

Squint (Strabismus)



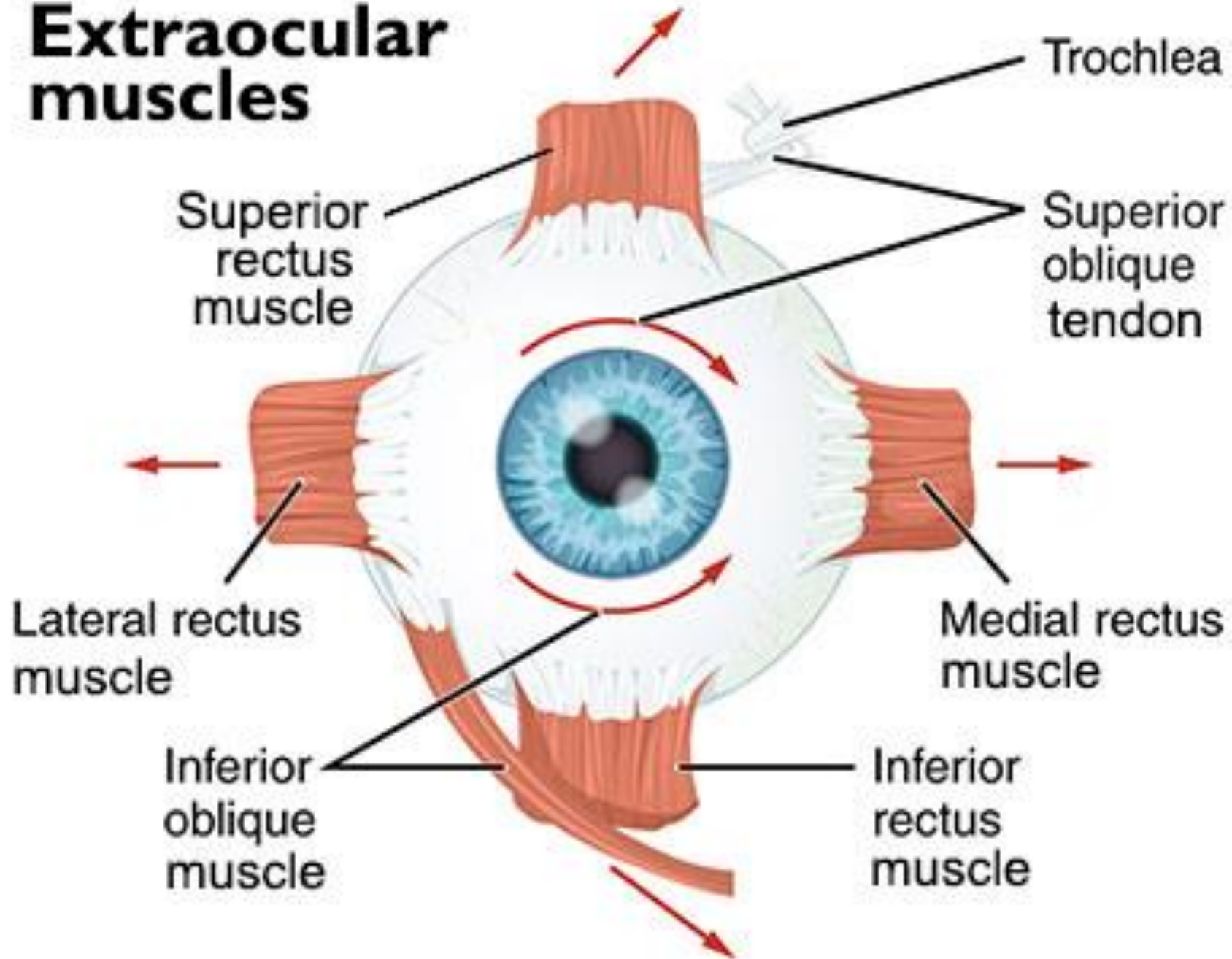
Definition

Squint (Strabismus):

A **squint**, or **strabismus**, is a condition in which the eyes do not align properly. One eye turns **inwards**, **upwards**, **downwards**, or **outwards**, while the other one focuses at one spot . As a result, both eyes are unable to look at the same spot at the same time. ❖

Squint is a condition rather than being a disease in which two visual axes are not directed toward the fixed object or fixation target. ❖

Extraocular muscles



Classification of squint

Several varieties of squint have been described, based on; ○

Direction of deviation; ➤

1-Exo (outward deviation)

2-Eso (inward deviation)

3-Hyper (upward deviation)

4-Hypo (downward deviation)

Whether deviation is constant or intermittent; ➤

1- Tropia (constant deviation) ;

e.g: exotropia, esotropia, hypertropia and hypotropia.

2- Phoria (intermittent deviation) ;

e.g: exophoria, esophoria, hyperphoria and hypophoria.

Squint Eye (Strabismus)

Normal



(Esotropia)



eye turns inwards

(Exotropia)



eye turns outwards

(Hypotropia)



eye turns downwards

(Hypertropia)



eye turns upwards

Exotropia

An exotropia is the medical name for a divergent squint where the one eye turns outwards

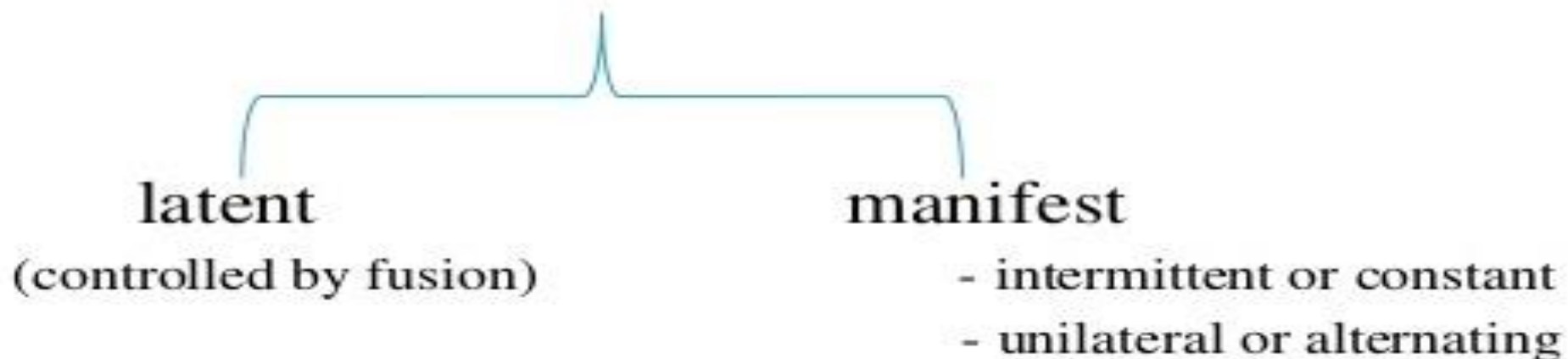


EXODEVIATIONS:

▶ Exo –

visual axis is deviated laterally and fovea rotated nasally

Exodeviations = divergent strabismus



PSEUDOEXOTROPIA

- ▶ Appearance of exodeviations
 - wide interpupillary distance
 - large positive angle kappa – hyperopia, ROP



Etiology

- ▶ Idiopathic
- ▶ Proposed causes are:
 - Excessive tonic divergence
 - Anatomical and mechanical factors within the orbit

TYPES :

