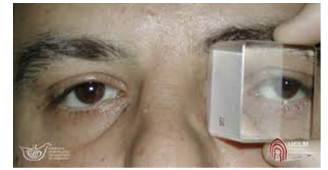
Top picture: Orthophoria (normal)
 Middle picture: Esotropia ~30 PD (pupil edge)
 Bottom picture: Esotropia ~90 PD (limbus)



Esotropia (inward deviation) light is shifted temporally

2- Krimsky test

The Krimsky test is essentially the same as Hirschberg test, except that we quantitate it better by using a prism. The prism is placed in front of the deviating eye and is used to move the light (corneal) reflex to the center of the pupil. The apex of the prism is directed towards the direction of deviation i.e. laterally if exotropic and medially if esotropic.

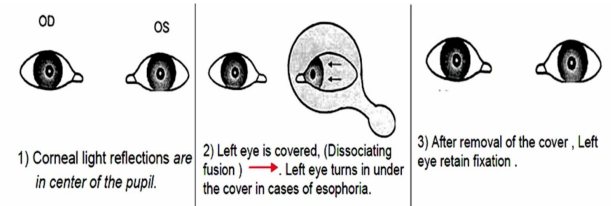


Krimsky test

3- Cover test (most important test) Watch this [video](#) and you'll understand everything!

There are 2 types of cover tests:

- **Unilateral** cover test (cover-uncover test): performed by having the patient focus on an object then covering the fixating eye and observing the movement of the other eye. If the eye was exotropic, covering the fixating eye will cause an inwards movement; and esotropic if covering the fixating eye will cause an outwards movement. It is used to **detect tropias**.
- **Alternating** cover test (cross-cover test): performed by moving the occluder from one eye to the other eye. Normally, the covered eye shouldn't move when the occluder is removed. It is the most accurate way to pick up subtle **phorias and tropias** since it breaks binocular vision.

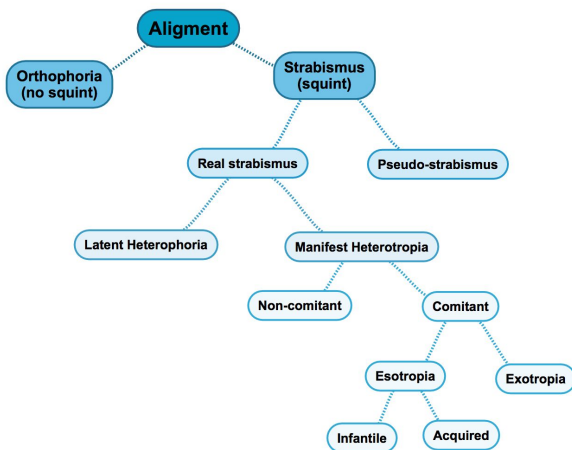


Cover - Uncover test In heterophoria.

EXAM دائما يسألون عنها بالاختبار

- ★ cover-uncover test → detect tropias
- ★ cross-cover test → detect phorias and tropias

• Classification:



Comitant (XT or ET)	Non-comitant (XT or ET)
Angle: almost the same in any direction of gaze (within 10 PD range)	Angle: changes with direction of gaze (Paretic as in 6th and 3rd nerve palsy, restrictive as in thyroid disease)
Comitant strabismus ET20 ET 25 ET30 ET25 ET30	Non-comitant strabismus ET 20 ET 10 ET 12 ET40 ET18

Comitant: The angle of deviation has not changed whether the child looks up, down, left and right

Incomitant: Diabetes is usually associated with 6th nerve palsy, when the patient looks at you he looks normal you will notice that the patient has problem when he looks to the action of the paralyzed muscle (Occurs in certain gazes)[doctor said: forget about the incomitant type, it's not our topic today]



He is looking to the left
The right eye is working
But the lateral rectus is the left eye is not working
Probably he is having 6th nerve palsy
(non-comitant or paralytic strabismus)



Classical picture of right third nerve palsy
1. ptosis
2. Large exotropia

● **Infantile esotropia:**

- Is the inward deviation of the eyes noted before the patient reaches age 6 months (we don't say congenital because congenital means the child is born with this problem but here the child is born normally but in the first 6 months he developed esotropia)
- When the eyes are misaligned in childhood, binocular vision, or the ability of the brain to use the two eyes together, does not develop.
- Classic infantile esotropia is constant and involves a large angle of deviation exceeding 20 prism diopters (PD) on corneal light reflex measurement (we measure the deviation using the prism)
- **Infantile esotropia may be associated with a spectrum of clinical presentations, including: amblyopia, impaired binocularity**(impaired 3D vision "stereopsis"), central scotomas, **Cross fixation** (is the use of the right eye to view the left visual field and the use of the left eye to view the right VF), **DVD**(dissociated vertical deviation, in cover test: when u cover the eye then uncover it the eye will move up and down), **latent nystagmus**, and **inferior oblique overaction(IOOA)**(when looking up and in the eye will ان يرتفع مره لدرجة ان العدسه كلها تدخل لجوالا)



