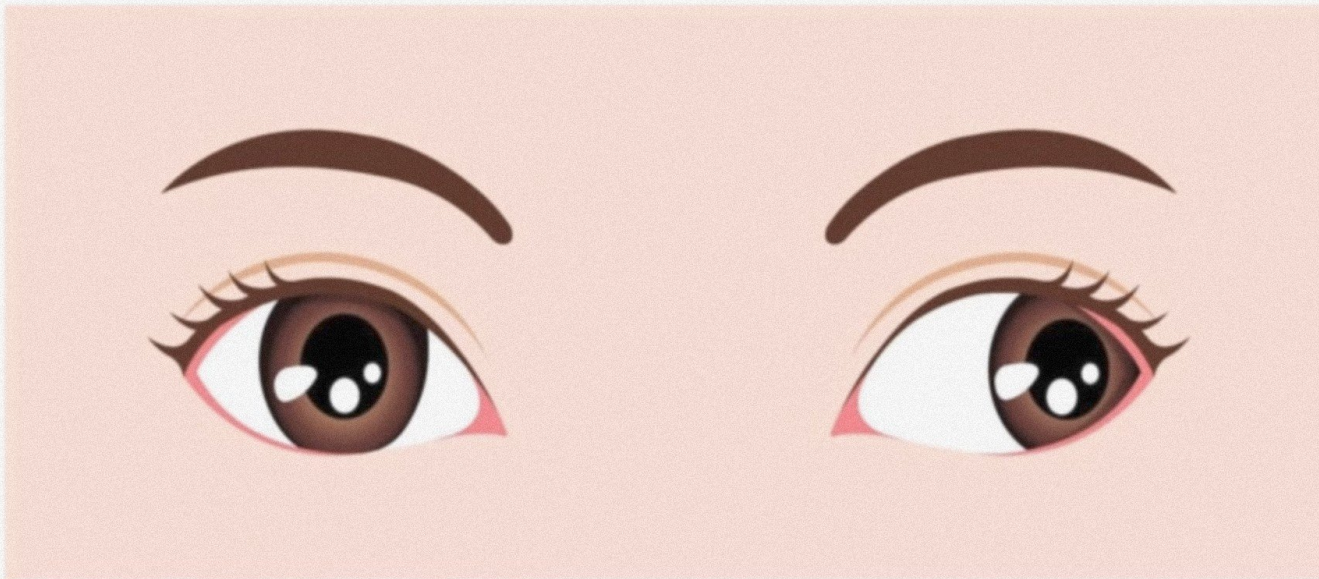


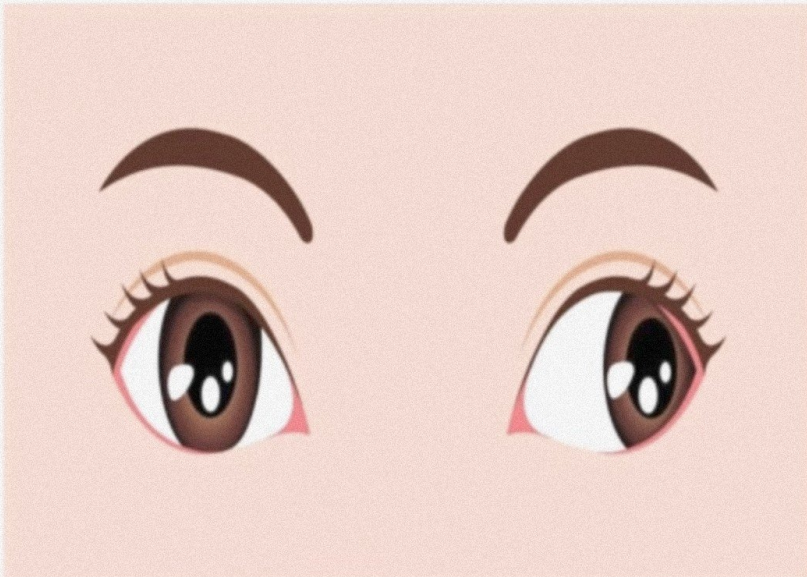
# WHAT IS EXODEVIATION?

- **Definition:** Exotropia is a form of strabismus where one or both eyes deviate outward.



# WHAT IS EXODEVIATION?

•**Definition:** Exotropia is a form of strabismus where one or both eyes deviate outward.