A. COMITANT

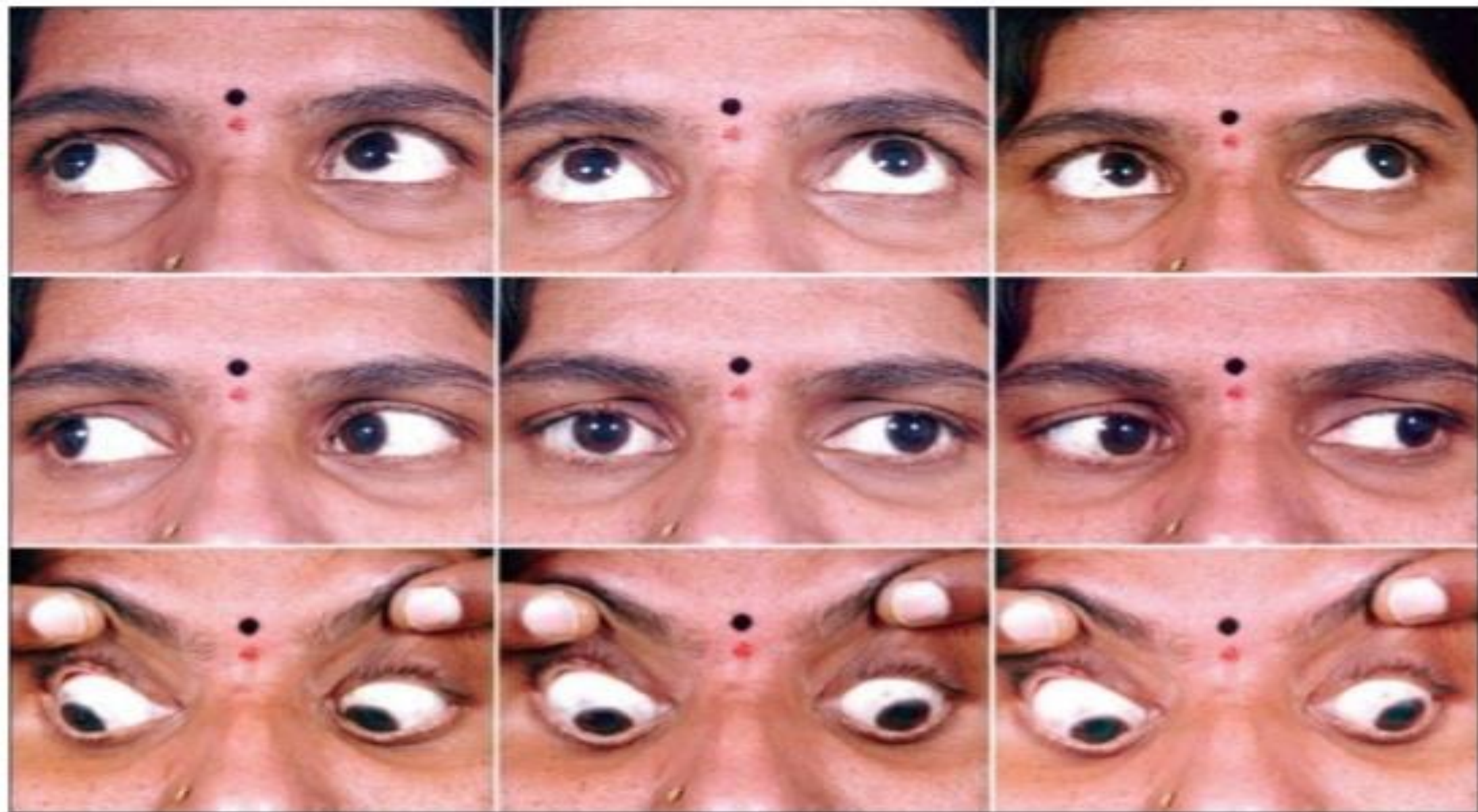
- Primary
 - Infantile exotropia
 - Intermittent exotropia
- Secondary
 - Sensory exotropia
 - Consecutive exotropia

B. Incomitant

- Paralytic
- Restrictive
- Musculofascial innervational anomalies

ESSENTIAL INFANTILE EXOTROPIA

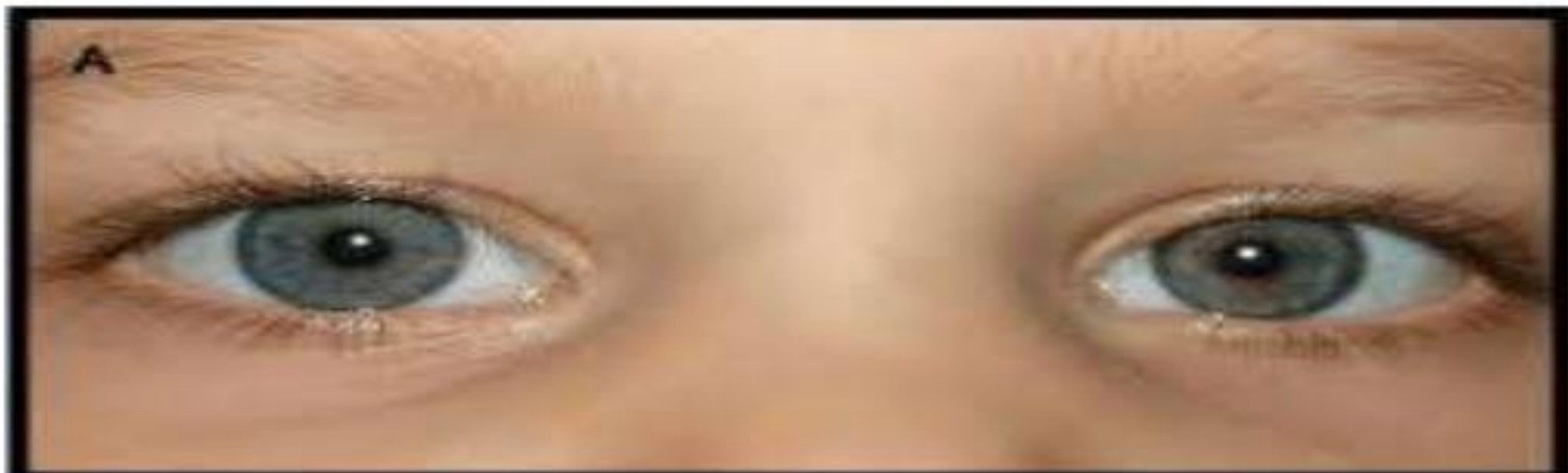
- ❖ It is a rare condition
- ❖ It occurs in patients with;
 - Craniofacial anomalies
 - Ocular albinism
 - Cerebral palsy
- ❖ Features:
 - Large angle constant exo deviation is mostly more than 35PD
 - Fusion will be poor
 - amblyopia > intermittent exotropia





Intermittent Exotropia

- ❖ Most common form of XT
- ❖ Onset: typically in first few years of life
- ❖ Most common symptoms;
 - Blur
 - Asthenopia
 - Diplopia
 - Monocular eye closure in bright sunlight
 - None (suppression or ARC)



SENSORY EXOTROPIA

- ✓ Poor vision in one eye leads to XT
- ✓ Sensory esotropia or exotropia may occur
- ✓ Secondary to some sensory deficit
- ✓ Causes
 - Marked anisometropia
 - Eg; unilateral high myopia
- ✓ retinoblastoma(22% present with strabismus)
- ✓ Unilateral cataract

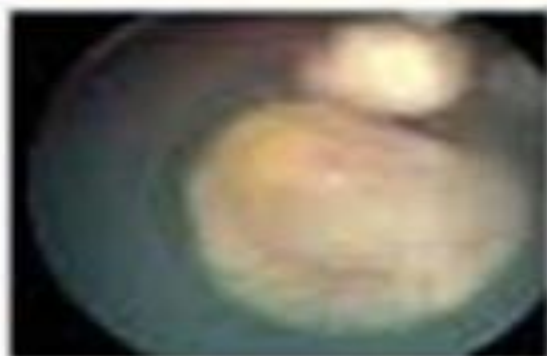


Fig. 10.12 *Nine gaze photographs of a patient with left sensory exotropia.*



RETINOBLASTOMA

3 UNC





CONSECUTIVE EXOTROPIA

- ▶ Formerly esotropic patient
- ▶ Either spontaneously or after surgical overcorrection
- ▶ Treatment:
 - Correction of refractive error if present
 - surgery(cosmetic)



Fig. 10.13 A patient with esotropia (A), who developed consecutive exotropia after surgery (B), which was surgically corrected to orthotropia (C).

