Hypertropia

Dr. AMEER Moh.

F.I.B.M.S./ C.A.B (Ophthalmology)

classification

A-Depending upon constancy of deviation

- Hyperphoria
- Intermittent hypertropia
- Hypertropia

B- direction of deviation

in the non-fixing eye

Hypertropia

Hypotropia

Depend up-on comitance of deviation

I-comitant vertical deviations

-Induced(refractive)

-End result of long-standing

-paralytic deviation

II-Incomitant vertical deviations

-Apparent oblique muscle dysfunction

-Paretic vertical deviations

-Restrictive vertical deviation

III. Dissociated vertical deviation (DVD)

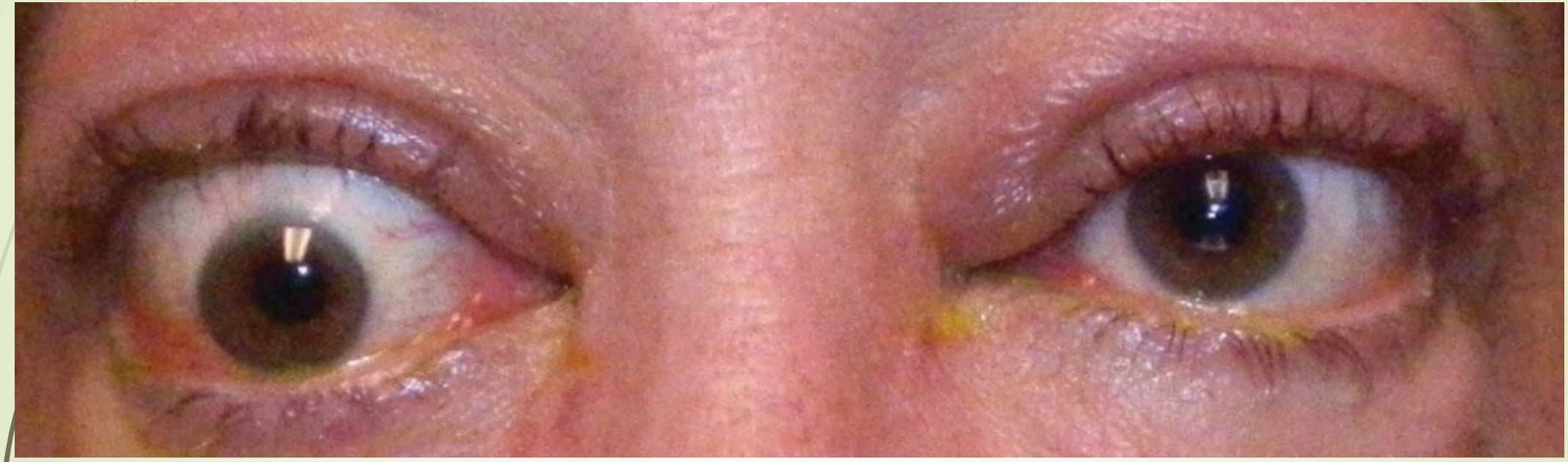
Etiology

- Vertical misalignments of the eyes typically result from dysfunction of the vertical recti muscles (inferior and superior rectus) or of the oblique muscles (the inferior oblique and superior oblique).
- More rarely, they are caused by abnormal positioning of the horizontal rectus muscles. Muscle dysfunction may result from paresis, restriction, over-action, muscle malpositioning, and dysinnervation.

Due to muscle restriction or over-action

- Thyroid Eye Disease: Thyroid eye disease leads to enlargement of the extraocular muscles and restrictive strabismus. Although any extra-ocular muscle can be involved, the inferior rectus is the most frequently affected, followed by the medial rectus muscle.
- Associated findings include: Intraocular pressure may increase when looking away from the restriction, proptosis, lid retraction, compressive optic nerve dysfunction, conjunctival hyperemia, chemosis, and corneal affections due to exposure