- Constant** in one eye
- Alternate** with preference/ Or no preference
- May be **Intermittent**
- May be associated with **vertical deviations**
- May be associated with **patterns**





1

## Know some terms :-

### **EXOPHORIA :**

Outward deviation never  
seen in a manifest state  
(only during Alternate Cover  
test )



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## Know some terms :-

### **EXOPHORIA :**

Outward deviation never seen in a manifest state (only during Alternate Cover test )

### **INTERMITTENT EXOTROPIA**

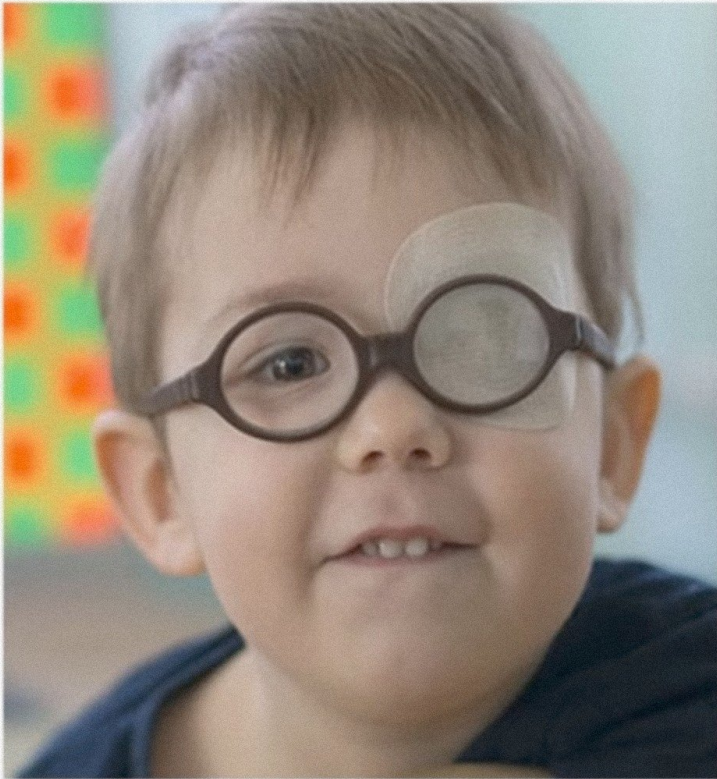
:Outward deviation is seen sometimes but can be controlled by fusion or accommodation

### **CONSTANT EXOTROPIA**

:Outward deviation is seen constantly (MANIFEST )



# PREVALENCE



- Especially in the **Asian** and **South Asian populations**.
- Regions closer to equator
- More in Women
- **Prevalence** of exotropia can be up to **7—18.5** times higher than that of esotropia
- The most common type is X(T) accounting for about **63%**.



# PREVALENCE



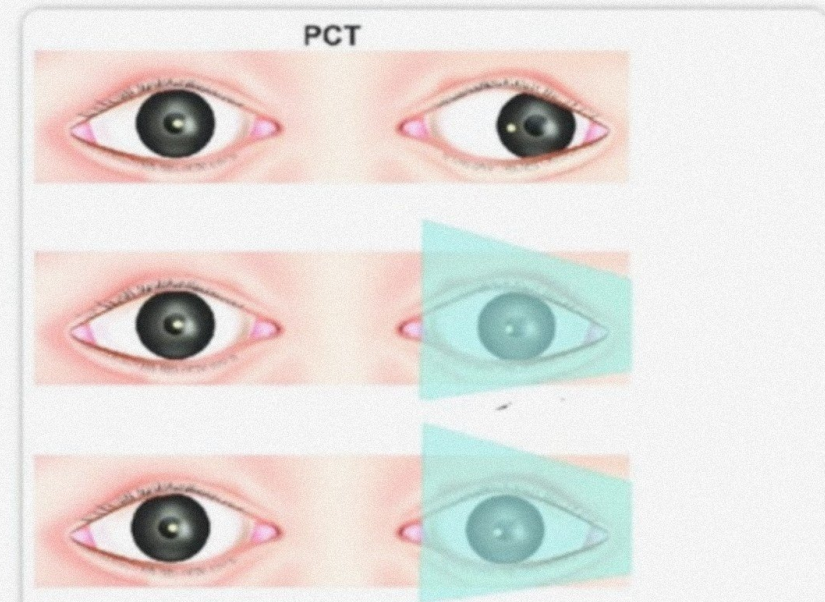
- Often starts at birth
- But kept in check by fusion and accommodation.
- Congenital XT → poor prognosis



1

## Know some symbols :-

- ❖ Exophoria : X'
- ❖ Intermittent exotropia : X(T)
- ❖ Exotropia : XT
- ❖ Base in : BI
- ❖ Divergent Squint : DS



LE exotropia : 40 PD (BI)  
Or 40 XT



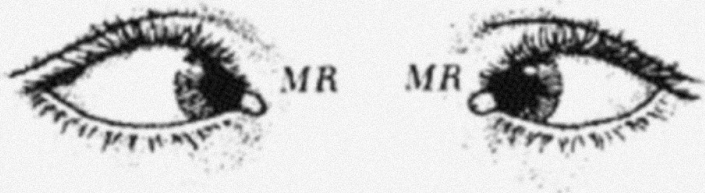
# What **Causes** Exodeviation ?