Alternating esotropia
So this child will not have amblyopia



Right esotropia



Left esotropia

Management of infantile esotropia:

1. Treat the amblyopia by occluding the good eye.
2. **ALWAYS** Surgery for the extra-ocular muscles **الحوال هنا مستحيل يروح بدون جراحه** (we go to the medial rectus and we detach it and then suture it backward by suturing the muscle backward we make it redundant according to severity of the strabismus the more severe the more we go back and this procedure is called recession) **surgery should be done at age of 10 to 11 months to achieve the binocular single vision**
the doctor said u don't have to know how it performed

Ophthobook

Treatment of strabismus Before taking anyone to surgery, correct all the non-surgical causes of strabismus: check for refractive error and treat any amblyopia. Many cases of strabismus will improve or resolve by just doing these things. Eye surgery consists of shortening or relaxing the extraocular muscles that attach to the globe to straighten the eye.

Strabismus surgery: To correct simple esotropias (cross-eyed) or exotropias (wall-eyed) we can weaken or strengthen the horizontal rectus muscles. A recession procedure involves disinserting the rectus muscle and reattaching the muscle to the globe in a more posterior position. This effectively weakens the action of this muscle and turns the eye accordingly.

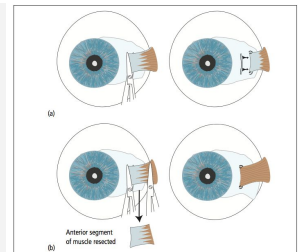


Figure 15.8 The principles of squint surgery. (a) Recession. The conjunctiva has been retracted to expose the medial rectus muscle. The muscle is then dissected and moved backwards on the globe. (b) Resection. Following exposure of the muscle the anterior tendon and muscle are resected, thus shortening them; the muscle is then reattached to its original position.

CASE: could come in the exam **(MCQ)**

A 4-month-old healthy child presents with a history of his eyes turning in most of the time, since about 8 weeks of age. How to approach this child:

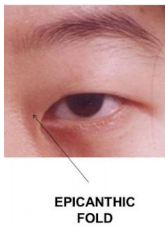
1. **history taking:** family history, born at which week of gestation, mode of delivery
2. **examination:**

- Check the visual acuity, how to check the visual acuity in infant? fix and follow (following an object), CSM test "Central (no deviation) Steady (no nystagmus) Maintained (if u remove the cover can he maintained his eye in the center)".
- Check the extraocular movement: to rule out paralytic 6th nerve palsy, how to check? spinning **دور راسه اذا طبيعي عينه بتتاظر على** يرى باتجاه دوران الراس
- Check the amount of deviation: Hirschberg test, Krimsky test
- Check the refraction: cycloplegia is achieved by dilated drop called cyclopentolate (0.5% if child age less than 1, 1% if ≥ 1yo)
- Check for the associations that we just mentioned above: cross fixation, DVD, IOOA, and latent nystagmus
- Fundus exam: to check the optic nerve and retinal

- **Pseudostrabismus:**

Is a condition in which alignment of the eyes is straight (also known as orthotropic) however, they appear to be crossed.

This condition most commonly occurs in infants when a flat nasal bridge and prominent epicanthal folds tend to obscure the nasal portion of the sclera



EPICANTHIC FOLD

- **Accommodative esotropia(very common):**

- Acquired after 6 months of age usually around 2 years
- Associated with **hyperopia** (Children with hyperopia will accommodate to see clearly and if he accommodate more he will converge more. In case of myopia it tends to produce exotropia due to lack of accommodation)
- Perform cycloplegic refraction on all children by using the retinoscope and loose lenses. Cycloplegia is achieved with Mydracyl 1% and cyclogel 1%. (Cycloplegia will paralyze the accommodation and will give us the exact amount of refractive error)
- Refractive error usually from **+3 to +4** (not everyone with hyperopia will develop esotropia but they said that is more with clever children because they are interested to know the details of everything)
- May precipitated by acute illness or trauma
- Start intermittent and if not treated become constant
- Refractive error correction by **glasses** will treat the condition **FULLY** (<10PD residual near and distance)(If the farsighted glasses control the crossing of the eyes, eye muscle surgery is never recommended)