PARALYTIC STRABISMUS

- ▶ 3rd nerve palsy
- ▶ Internuclear ophthalmoplegia(INO)
- ▶ Ocular myasthenia



Paralytic pontine exotropia OS

2nd Row



Figures 11 and 12 - Patient with right VI nerve palsy after traumatic brain injury, with central right facial paralysis and left hemiparesis. After recession of the right MR and Carlson-Jampolsky transposition in the same eye, the patient developed secondary exotropia with loss of action of the right MR, difficult to correct, with a poor functional outcome in terms of muscle function, aesthetics and control of diplopia

RESTRICTIVE STRABISMUS

- ▶ Dysthyroid orbitomyopathy
- ▶ Fibrosis secondary to orbital trauma and orbital surgery
- ▶ Parasitic cyst
- ▶ Orbital tumours



MUSCULOFASCIAL INNERVATIONAL ANOMALIES

- ▶ Duanes's retraction syndrome type 2:
 - LR innervations present on abduction as well as adduction
 - Abduction : normal
 - Adduction : limited
 - globe retraction
 - narrowing of palpebral aperture
 - upshoot or down shoot

PROGRESSION OF EXOTROPIA:

- 1) Stage of latent deviation (Phoria)
- 2) Stage of intermittent exotropia
(Distance deviation $>$ near deviation)
- 3) Stage of constant exodeviation
(inadequate fusional convergence lead to constant exo)

CLINICAL FEATURES:

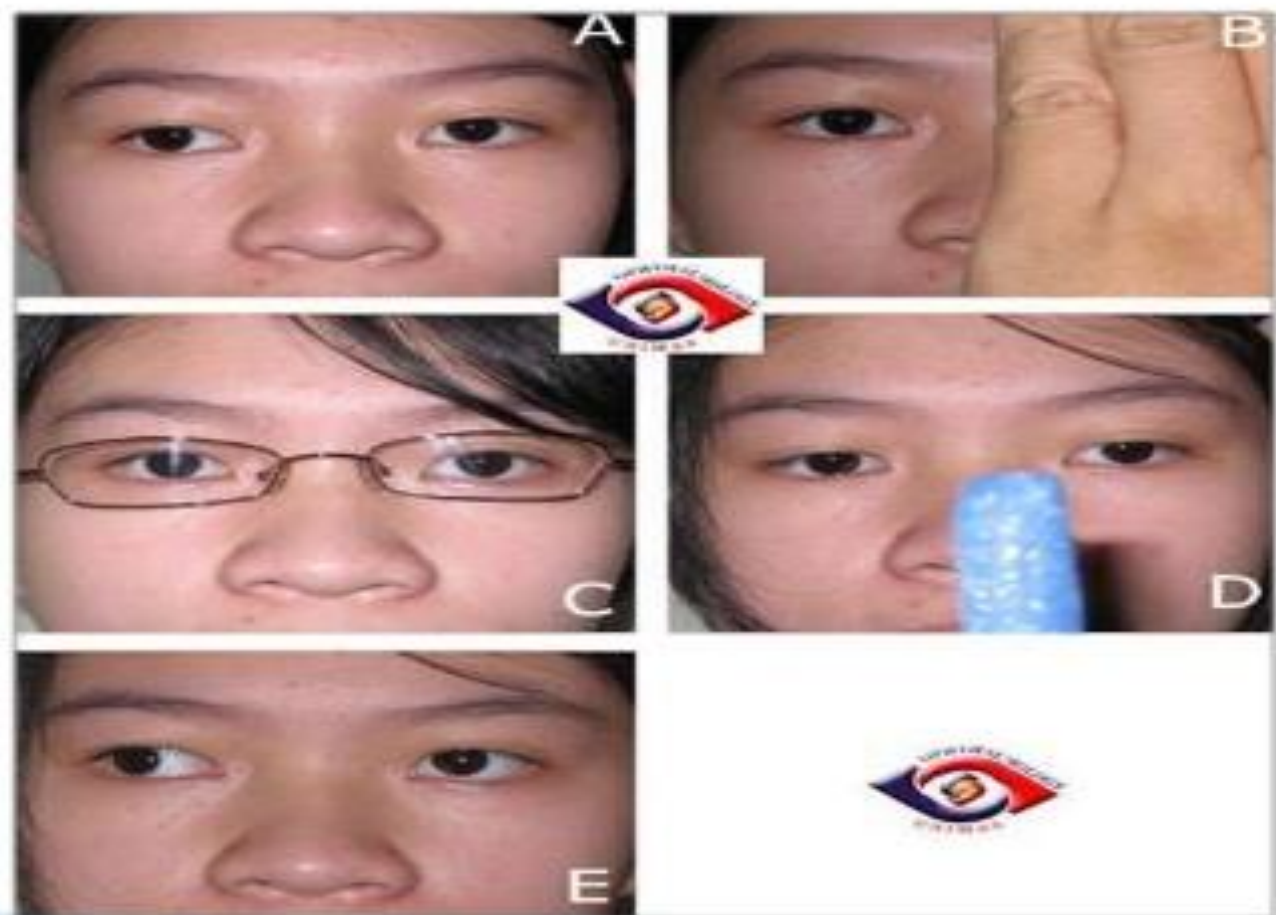
- ▶ Latent or intermittent form increases.
- ▶ Prevalence less than esodeviation.
- ▶ Age of onset of majority is shortly after birth.
- ▶ Genuine “congenital” exotropia: poor prognosis.
- ▶ More common in females.
- ▶ Refractive errors-mostly seen in myopes.
- ▶ Precipitating factors.

DUANE'S CLASSIFICATION


- ▶ Merely a descriptive classification
 1. Divergence excess pattern
 2. Basic exodeviation
 3. Convergence insufficiency pattern
 4. Simulated divergence excess pattern

1. DIVERGENCE EXCESS PATTERN:

- ▶ The exodeviation is at least 15PD greater at distance than near even after performing the patch test.