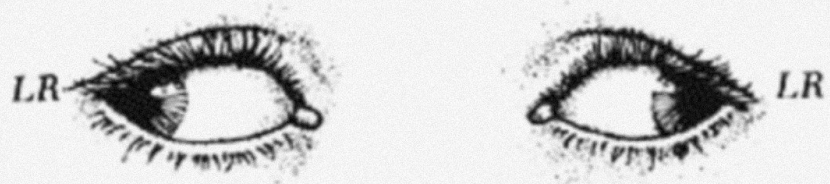


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# Innervational Factors (**Duane's Theory**):

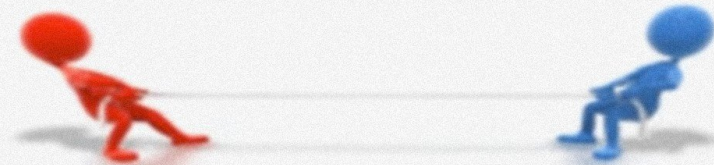


*Convergence*



*Divergence*

- Imbalance between **convergence** (inward movement) and **divergence** (outward movement) mechanisms.

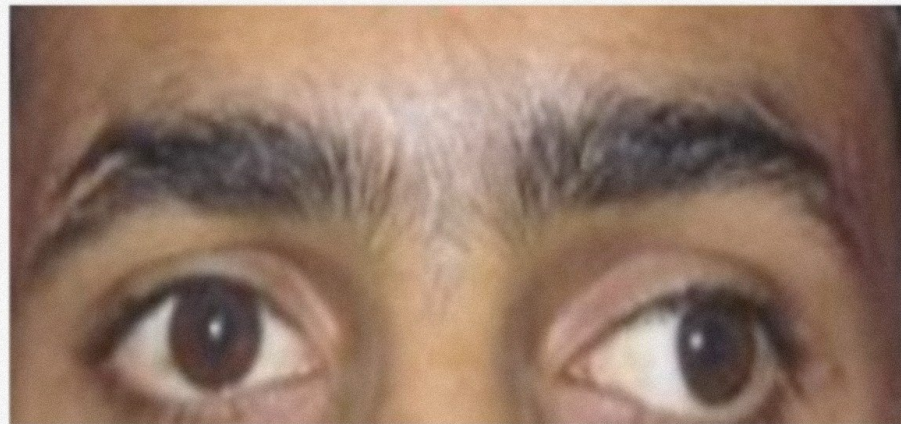


# "Physiological position of Rest"

- Typically **Slightly** divergent



• **Hyperactive tonic divergence causes an outward drift.**



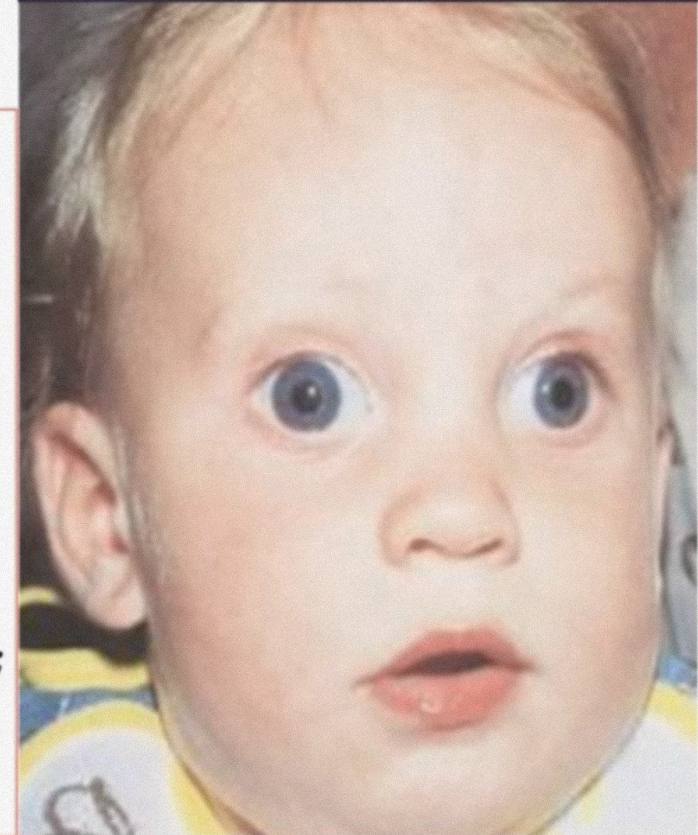


In childhood the convergence is robust and can mask the deviation at near

- *Early Onset*
- *Large Angle Deviation*
- *Poor Binocular Vision*
- *Associated Ocular and Neurological Abnormalities*
- *Early Surgical Treatment*