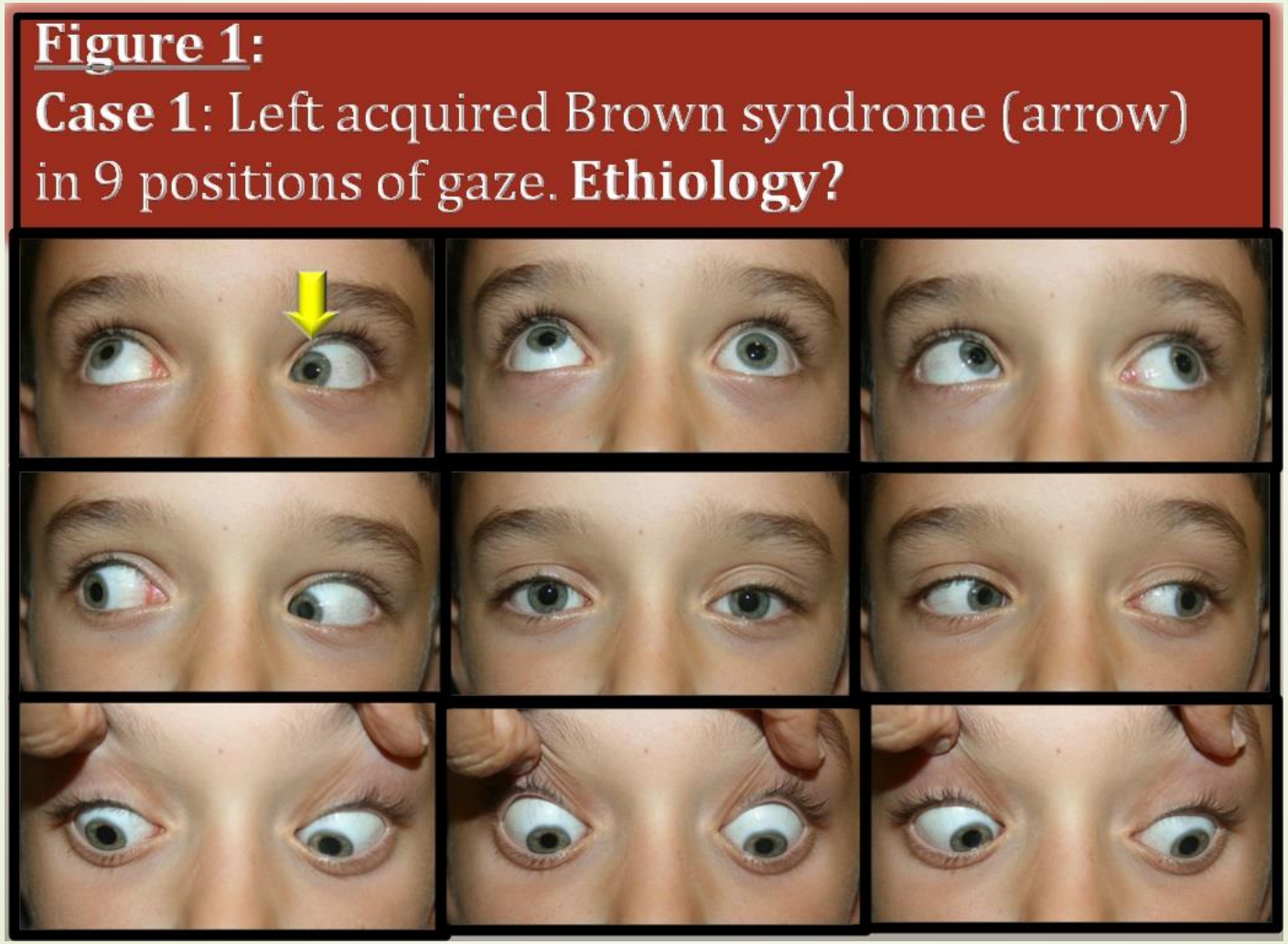
Due to muscle restriction or over-action



Due to muscle restriction or over-action

- Brown Syndrome: Poor movement of the superior oblique tendon through the trochlea leads to limited elevation of the eye in adduction, frequently with an associated exotropia in up-gaze.
- Congenital (Ex.: Inelasticity of the SO muscle-tendon complex; pseudo-Brown's syndrome due to inferior orbital adhesions; inferior displacement of the lateral rectus).
- Iatrogenic (Ex.: Following glaucoma, oculoplastics or strabismus surgery; ENT surgery)
- Inflammation of the trochlea (Ex.: Rheumatoid arthritis; systemic lupus erythematosus)
- Traumatic
- Nasal sinus infection