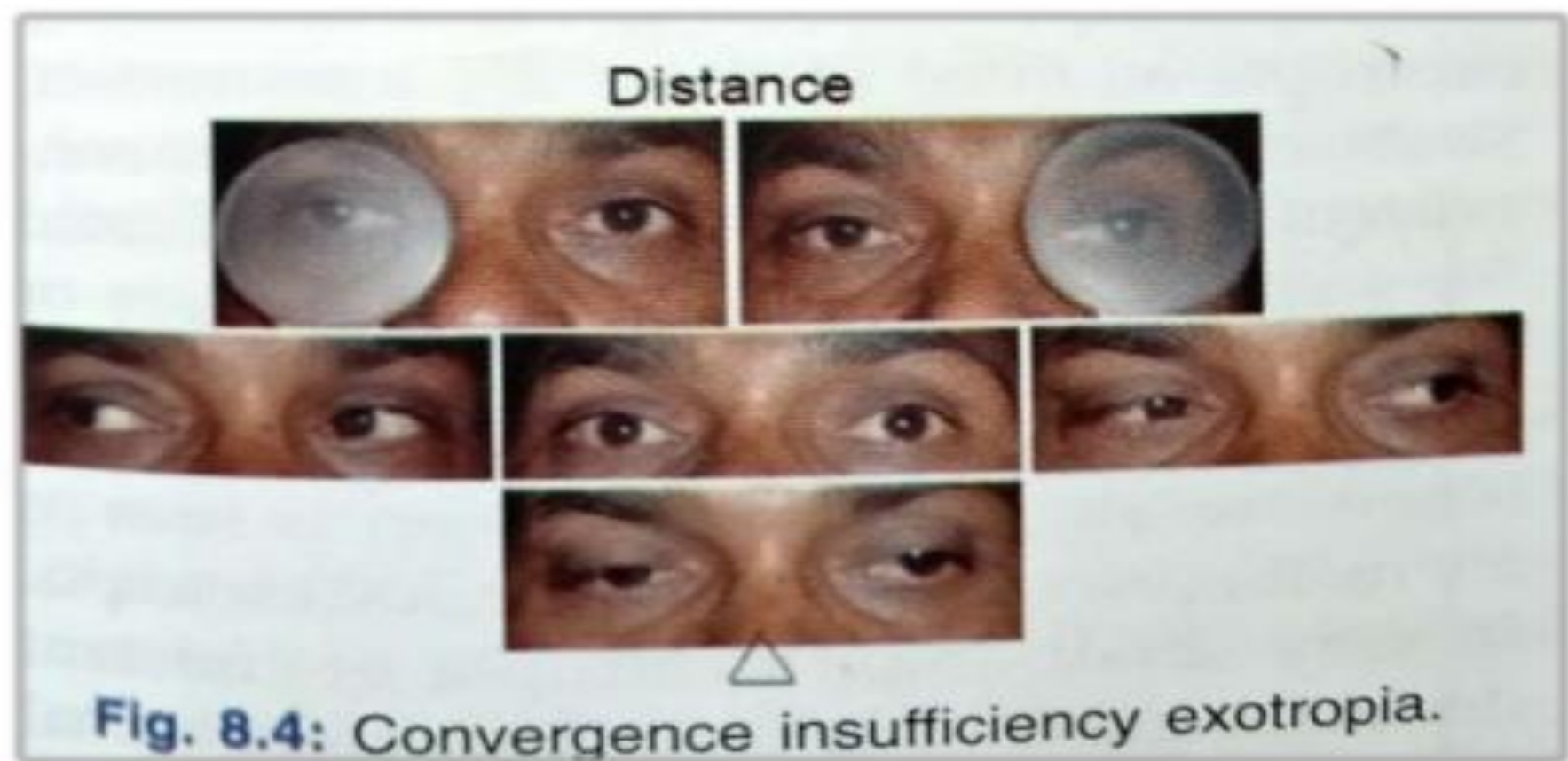


2. BASIC EXODEVIATION:

- ▶ Exodeviation is equal at distance and at near.
 - ▶ It is associated with both divergence excess and convergence insufficiency.
 - ▶ Also known as mixed type exodeviation.
- 

3. CONVERGENCE INSUFFICIENCY PATTERN:

- ▶ Near deviation is 15PD larger than distance deviation.



4.SIMULATED DIVERGENCE EXCESS PATTERN:

- ▶ Distance deviation is 15 PD larger than near deviation.
- ▶ Initially Pt has esophoria, to overcome this pt does excessive effort to diverge
- ▶ This results to simulation of Exo Deviation

SIGNS AND SYMPTOMS:

- ▶ Exophoria:
 - eyestrain
 - headache
 - blurring of vision
 - difficulties with prolonged periods of reading
- ▶ Children with intermittent or constant exotropia:
 - less frequently symptomatic
- ▶ Adults with intermittent exotropia
 - commonly symptomatic
- ▶ Micropsia occurs in patients who uses accommodative convergence to control exodeviations.

TREATMENT:

1. NON-SURGICAL:

- Optical treatment
- Prismotherapy
- Orthoptic treatment:
 - a. Antisuppression exercises
 - b. Relative convergence exercise
 - c. Occlusion

2. SURGICAL:

- LR Recession(15D=4mm)
- MR Resection(3-6mm depending upon size of deviation)

Esotropia

- ↳ Esodeviation that is not controlled by fusional mechanisms so that deviation is constant



Introduction

- ✓ The term is derived from 2 Greek words: *ésò*, meaning inward, and *trépò*, meaning turn
- ✓ In esotropia, the eyes are crossed; that is, while one eye looks straight ahead, the other eye is turned in toward the nose
- ✓ Esodeviations are the most common type of ocular misalignment
- ✓ Represents 50% of ocular deviations in pediatric age group

Introduction

- ✓ Three commonly recognized forms
 - ✓ Esophoria
 - ✓ Intermittent Esotropia
 - ✓ Esotropia

Esophoria

- ↳ Latent esodeviation that is controlled by fusional mechanisms
- ↳ Eyes remain properly aligned under normal binocular viewing conditions

Types of Esotropia

- ✓ Congenital infantile esotropia
- ✓ Accommodative esotropia
- ✓ Acquired non accommodative esotropia
- ✓ Cyclic esotropia
- ✓ Divergence Insufficiency
- ✓ Sensory esotropia

PSEUDOSTRABISMUS

- ✓ Wide nasal bridge
- ✓ Prominent epicanthal folds
- ✓ Narrow interpupillary distance
- ✓ With the formation of the bridge of the nose, pseudostrabismus disappears



FIGURE 13-4A,B. Pseudo-strabismus. (A) Note the large epicanthal folds giving the appearance of esotropia even though the eyes are well aligned. (B) Pinching the epicanthal skin folds demonstrates the eyes are well aligned.

Intermittent Esotropia

- ↳ Is an esodeviation that is intermittently controlled by fusional mechanisms
- ↳ Manifest under certain conditions such as fatigue, illness, stress or tests that interfere with the maintenance of normal fusional abilities {such as covering one eye}

Definition & Incidence

- ✓ Large angle esotropia present before 6 months of age
- ✓ Prevalence: 27/ 10,000

Associated factors

- ✓ *Essential Congenital esotropia* : most common form of strabismus
- ✓ Incidence : 1 to 2 per cent
- ✓ Sex distribution : Uniform
- ✓ Family history positive but no well defined genetic pattern
- ✓ Concordance in monozygous twins to be 81 per cent, compared with 9 per cent in dizygotic

- ✓ Incidence -- higher in patients with cerebral palsy, hydrocephalus (30%)
- ✓ Maternal cigarette smoking and low birth weight linked to the development of esotropia
- ✓ More prevalent in low birth weight, premature infants, perinatal hypoxia
- ✓ Increased risk of development of mental illness by early adulthood

Etiology

↳ WORTH THEORY

- ↳ Congenital absence of cortical fusion potential
- ↳ Lack of binocular fusion

↳ CHAVASSE THEORY

Have potential for high grade stereopsis



Primary motor misalignment



Disruption of binocular vision

Clinical Features

- ‡ Associated with vertical divergence & inferior oblique over-action over the period of time
- ‡ Mild to moderate amblyopia
- ‡ Small degree of hyperopia



Examination

- ⌘ Amblyopia assessment
- ⌘ Check extra ocular movements to rule out VI N palsy
- ⌘ Verify abduction deficit with vestibular stimulation:
 - ⌘ Dolls head phenomenon test
 - ⌘ Rotating the child gently



FIGURE 13-3. Diagram of an infant in examiner's hands. Infant is moved to the right, which stimulates eye movement to the left. If the right eye fully abducts, then lateral rectus function is normal and there is no significant restriction of the medial rectus muscle. Spinning an infant will cause the eyes to move opposite to the spin, an excellent way to examine horizontal ductions in an otherwise uncooperative infant.

Examination

If it persists - perform **Abduction saccades**

- ✓ **Brisk saccades** - LR functioning but restricted
- ✓ **Absent saccades** - weak LR due to VI nerve palsy

CIANCIA SYNDROME

↳ *Large angle congenital esotropia with cross fixation, in which both eyes appear to be "stuck" in towards the nose*

Features :

- ~ Large angle deviation (>60 PD)
- ~ Bilateral limited abduction
- ~ Fixing eye in adduction
- ~ Nystagmus on attempted abduction, not adduction
- ~ Face turn to side of fixing eye

Ciancia's syndrome



Congenital Esotropia Observational Study (CEOS)

- ✓ Infantile esotropia < 40 pd and intermittent or variable frequently resolves spontaneously at less than 20 weeks of age
- ✓ Cases with a constant deviation ≥ 40 pd presenting after 10 weeks of age -- spontaneous resolution less likely

Treatment

Non – Surgical Measures

- Correction of refractive errors
 - More than +2.00 D, should be corrected in small angle cases
 - More than +3.00 D, should be corrected in large angle esotropia
 - Miotics in uncooperative infants
- Amblyopia therapy