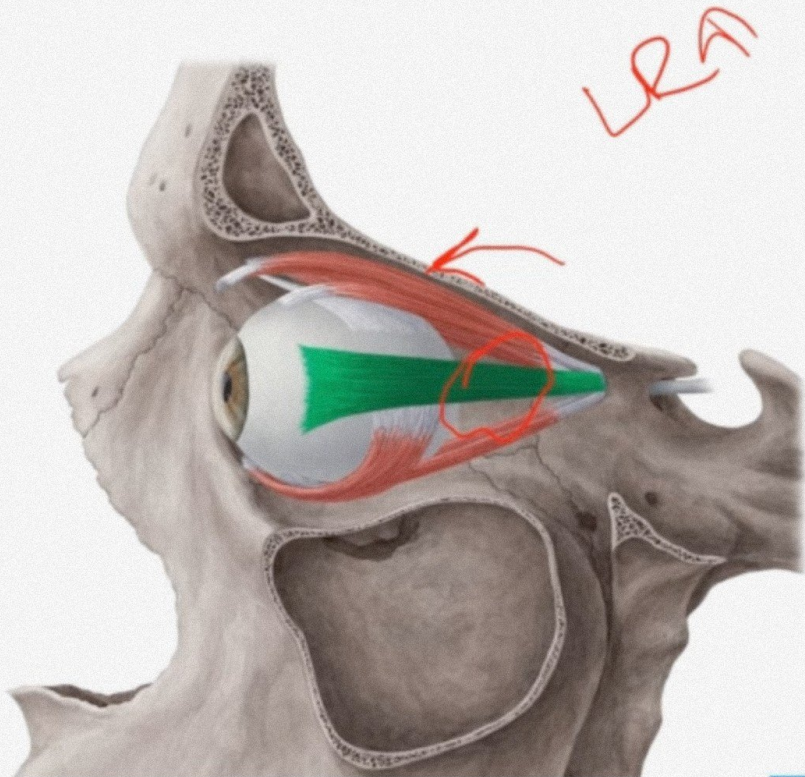
*Common*

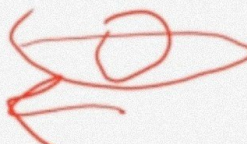
## Infantile exotropia



2.

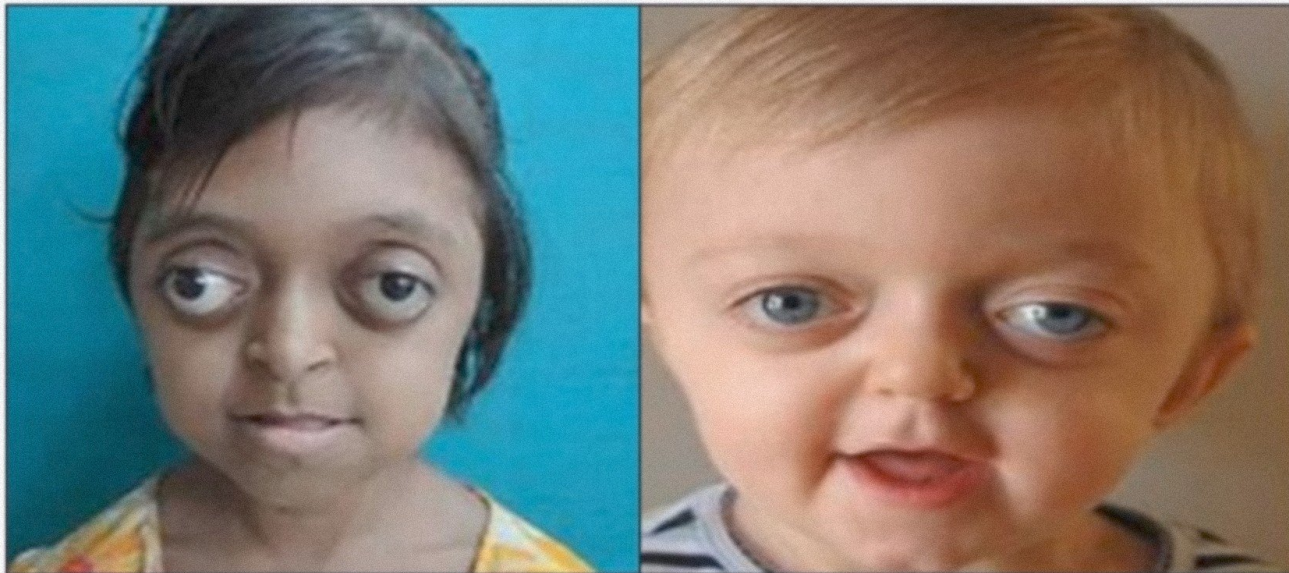
## Mechanical Factors (**Bielschowsky's Theory**)