Due to muscle restriction or over-action



Inferior Oblique Overaction

- Over-elevation of the eye in adduction
- Other features: If primary and bilateral, it gives rise to a Y-pattern, with divergence in upgaze; if secondary, i.e. due to a paresis of another vertical muscle, it may give rise to a V pattern, with additional convergence in downgaze.
- When it is primary (not related to a paresis of another vertical muscle), the head tilt- test is negative (the superior rectus and oblique muscles are ‘’working’’).
- It is frequently bilateral and associated with a horizontal strabismus, although it may be isolated.

Superior Oblique Overaction

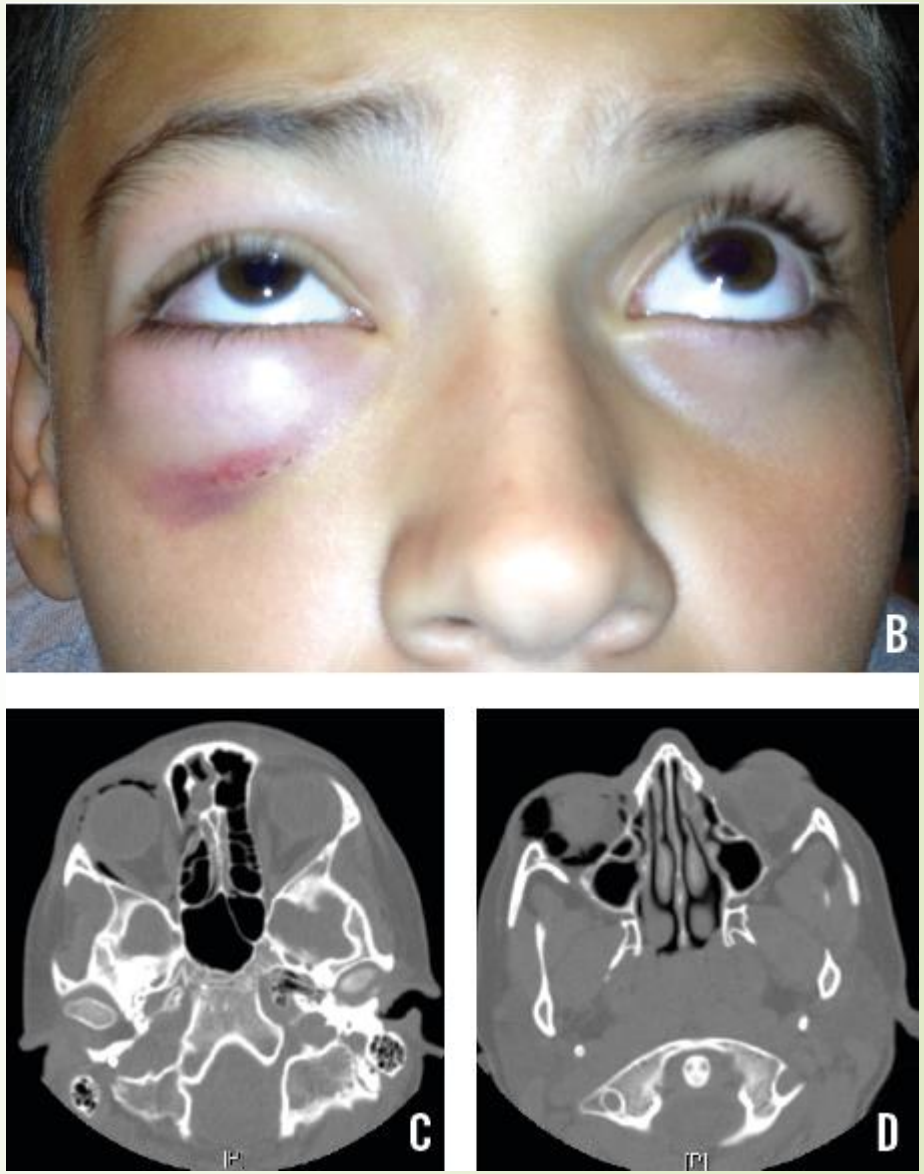
- Vertical deviation, that increases on adduction of the affected eye. Ex.: A left superior oblique overaction causes a right hypertropia on right gaze, intorsion and abduction in downgaze.
- If congenital, the intorsion is frequently only objective and not subjective, since there is sensory adaptation. It frequently coexists with an underaction of the contralateral IR and intermittent exotropia.