Surgical Treatment

Time Of Surgery

- ✓ Standard approach - Between 6 months to 2 years to age
- ✓ Peripheral fusion is achieved in most cases if operated before 2 years of age
- ✓ Recent studies favour early surgery as soon as diagnosis is made
- ✓ Wait upto 6 months of age in intermittent esotropia or small to moderate angle deviations

ACQUIRED ESOTROPIAS

- ↳ Onset in few years of life
- ↳ Insignificant refractive error & accommodative factor
- ↳ Three types :
 - ↳ Basic Esotropia
 - ↳ Convergence excess esotropia
 - ↳ Divergence Insufficiency Esotropia
- ↳ Therapy : treatment of amblyopia and surgical treatment of the underlying deviation
- ↳ Rule out a CNS lesion in case of acquired esotropia

NYSTAGMUS BLOCKAGE SYNDROME

- ✓ Patients with congenital nystagmus may use accommodative convergence to dampen their nystagmus
- ✓ Have straight eyes with congenital nystagmus on distance fixation
- ✓ But on near fixation, they manifest a variable esodeviation while using accommodative convergence to dampen the nystagmus and improve vision

NYSTAGMUS BLOCKAGE SYNDROME

- ✓ Nystagmus is inversely proportional to angle of deviation
- ✓ Appears as fixing eye moves from adduction to abduction
- ✓ Fixation occurs with the adducting eye
- ✓ Head tilt towards the side of fixating eye

CYCLIC ESOTROPIA

- ✓ Acquired esotropia which occurs most frequently between 2-6 years of age
- ✓ Strabismic & non strabismic phase of 24 hrs each
- ✓ Lasts for months to years

Strabismic phase :

- ✓ Large deviation(40-70PD)in early childhood
- ✓ Suppression in deviated eye

Non Strabismic phase :

- ✓ No manifest deviation, normal fusion and stereopsis

CYCLIC ESOTROPIA

- ✓ These patients are actually esotropic but able to maintain fusion periodically
- ✓ Correcting for the deviation therefore does not cause over correction on orthophoric days; patient has enough compensatory divergence
- ✓ Not associated with any phoria on normal days
no accommodation / fusional component

Treatment

- ✓ B/L medial rectus recession
- ✓ MR recession + LR resection

DIVERGENCE PARALYSIS

- ✓ Commitant esotropia for distant fixation in patients with normal ductions & versions
- ✓ Idiopathic condition
- ✓ CNS disease: polio, neoplasms

Divergence Paralysis

- ✓ Sudden onset diplopia at distant fixation
- ✓ Commitant esotropia
- ✓ Unrestricted field of vision
- ✓ Abduction & versions are normal

Treatment:

- ✓ Self limiting: disappear in 5 -6 months
- ✓ Base out prisms: relieve diplopia
- ✓ B/L LR resection if > 6months

SENSORY ESOTROPIA

- ✓ Esotropia secondary to poor visual function in one eye in childhood
- ✓ Monocular lesions which prevent normal binocular vision development
- ✓ Congenital cataracts, corneal opacities, retinoblastoma, optic atrophy

Treatment

- ✓ Evaluate the good eye fully for refractive errors
- ✓ Treat underlying causes, along with management of amblyopia before squint surgery
- ✓ MR recession +/- LR resection
- ✓ Inform patient about recurrence chances

Consecutive esotropia

- ✓ Results from over correction of exodeviations
- ✓ For deviations < 20 P.D. no active management
- ✓ Deviations > 20 PD wait for 6 months \rightarrow if no improvement occurs surgical correction is required
- ✓ Use of adjustable sutures recommended in these cases
- ✓ In very large esodeviation presenting immediately after surgery, it is important to remember **muscle detachment from new site of insertion**

Hypertropia

Hypertropia is a condition of misalignment of the eyes (strabismus), whereby the visual axis of one eye is higher than the fellow fixating eye.

Dissociated vertical deviation is a special type of hypertropia leading to slow upward drift of one or rarely both eyes when the patient is inattentive.



Hypotropia

Hypotropia is the similar condition, focus being on the eye with the visual axis lower than the fellow fixating eye.



Causes

Hypertropia may be either congenital or acquired, and misalignment is due to imbalance in extraocular muscle function. The superior rectus, inferior rectus, superior oblique, and inferior oblique muscles affect the vertical movement of the eyes. ●

Superior oblique Palsy / Congenital fourth nerve palsy ●

Inferior oblique overaction ●

Brown's syndrome ●

Duane's retraction syndrome ●

Double elevator palsy ●

Fibrosis of rectus muscle in Graves Disease (most commonly inferior rectus is involved) ●

Surgical trauma to the vertical muscles (e.g. during scleral buckling surgery or cataract surgery causing iatrogenic trauma to the vertical muscles). ●

Treatment

Correction of refractive errors by glasses ●

Prism therapy (if tolerated, to manage diplopia) ●

**Patching (mainly to manage amblyopia in children and
diplopia in adults)** ●

Botulinum toxin injection ●

Surgical correction ●

Heterophoria and Heterotropia

Terminology

Hetero = Different⊙

Phoria = Intermittent deviation⊙

Tropia = Constant deviation⊙

Heterophoria vs Heterotropia

In heterophoria there is a relative deviation of the visual axes held in check by the fusion mechanism, whereas in heterotropia there is a manifest deviation of the visual axes.

The relative position of the visual axes is determined by the equilibrium or disequilibrium of forces that keep the eyes properly aligned and of forces that disrupt this alignment. Clearly, the fusion mechanism and its anomalies are involved in some manner in producing comitant heterotropias.

CONCOMITANT or INCOMITANT

(LATENT)

HETEROPHORIA

ESOPHORIA (ESO, SOP)
EXOPHORIA (EXO, XOP)
HYPERPHORIA
HYPOPHORIA

INCYCLOPHORIA
EXCYCLOPHORIA

DISTANCE

NEAR

COMPENSATED

DECOMPENSATED

(MANIFEST)

HETEROTROPIA

ESOTROPIA (ESOT, SOT)
EXOTROPIA (EXOT, XOT)
HYPERTROPIA
HYPOTROPIA

CONSTANT

INTERMITTANT

UNILATERAL

ALTERNATING

RE

LE

ESSENTIAL

ACCIDENTAL

Heterophoria

Heterophoria or latent squint is defined as a condition in which eyes in the primary position or in their movement are maintained on the fixation point under stress only, with the aid of corrective fusion reflexes. When the influence of fusion is removed, the visual axis of one eye deviates.

Orthophoria is characterised by perfect alignment of two eyes in all positions of gaze and at all fixation distances so that the visual axes are parallel for distance and have proper convergence for near. Orthophoria as such is a rarity. A small amount of heterophoria is usually present.

Causes

1- Static causes or anatomical factors: Anatomical factors causing heterophoria include;

Orbital asymmetry: May be due to size, orientation and shape of orbits. .A

Interpupillary distance (IPD) abnormalities: Wide IPD is associated with exophoria and small IPD with esophoria. .B

Size and shape of globes. .C

Abnormal strength or structure of extra-ocular muscles. .D

Volume of retro-bulbar tissue, orbital fascias and ligaments. .E

Anomalous central distribution of the tonic innervations of eyes. .F

Variation to the optical axis of the eye. .G

Causes

2- Kinetic causes (physiological factors): These may be;

Age: Esophoria is common in younger age groups as compared to exophoria. Exophoria is more often seen in elderly group.

Convergence: Excessive use of convergence may cause esophoria as is seen in bilateral congenital myopes. Decreased use of convergence leads to exophoria as is present in presbyopia (age-related diminution of vision).

Accommodation: Increased accommodation leads to esophoria as is seen in hypermetropia (far-sightedness) and also in individuals doing excessive near work. Decreased accommodation is associated with exophoria as is seen in simple myopia.

Dissociation factors: Prolonged constant use of one eye may result in exophoria. This is seen in people using unocular microscope and in watchmakers using unocular magnifying glass.

Causes

3- Neurogenic causes: Lower motor neuron disease leads to incomitant heterophoria (deviations which vary with the direction of gaze) and upper motor neuron disease leads to comitant heterophoria (deviations are same in all directions of gaze for a particular fixation distance).