- **Partial Accommodative Esotropia: F2 slides only!**

- >10 PD residual for D+N(near and distance)with full hypermetropic correction.
- Treatment :Surgery for the **residual** deviation(do surgery for the part which not corrected by glasses فيجد الجراحه بيظل يلبس نظاره)

- **High AC/A ratio ET: F2 slides only!**

- **First what do we mean by AC/A ratio?** The accommodative convergence/accommodation (AC/A) ratio gives the relationship between the amount of convergence (in-turning of the eyes) that is generated by a given amount of accommodation (focusing effort).
- Esotropia with high AC/A ratio (also termed nonrefractive accommodative esotropia) ببساطه مشكلته انه ينحول اذا ناظر للقريب بس اذا ناظر للبعيد ماينحول اذا ناظر للقريب بس اذا ناظر للبعيد ماينحول
- **Treated by:** bifocal glasses should be bisecting the pupil

- **Divergence paralysis: F2 slides only!**

- ET at Distance > Near ينحول للبعيد بس اذا ناظر قريب ماينحول يكون مستقيم طبيعي
- Adult
- You should do urgent MRI to check for underlying cause could be: arnold chiari, pontine tumor
- First, treat the underlying cause then treat the esotropia with surgery

- **Sensory ET: F2 slides only!**

- ET due to unilateral blindness
- Treatment: Surgical usually for cosmetic purposes

- **Cyclic ET: F2 slides only!**

- Very rare
- Acquired (2-6yrs).
- Cycle between straight and ET (يجي ويروح) they are lucky because they won't develop amblyopia
- **Treatment:**
 - First if hypermetropia treat with glasses
 - if NOT hypermetropia treat by surgery

- **Exodeviation**

The doctor said the only thing that you need to know about exotropia that it is **not related to amblyopia** (the other details from F2 notes)

a horizontal form of strabismus characterized by visual axes that form a divergent angle

Type	Definition
Basic	Distance and near measurements are equal.
Pseudodivergence Excess	Distance measurement initially exceeds near, but the near measurement approaches distance after 30–60 minutes of monocular occlusion.
True Divergence Excess	Distance measurement exceeds near measurement by ≥ 10 prism diopters even after monocular occlusion for 30–60 minutes.

Basic	Pseudo divergence excess	True divergence excess
<ul style="list-style-type: none"> • XT D=N • Tx: BLR weakening 	<ul style="list-style-type: none"> • Xt D>N • Patch 30-60min • XT D=N • Tx: BLR weakening 	<ul style="list-style-type: none"> • XT D>N • Patch 30-60min • XT D>N • Tx: R&R

*XT: Exotropia *D:Distance *N:near *BLR:bilateral rectus *Tx:Treatment *R&R: Resection & Recession lateral rectus

- **Intermittent exotropia**

- Acquired.
- Early childhood.
- Intermittently controlled by fusional convergence.
- Close one eye in the bright light. **b/c in bright light they can't fuse so to prevent diplopia they tend to cover one eye.**

Treatment:

- First start with Non-surgical: alternate patching, over minus lenses (**inducing accommodation to keep the eye in**)
- surgical **involves lateral rectus muscle**

Surgery indications:

- poor control.
- The deviation occurs more than 50% of time.
- Lost distance stereopsis.



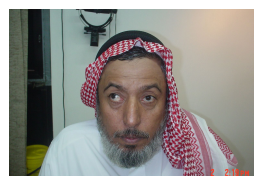
This deviation may later progress to constant exotropia

- **Congenital exotropia:**

- Very rare.
- Constant large angle between the two eyes which is assessed by the prism
- Poor fusion prognosis
- High risk of amblyopia
- Associated with craniofacial abnormalities, albinism, Cerebral Palsy
- **Treatment:** Bilateral rectus muscle (BLR) Weakening.

- **Sensory exotropia:**

- Blind eye drifts outward
- **Treatment:** Surgery (cosmetic purpose)



- **Convergence insufficiency:**

- Inability to maintain the convergence on objects approaching from distance to near (**moving pencil from distance to near your eyes will cross normally. In such patient their eyes will drift out**) Exophoria X or exotropia XT at near N, Straight at distance D.
- **Seen in elderly**
- Symptoms: asthenopia (frontal headache), diplopia (**when they look at near**)
- Remote near point of convergence (normal 5-6 cm).
- **Treatment:** orthoptic exercise (**pencil push up**)