- Shape and orientation of orbits 
- Size and elasticity of the eye muscles
- Position and condition of surrounding tissues
- Volume and viscosity of retrobulbar tissue.
- Scar tissue and Fibrosis

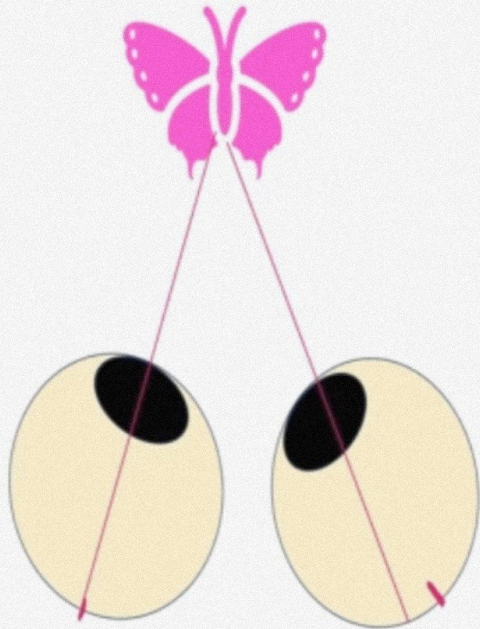


High prevalence of exodeviations is seen in patients with craniofacial dysostosis (**Crouzon's disease & Apert Syndrome**), characterized by shallow, laterally directed orbits.



### 3.

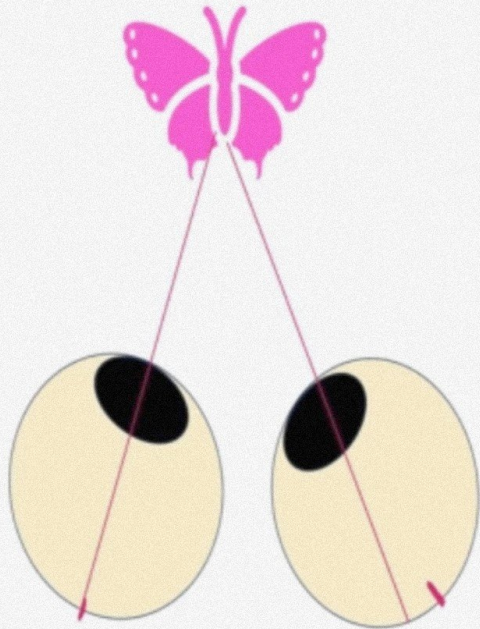
## Role of Defective Fusion (**Theory by Worth**)



- Fusion defects are central to squint development.
- Fusion faculty may be **absent** or **weak**, causing eye misalignment.
- **Good fusional** reserves can prevent manifest exodeviation, but defective fusion may cause it to emerge.

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## Role of Defective Fusion (**Theory by Worth**)



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# SENSORY FUSION



- The unification of visual excitations from corresponding retinal images into a single visual percept, a single visual image