Practical Tips

Accommodative Heterophoria

A high AC/A ratio will tend to produce less exophoria at near, and may even produce esophoria.

A low AC/A ratio will produce greater than normal exophoria at near

Uncorrected hypermetropia may produce esophoria at distance and near

Uncorrected myopia tends to produce exophoria at near.

Signs & Symptoms of Heterophoria

Signs

When the fusional vergence system can no longer hold back heterophoria, the phoria manifests. In this condition, the eyes deviate from the fixating position.

Symptoms

Depending upon the symptoms, heterophoria may be divided into ● compensated and de-compensated types:

I. Compensated heterophoria: It is not associated with any symptoms. Compensation depends upon the reserve neuromuscular power to overcome the muscular imbalance.

Symptoms

II. De-compensated heterophoria: Symptoms arise when the fusion amplitudes are inadequate to control deviation. Even debilitating illness may precipitate symptoms in a previously asymptomatic patient. It is associated with symptoms such as:

Symptoms of muscular fatigue: These result due to continuous use of reserve neuromuscular power. Common symptoms are;

- Headache.
- Asthenopia (eyestrain).
- Photophobia (increased sensitivity to light).
- Difficulty in changing focus from near to distance and vice versa.

De-compensated heterophoria

**Symptoms due to failure in maintaining ❖
binocular single vision (BSV):** These are

- Blurring of vision.
- Crowding of words while reading.
 - Difficulty with stereopsis
 - Intermittent diplopia.
- Intermittent squint without diplopia.

De-compensated heterophoria

Symptoms due to defective postural sensations: ❖
These causes problem in judging distances and positions,
especially of objects in motion.

Heterophoria likely to be compensated if:

no symptoms are present

quick, smooth recovery after dissociation

heterophoria is of low magnitude

Px has balanced prism vergences

good stereopsis is present.

Heterophoria likely to be decompensated if:

symptoms are present

recovery movements are slow and hesitant

heterophoria is of large magnitude

binocular vision breaks down easily

Px has poor stereopsis

fixation disparity is present

Clinical types of heterophoria

Exophoria: It is characterised by a tendency of the eyes to diverge, which is checked by fusion amplitudes. It is a passive process unlike esophoria (which is an active process). An exophoria of less than 9 prism dioptres is usually not significant.

There are three types of exophoria:

- Divergence excess type.**
- Basic type.**
- Convergence weakness type.**

Clinical types of heterophoria

Esophoria: It is characterised by a tendency of the eyes to deviate inwards, which is held in check by fusion impulses. It is either due to hypermetropic refractive error or high accommodative convergence/ accommodation (AC/A) ratio or increased amount of near work.

There are three types of esophorias:

Convergence excess type.

Basic type.

Divergence weakness type.

Clinical types of heterophoria

Hyperphoria: Hyperphoria is characterised by a tendency of the eyes to deviate upwards in a vertical direction, which is held in check by fusion amplitudes.

Hypophoria: Hypophoria is characterised by a tendency of the eyes to deviate downwards in a vertical direction, which is held in check by fusion amplitudes.

Clinical types of heterophoria

Cyclophoria: Cyclophoria is characterised by a tendency of the eyes to rotate around their sagittal axis (antero-posterior), which is held in check by fusion amplitudes. This can be divided into two categories;

Incyclophoria: Incyclophoria is characterised by inward rotation of the upper pole of the cornea.

Excyclophoria: Excyclophoria is characterised by outward rotation of the upper pole of the cornea.

Anisophoria: Anisophoria is that type of heterophoria in which the degree of muscular imbalance varies with the direction of conjugate gaze.


Diagnosis

There are different methods for diagnosis of heterophorias. There is no reason to believe that heterophorias are of smaller magnitude as compared to heterotropia. Heterophoria may be as large as 25° and heterotropia may be as small as 5° (microtropia). Nature of deviation depends upon the degree of fusion amplitude.


Examination of patient comprises of detailed history and determination of refractive error (retinoscopy) under cycloplegia. Ocular movements should also be tested in all positions of gaze. Important tests in the evaluation of heterophoria include

Diagnosis

Cover- Uncover test:

It should be performed for both distance and near. One eye of the patient is covered while fixating with other eye at a distant target. The eye is then uncovered and any movement of the eye to take up fixation is noted. 

The test is repeated with other eye. The direction of deviation, the degree of deviation and speed of recovery is noted. 

If the right eye is deviated while under cover, a re-fixation movement (recovery to Binocular single vision) is observed on being uncovered. 

Adduction of the right eye indicates exophoria and abduction esophoria. 

Upward or downward movement indicates a vertical phoria.

After the cover is removed, the speed and smoothness of recovery indicates the strength of motor fusion. 

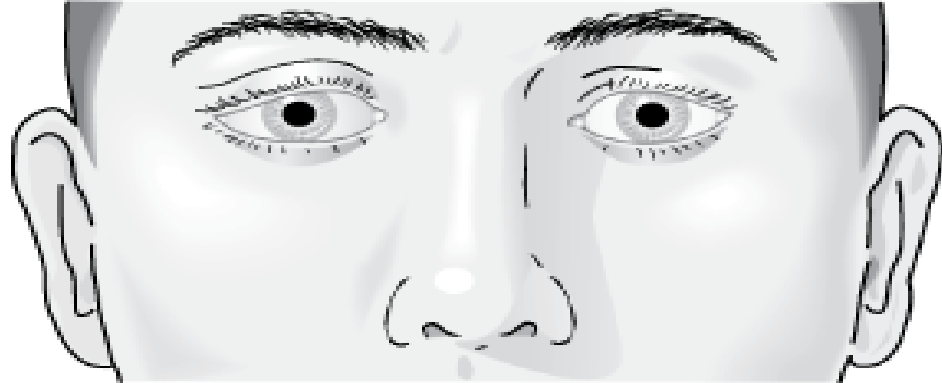
Diagnosis

Alternate cover test: ●

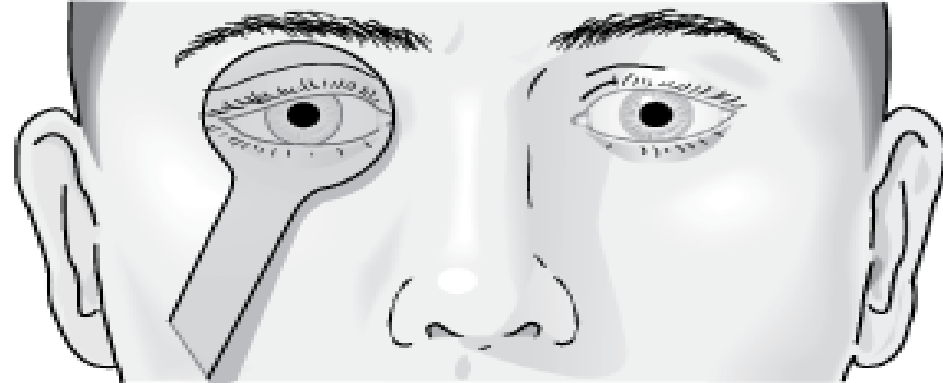
The alternate cover test induces dissociation to reveal total deviation when fusion is disrupted. It is performed after cover-uncover test. The occluder is shifted quickly back and forth from one eye to other, several times.

After the cover is removed, the speed and smoothness of recovery is noted as the eyes return to their pre- dissociated state.