Superior Oblique Overaction

- Sometimes it can give rise to an acquired Brown's syndrome, due to SO contracture.
- A vertical deviation in primary position is more frequently associated with a unilateral or asymmetric SO paresis.
- When bilateral, it frequently gives rise to lambda-pattern (λ), with accentuated exotropia in downgaze.

Orbital Causes of Vertical Restriction

- Orbital wall (blowout) fracture with entrapment, orbital mass, and orbital or extraocular muscle inflammation can lead to vertical strabismus



Due to a weak muscle

- Unilateral Superior Oblique Paresis
- Bilateral Superior Oblique Paresis
- Superior Rectus Underaction
- Monocular Elevation Deficit Syndrome (MEDS)
- Inferior Rectus Underaction

Unilateral Superior Oblique Paresis

- Hypertropia that increases on adduction and with ipsilateral head tilt. Ex.: Left superior oblique paresis causes a left hypertropia on right gaze and head tilt to the left. (BOOT-WOOG)
- It is the most common cause of an isolated vertical deviation.
- Other features: Mild extorsion (<10°); compensatory head tilt to the contralateral side and face turn towards the contralateral shoulder, sometimes associated with a facial asymmetry; contralateral inferior rectus overaction (“fallen eye’’); large vertical fusional amplitudes when congenital.

Bilateral Superior Oblique Paresis

- Left hypertropia in right gaze and left tilt, right hypertropia in left gaze and right tilt, the hypertropia is less evident than in unilateral superior oblique paresis.
- Larger extorsion than in unilateral paresis (>10°); esotropia increasing in down gaze (>10°) – V pattern of the "arrow subtype'.

Monocular Elevation Deficit Syndrome (MEDS)

- Monocular elevation deficiency (previously termed double-elevator palsy) involves a limitation of upward gaze with a hypotropia that is similar in adduction and abduction.
- There are 3 forms of this motility pattern, each with a different cause: restriction of the inferior rectus muscle; deficient innervation of elevator muscles (paresis of 1 or both elevator muscles or a monocular supranuclear gaze disorder); a combination of restriction and elevator muscle deficit

Monocular Elevation Deficit Syndrome (MEDS)

- The clinical features of each form of monocular elevation deficiency are as follows:
- Restriction: ■ positive forced duction on elevation ■ normal force generation and saccadic velocity (no muscle paralysis) ■ often an extra or deeper lower eyelid fold on attempted upgaze ■ poor or absent Bell phenomenon.
- Elevator muscle innervational deficit: ■ negative forced duction on elevation ■ reduced force generation and saccadic velocity ■ preservation of Bell phenomenon (indicating a supranuclear cause) in many case

Monocular Elevation Deficit Syndrome (MEDS)