**Single vision is the hallmark of retinal correspondence**

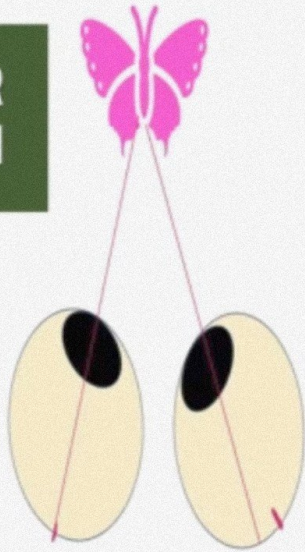






# MOTOR FUSION

MOTOR  
FUSION

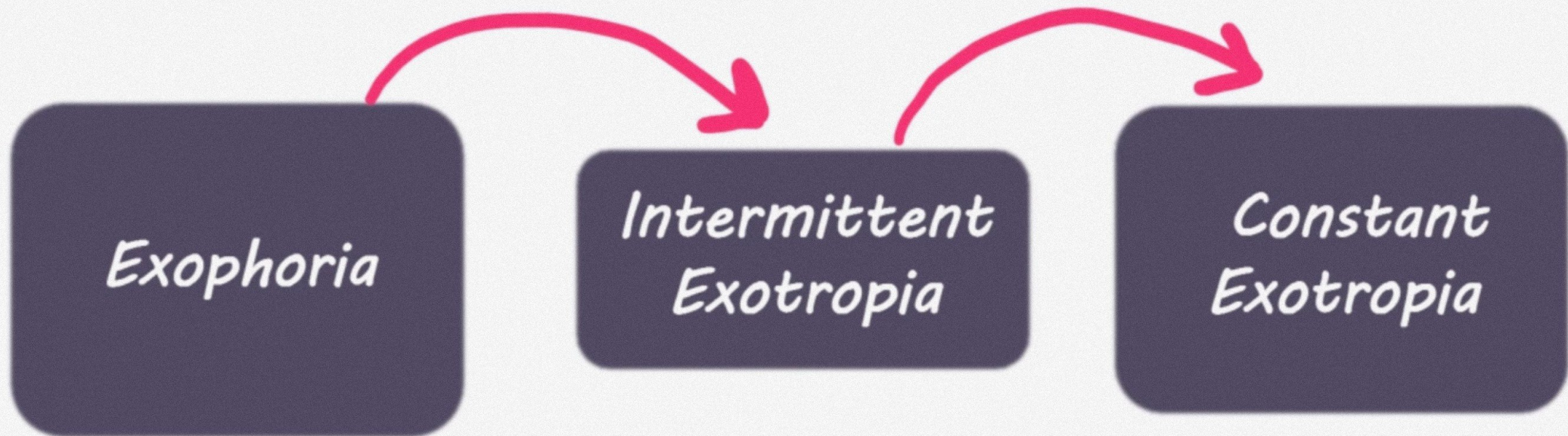


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- The term motor fusion refers to the ability to **align the eyes** in such a manner that sensory fusion can be maintained.
- Motor fusion is the exclusive function of the extrafoveal retinal periphery.
- No stimulus for motor fusion exists when the images of a fixated visual object fall on the fovea of each eye.
- **RETINOMOTOR VALUE OF THE RETINAL ELEMENTS**

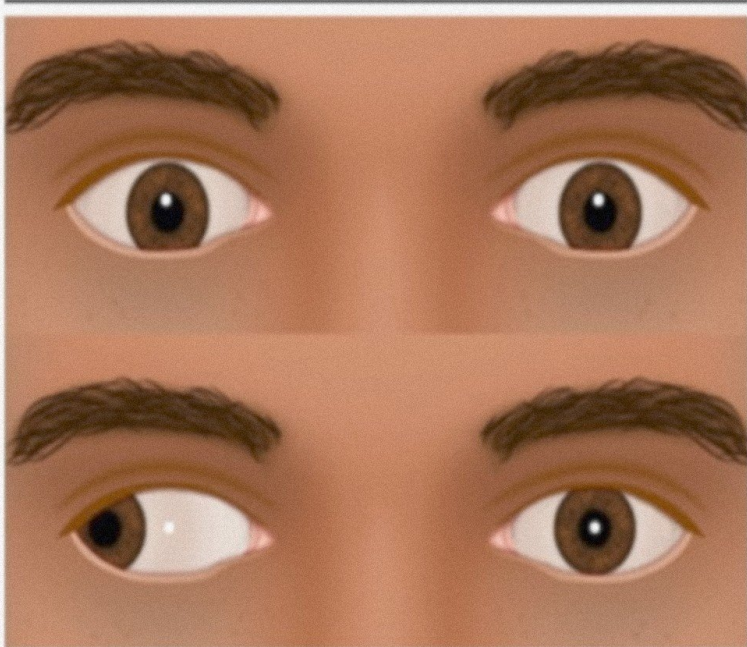


## Compensation Failure:



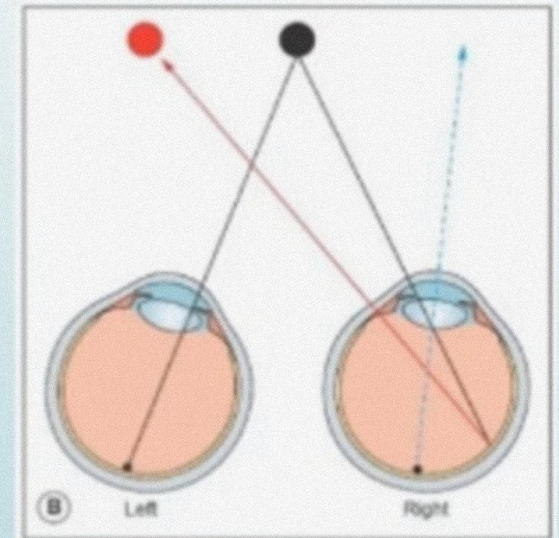
4.