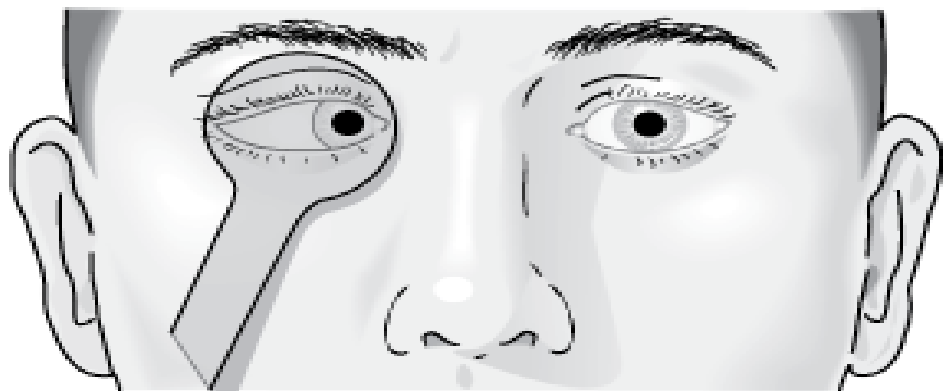
A patient with well compensated heterophoria will have straight eyes before and after the test has been performed, whereas a patient with poor control may decompensate to manifest deviation.



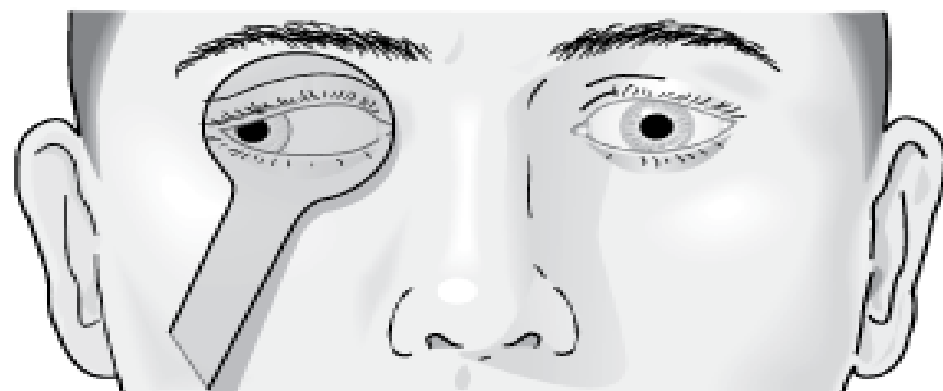
Eyes straight (maintained in position by fusion).



Position of eye under cover in orthophoria (fusion-free position). The right eye under cover has not moved.



Position of eye under cover in esophoria (fusion-free position). Under cover, the right eye has deviated inward. Upon removal of cover, the right eye will immediately resume its straight-ahead position.



Position of eye under cover in exophoria (fusion-free position). Under cover, the right eye has deviated outward. Upon removal of the cover, the right eye will immediately resume its straight-ahead position.

Source: Riordan-Eva P, Cunningham E: *Vaughan & Asbury's General Ophthalmology*, 18th Edition: <http://www.accessmedicine.com>

Diagnosis

Maddox rod test:

The Maddox rod consists of a series of fused cylindrical red glass rods that convert the appearance of a white spot of light into a red streak.

The optical property of the rod causes the streak of light to be at an angle of 90° with the long axis of the rods. The Maddox rod is placed in front of one eye and the patient fixates with both eyes on a spot of light.

The patient is asked whether the streak produced by the Maddox rod passes through the fixation light seen by the other eye.

When the rod is placed horizontally, a vertical streak is produced and it gives an idea about exophoria or esophoria. But a vertically placed rod produces a horizontal streak, and it delineates hyper- or hypophoria.

Prisms may be inserted in front of one eye to make the streak pass through the point of fixation, which estimates the degree of error. A Maddox tangent scale placed at one meter or five meters may be used to measure the degree of heterophoria directly from the scale.



Up gaze



What the patient sees



What the patient sees



What the patient sees



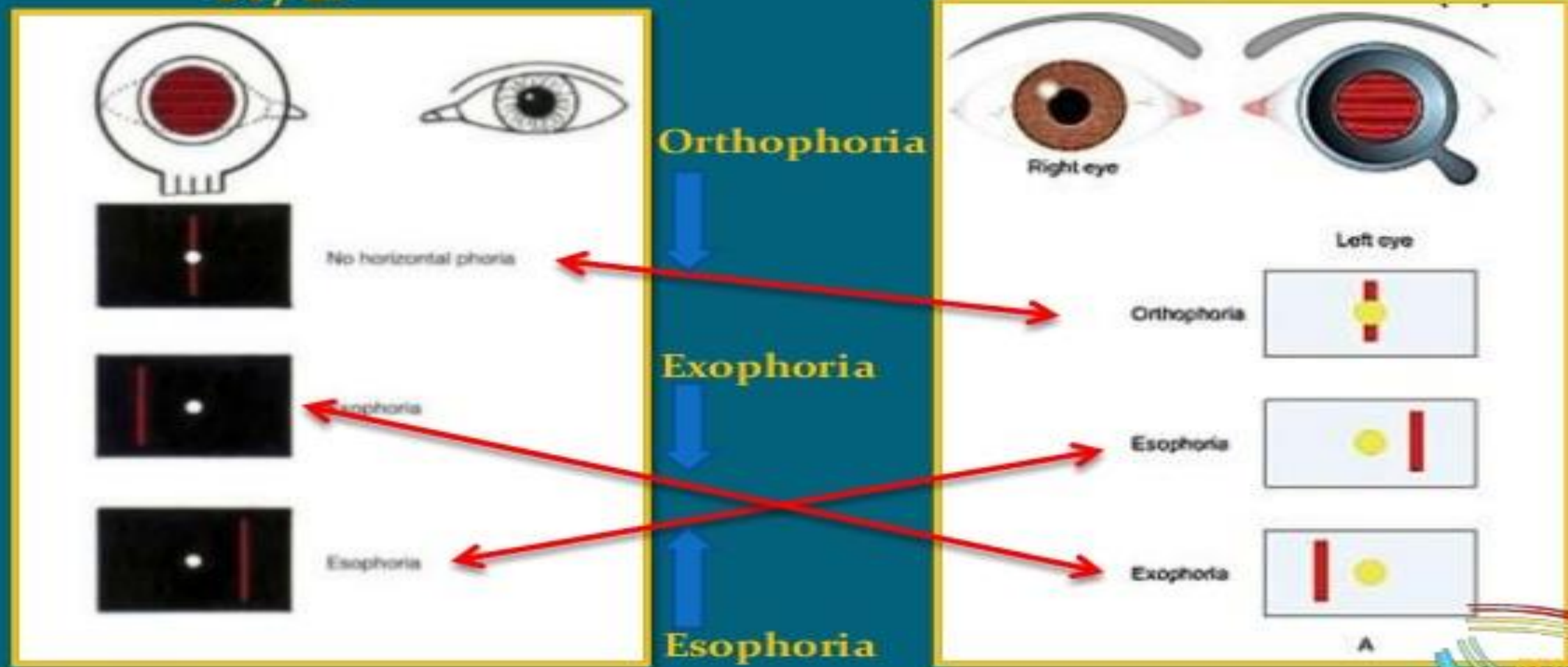
Down gaze

Fig. 13.34 Maddox rod test—no vertical deviation. The Maddox rod is placed in front of the right eye, with the cylinders oriented vertically. The patient sees a white light and a horizontal red line when looking at the examiner's light.

Method of assessment

R/E

L/E



Right gaze



Straight



Left gaze



What the patient sees



What the patient sees



What the patient sees



Fig. 13.35 Maddox rod test—right abduction deficit (esodeviation). When the Maddox rod with cylinders oriented horizontally is placed in front of the right eye as the patient gazes straight ahead, a vertical red line appears 1 inch to the right of the white light. In right gaze, the vertical red line appears 3 inches to the right, and in left gaze, the vertical red line intersects the white light.