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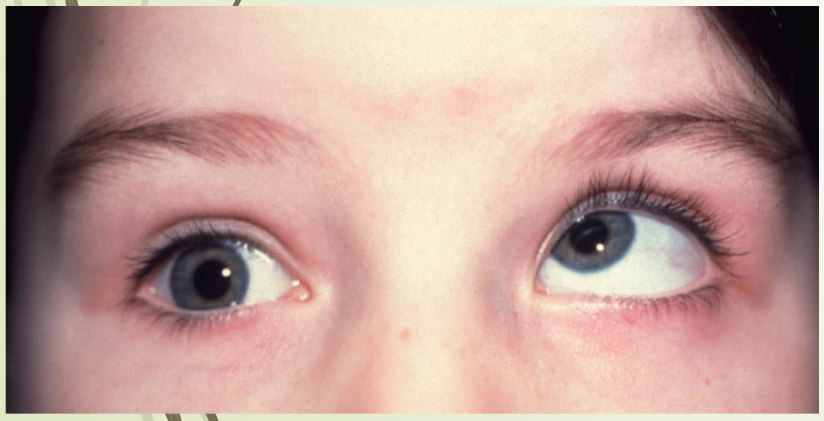
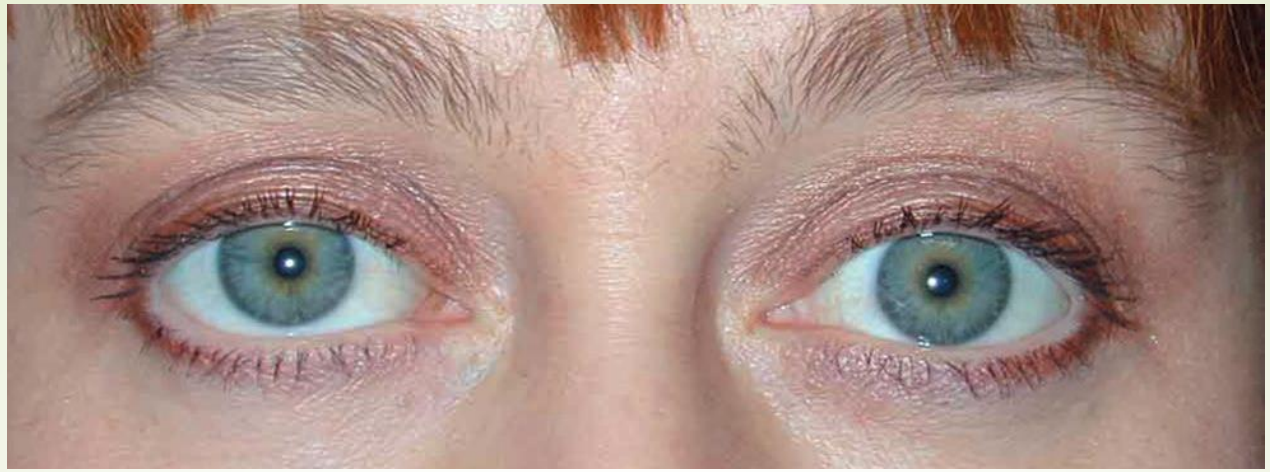


Dissociated Vertical Deviation

- A dissociated vertical deviation is an upward drift of one eye when binocular fusion is interrupted (such as with alternate cover testing) that is not associated with a compensatory downward shift of the fellow eye when attention is focused on the drifting eye.
- For example, on alternate cover testing, the right eye would drift upward when covered and be seen to come down when the left eye is covered. When the cover is switched back to the right eye again, there is NO upward refixation movement of the left eye.

Dissociated Vertical Deviation

- Other features: Abduction and extorsion. Increased vertical deviation on head tilt to the ipsilateral side.
- Most frequently both eyes are affected, although it may be asymmetrical . When bilateral, the vertical deviation of each eye is not related to the other, as in true hypertropia (no yoke muscle overaction is present)
- Any cause leading to a disruption of normal binocular development can be at its origin.



Signs and Symptoms

- Suppression: typically happens when the deviation starts in the early years of life (before 6 years of age)
- Diplopia: Occurs when the deviation is acquired after a significant maturation of the visual system (7 to 8 years of age), when suppressive mechanisms are usually no longer initiated
- Confusion: Two images are perceived in the same location, due to a misalignment of retinal correspondence points on the fovea.

Signs and Symptoms

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Diagnosis

Sensorimotor Testing

- The degree of misalignment should be determined for at least primary, horizontal, and vertical gazes and in head tilt.
- Torsion can be testing with the double maddox rod test.
- Haplosopic testing can be performed to evaluate for the ability to fuse in the setting of torsion.
- Worth 4 dot and Bagolini lenses can be used to evaluate for suppression.