## Sensory Adaptation and Suppression:



**eXotropia**

**X = Crossed  
diplopia**



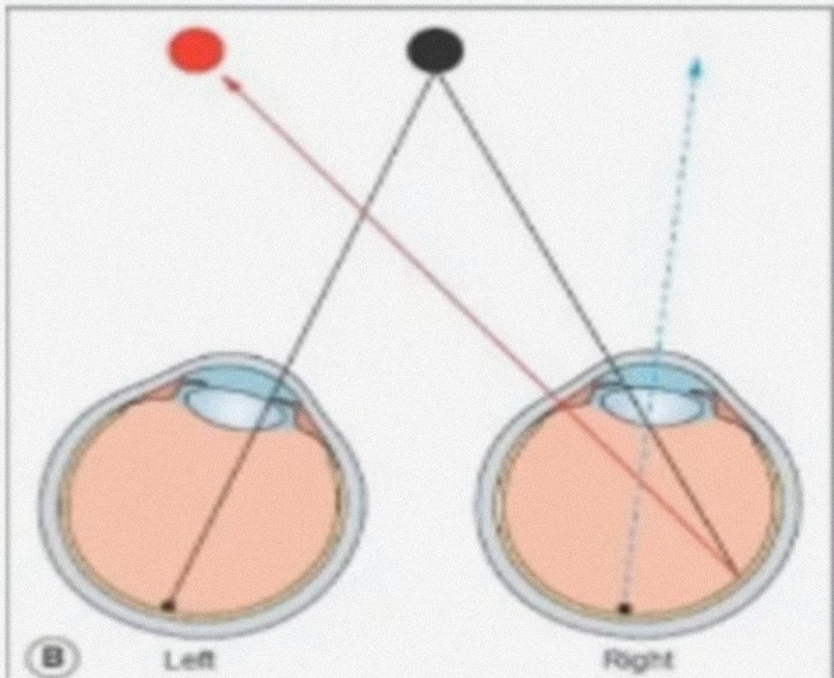


- **Central suppression**
- **Peripheral Suppression**
  
- **Within the critical period only. (6-7 years )**
- **Source:** Birch, E. E. (2013). "Amblyopia and binocular vision." *Progress in Retinal and Eye Research*, 33, 67-84.



# 5

## Theory of Hemiretinal Suppression (Knapp and Jampolsky)



- *Confusion & diplopia →*
- *Hemiretinal suppression →*
- *Deviation becomes tolerable →*
- *No incentive for motor fusion →*
- *Progression from exophoria to exotropia*



# Sensory Adaptation

- **Phoric Phase:** Eyes are well-aligned, allowing **fusion** and good stereoacuity.
- **Tropic Phase:** Eye turns outward, leading to **suppression** of part of the retina.





*Key Point: Late-onset  
exotropia can lead to  
**diplopia** due to loss of  
suppression ability*



# SENSORY ADAPTATIONS

## *•Phoric Phase Of Intermittent Exotropia*

- Eyes are perfectly aligned
- Bifoveal fusion with excellent stereoacuity ranging between 40-60 second arc.
- Excellent bifoveal fusion develops because the eyes are well aligned in early infancy when the critical binocular cortical connections are being established
- Deviation is intermittent, allowing reinforcement of fusion.






# SENSORY ADAPTATIONS

## • *Tropia Phase Of Intermittent Exotropia*

- Exotropia is manifest most patients will show large regional suppression of the temporal retina.
- Anomalous Retinal Correspondence
- A minority of patients with intermittent exotropia may have the monofixation syndrome
- A rare patient may even have a significant amblyopia.





6.

## AC/A Ratio and Exodeviation

- Normal or slightly high in exodeviation patients.
- **Kushner's (1988) Findings:** 60% of patients with divergence excess exotropia have a high AC/A ratio and 40% had a normal AC/A ratio



## What is AC/A ratio?

$$\text{AC/A ratio} = \frac{\text{Change in Convergence}}{\text{Change in Accommodation}}$$

### • LENS GRADIENT METHOD

- lens stimulate accommodation
- + lens Relax accommodation



$$\text{AC/A ratio} = \frac{\text{Change in Convergence}}{\text{Change in Accommodation}}$$

Change in Near Deviation = Near Deviation with Lens – Original Near Deviation

$$\text{AC/A Ratio} = \frac{\text{Change in Near Deviation (PD)}}{\text{Lens Power (D)}}$$

Esophoria is plus, Exophoria is minus.