Diagnosis

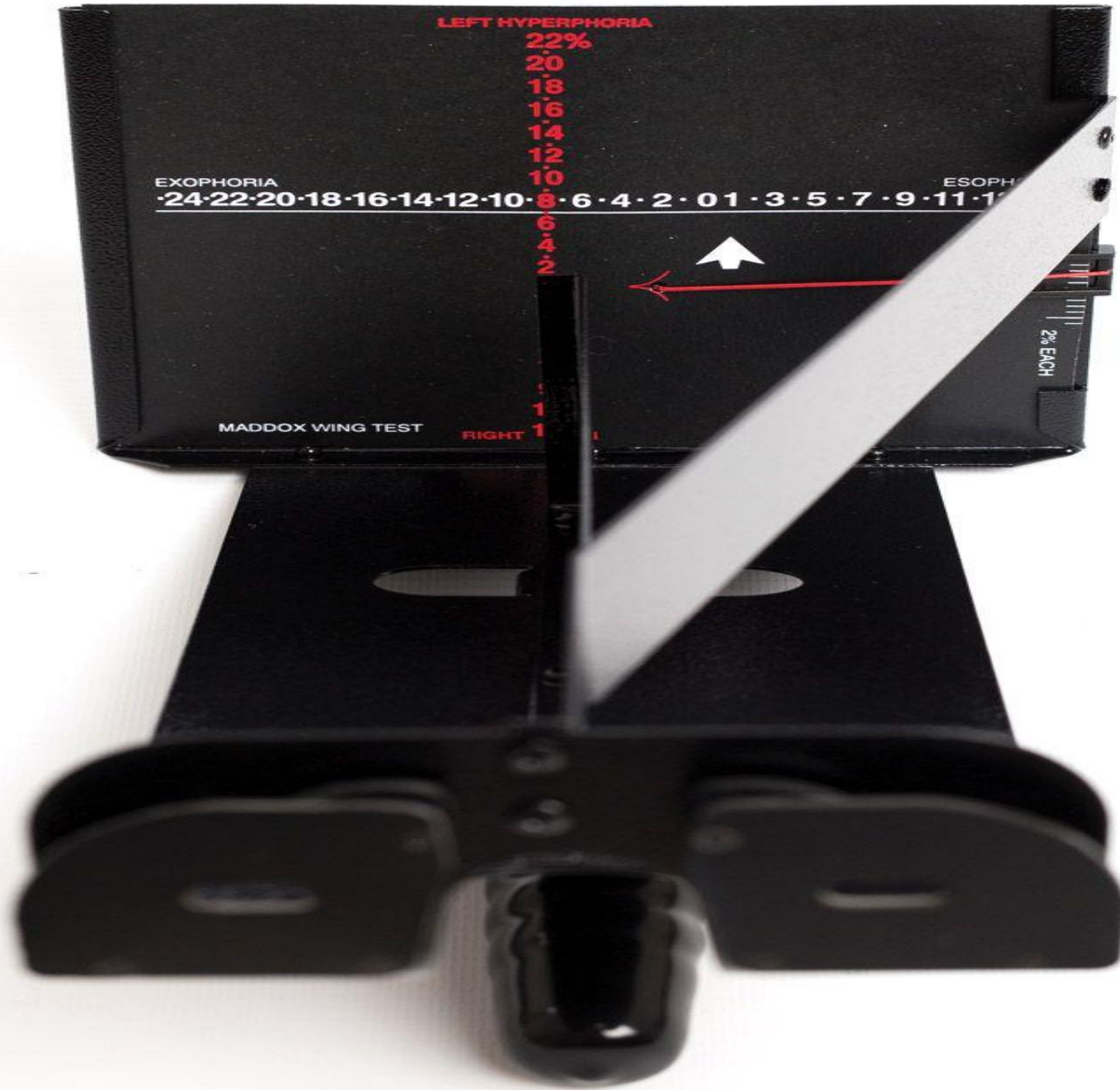
Maddox wing test: ○

This is used to measure degree of heterophoria at near fixation. The instrument is constructed in such a way that the right eye sees only a white vertical arrow and a red horizontal arrow, whereas the left eye sees only horizontal and vertical rows of numbers. ❖

Patient rests the front piece of Maddox wing on nose and looks through the slit in eyepieces. Right eye of patient sees white scale and the left eye sees arrow. ❖

The number on scale through which white arrow passes, gives the measurement of horizontal heterophoria. ❖

Similarly, reading on vertical scale measures vertical phorias. Cyclophoria may be found by adjusting shaft of red arrow parallel to the horizontal scale. ❖



LEFT HYPERPHORIA

22%
20
18
16
14
12
10
8
6
4
2

EXOPHORIA

-24 · -22 · -20 · -18 · -16 · -14 · -12 · -10 · -8 · -6 · -4 · -2 · 0 · 1 · 3 · 5 · 7 · 9 · 11 · 13

ESOPHORIA

MADDOX WING TEST

RIGHT

2% EACH

LEFT HYPERPHORIA

22 Δ

20

18

16

14

12

10

EXOPHORIA

22 Δ 20 18 16 14 12 10 8 6 4 2 0 1 3 5 7 9 11 13 15 Δ

11 13 15 Δ

6 4 2 0 2 4 6 8 10 12 14 16 18 20 22 Δ

RIGHT

HYPERPHORIA



INCY

EXCY
FLUCH

ENGLAND

INST. No 1370
MADDOX WING TEST

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Diagnosis

Synoptophore: This may also be used to measure degree of  heterophoria.



Treatment of Heterophoria

Treatment is indicated for decompensated heterophoria. ●

Lesser degrees of heterophoria without any symptoms require no treatment except for correction of refractive error, if present.

They are divided in to two groups; ●

Medical therapy □

Surgical therapy □

Treatment of Heterophoria

Medical therapy are divided in to three categories; 

Optical .1

Orthoptics .2


Miotic drugs .3

Treatment of Heterophoria by opticals

Esophoria:

Full correction of the refractive error is given to the patient when refraction shows significant amount of hypermetropia (+1.25 dioptries or more). 

Patients with high AC/A ratio and a symptomatic esophoria without hypermetropia may be treated with miotics or bifocal glasses. 

Base-out prisms for visual comfort in patients with non-accommodative esophoria. To prevent total inactivity of fusion divergence mechanism, one-half to one-third only of the angle of deviation is corrected. This does not correct underlying cause of latent deviation. It is used mainly in elderly patients with symptomatic esophoria who do not respond to orthoptic treatment. It may also be used in younger patients prior to surgery. 

Treatment of Heterophoria by opticals

Exophoria: ○

Patients without asthenopia do not require any treatment. ❖

Significant refractive errors, especially anisometropia, aniseikonia, aphakia, intraocular lens (IOL) with wrong power (pseudophakia), and astigmatism, should be treated to produce sharp retinal images which increase stimulus to fuse. ❖

Hypermetropia of less than 2 Dioptres may be left uncorrected in children, though in older patients this needs to be corrected to avoid asthenopia. ❖

Exophoria treatment cont.

Presbyopia patients are given the weakest bifocal lenses which provide comfortable near vision. ❖

Half of exodeviation may be treated with base-in prisms for near vision. ❖

Myopic errors are fully corrected. ❖

Minus lenses may decrease exodeviation in patients with high AC/A ratio. ❖

Exophoria treatment cont.

In younger children with convergence insufficiency exodeviation, minus lenses as lower segment bifocals may be tried, as a temporary measure.

In divergence excess exodeviation, minus lenses as upper segment bifocals may be tried.

Prisms may be used for postoperative overcorrection of exodeviation. It is sometimes used preoperatively to enforce bifoveal stimulation.

Treatment of Heterophoria by opticals

Hyperphoria: ●

Prisms in glasses may also be tried in selective cases of hyperphoria. The prism is prescribed with the apex toward the direction of hyperphoria to correct one-half or at the most two-third of heterophoria only.

Treatment of Heterophoria

Orthoptics:

This is the mainstay of treatment. Patients with moderate degrees of exophoria or esophoria who have fair degree of binocular function, orthoptic exercises are the treatment of choice.

Patients with convergence insufficiency are given convergence exercises on synoptophore.

Likewise, patient with divergence insufficiency are given divergence exercises.

Treatment of Heterophoria

Miotic drugs: ●

Miotic drugs may be useful in near esophoria due to high AC/A ratio. These facilitate peripheral accommodation so that less than normal innervation is required and consequently less than normal accommodative convergence occurs.