Differentiating between a Paresis and a Restriction of the Antagonist

- **Forced Duction Test:** can evaluate for evidence of restriction and possibly of laxity in the setting of a muscle palsy
- **Saccadic Eye Movements:** In the case of a restriction, normal saccadic eye movements can be observed until the full restrictive amplitude is achieved, where it stops abruptly. In the case of a palsy, saccadic velocity and force generation are decreased
- **Intraocular Pressure:** Restrictions may lead to increase IOPs when the eye is moving against the restriction. (differential IOP)
- **Lid fissure:** Restrictions may cause lid fissure narrowing, while a paresis causes lid fissure widening.

Three Step Test for Cyclovertical Muscle Palsy

1. Determine which eye is hypertropic

The impacted muscle will be a depressor of the higher eye (inferior rectus or superior oblique) or a elevator of the lower eye (superior rectus or inferior oblique)

Three Step Test for Cyclovertical Muscle Palsy

2. Determine in which horizontal gaze the hypertropia is worse
   - If worse in left gaze, the oblique muscles in the right eye or the vertical recti in the left eye are affected
   - If worse in right gaze, the oblique muscles in the left eye or vertical recti in the right eye are affected

Three Step Test for Cyclovertical Muscle Palsy

3. Determine in which head tilt the deviation is the worse
   - If worse in right tilt, the right eye intorters (superior oblique and superior rectus) or left eye extorters (inferior oblique and inferior rectus) are affected
   - If worse in left tilt, the left eye intorters (superior oblique and superior rectus) or right eye extorters (inferior oblique and inferior rectus) are affected

Three Step Test for Cyclovertical Muscle Palsy

The tree-step-test is not diagnostic when more than one muscle is affected or there is a restrictive cause;

- A paresis of more than one vertical muscle,
- contracture of the vertical recti,
- previous vertical muscle surgery,
- skew deviation,
- myasthenia gravis,
- dissociated vertical deviation and
- small vertical deviations associated with horizontal strabismus.

Vertical Strabismus Exam Findings by Etiology

Cause	Deviation and Motility	Pattern	Torsion	Deviation with head tilt	Forced Duction Testing	Other
Brown Syndrome	Elevation deficit and VS worst in adduction, occasional over-depression in adduction	None, Y, or V	None	No	Limited elevation in adduction	
Inferior oblique palsy	Elevation deficit and VS worst in adduction	A	Intorsion	Worse with contra-lateral tilt		Associated superior oblique over-action