## What is AC/A ratio?

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# What is AC/A ratio?

$$\text{AC/A ratio} = \frac{\text{Change in Convergence}}{\text{Change in Accommodation}}$$

*Handwritten notes in red:*  
2.1      5.1  
↓ 5.1  
3.1



# Low AC/A Ratio



- The eyes do not converge sufficiently.
- Outward drift /exotropia during near work.
- Convergence insufficiency exotropia (Near exotropia )

## High AC/A Ratio



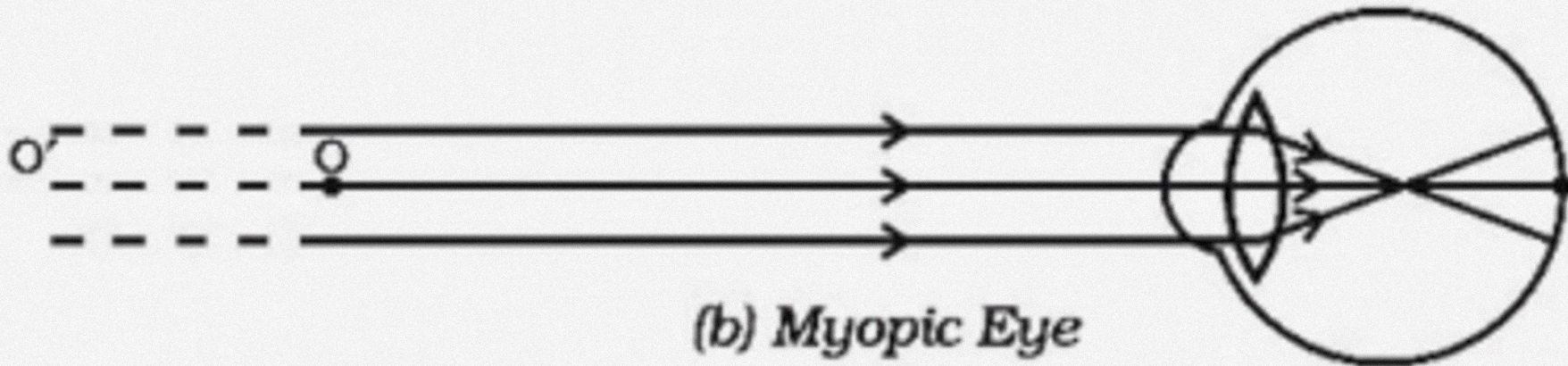
- The eyes converge more than normal for a given amount of accommodation.
- This can cause the eyes to converge well for near tasks but over-diverge for distant objects, creating an outward drift during distance vision tasks
- Divergence excess exotropia





7

# Role of Refractive Errors ( **DONDERS** )

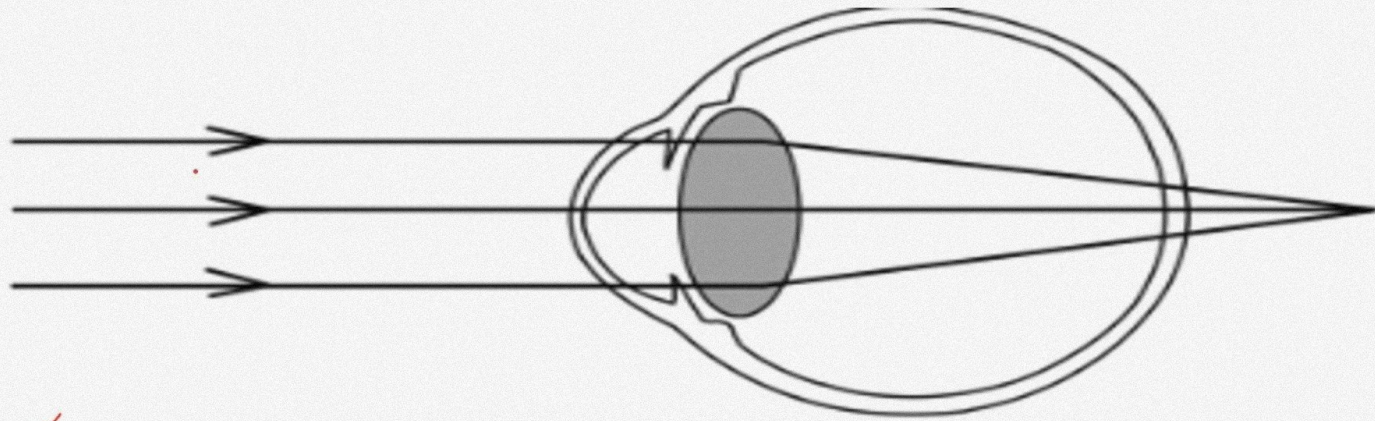


- **Myopia:** Less accommodative effort → reduced convergence → *exodeviation*.



7

## Role of Refractive Errors ( **DONDERS** )



- **High** Hypermetropia: No attempt to focus clearly → low AC/A ratio → *exodeviation*.