Parks three-step test

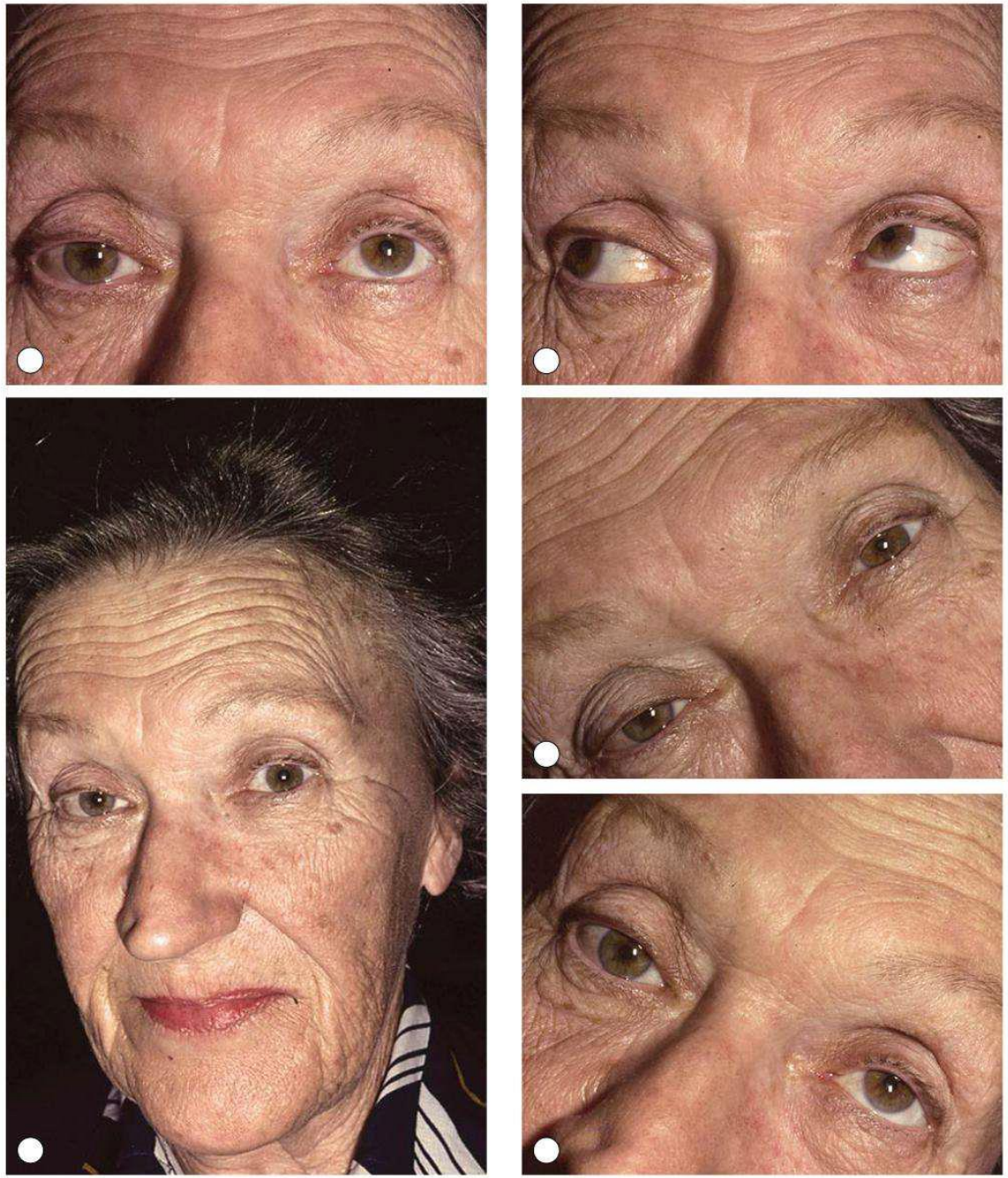
is clinical test allows isolation of a single weak muscle in patients with vertical diplopia of acute onset. It is inaccurate in some circumstances, including patients who have undergone previous extraocular muscle surgery.

1- Step one. In the primary position, the hypertropic eye is identied, narrowing the affected muscle to one of the depressors of the hypertropic eye (superior oblique or inferior rectus) or one of the elevators of the hypotropic eye (superior rectus or
inferior oblique). In a fourth nerve palsy, the involved eye is higher (see Fig. 19.70A).

2- Step two. the eyes are examined in right and left gaze to determine where the hypertropia is greater, thus assigning the weakness to the two of the four previously identifed muscles having the greatest vertical action in that position. In superior
oblique weakness (see Fig. 19.70B) the deviation is worse on opposite gaze – **WOOG.**

3- Step three

the Bielschowsky head tilt test (BHTT) is performed with the patient fxating on a target directly ahead, optimally at 3 metres (see Fig. 19.70D and E).
the head is tilted to each side in turn in order to assess the muscles responsible for cyclotorsion, with observation to determine the position in which the hypertropia is worse.
On tilt to one side, the superior oblique and superior rectus (note that both are superior) muscles of the eye of that same side correctively intort and the inferior rectus and inferior oblique (note both are inferior) of the contralateral eye correctively extort. From the two muscles previously
isolated, one can be eliminated.
{ In fourth nerve palsy the deviation is better on opposite tilt – BOOT (see Fig. 19.70D).
In practice, as the threestep test is almost always employed to confrm a fourth nerve palsy, the BHTT alone is often suffcient for a working diagnosis.



Left fourth nerve palsy.
A) Left hypertropia (left over right) in the primary position;
B) increase in left hypertropia on right gaze due to left inferior oblique overaction;
C) compensatory head posture; head tilt to right, face turn to the right and chin depressed;
D) no hypertropia on right head tilt;
E**) marked hypertropia on left head tilt**: positive Bielschowsky test.