



Clinical evaluation *in patients of* **Vertigo / Imbalance**



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MAINTENANCE of BALANCE (Physiology)



- CNS collects information about static / dynamic position of the body in relation to the ground and the surroundings from certain sensors in different parts of the body
- ↓
- Information from different sensors integrated in the brain and **compared with previously stored experiences**
- ↓
- A very precise, coordinated and accurately timed motor output generated reflexly which contracts some specified muscles and restores balance. 2

Physiology of Balance

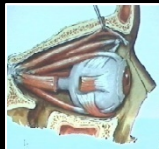


- Afferent SENSORY system
(inputs to the balance system)

- Vestibular labyrinths



- Eyes



- Proprioceptors



- Efferent MOTOR system
(output generated by the brain)

- Directed to-

- Muscles of LIMBS / TRUNK /NECK through VESTIBULOSPINAL system.

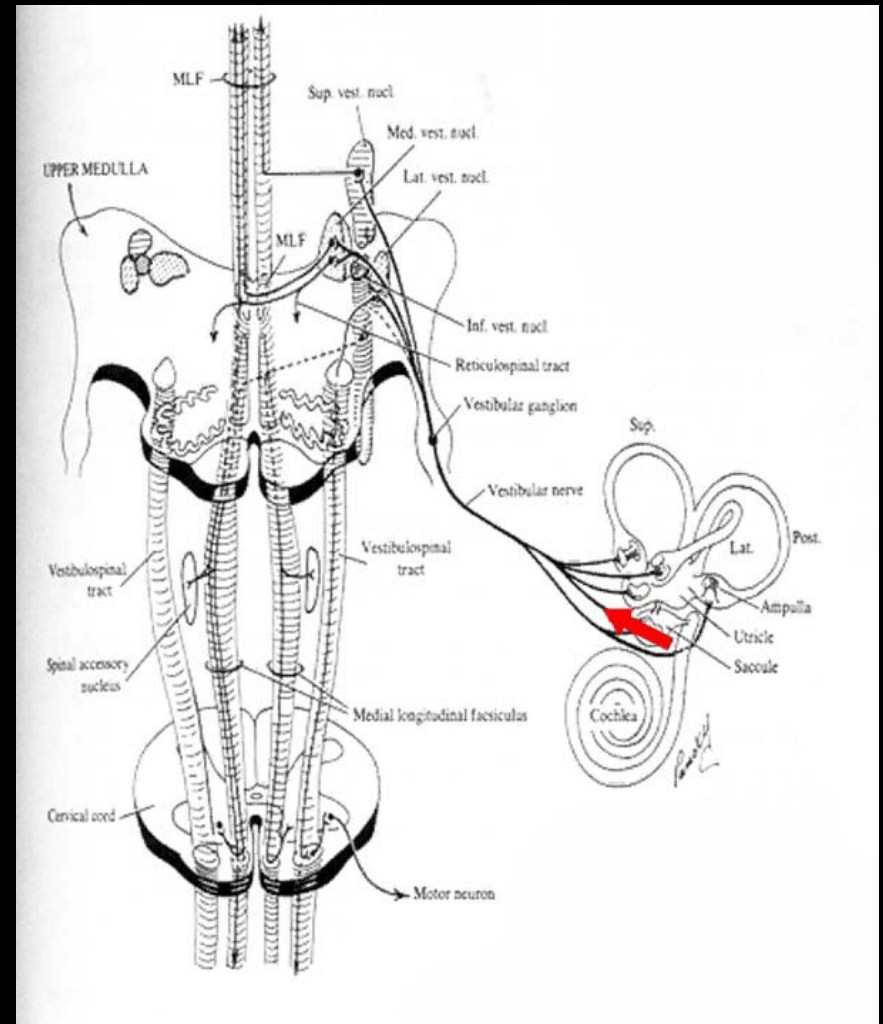
- Muscles of the EYES through VESTIBULO-OCULAR system.

- *Cerebellum fine tunes the motor output*

- *Cognitive system determines the nature of the response*

The Reflex Pathway

- *Afferent Sensory organ*
- *Afferent Neural pathway*
- *Center of reflex in brainstem*
- *Efferent neural pathway*
- *Effector motor organ*



RIGHT



...NORMAL...

LEFT



- Sensation of VERTIGO is caused when there is a disparity in the electrical discharge from the 2 vestibular labyrinths. Hence severe vertigo is felt if one vestibular labyrinth is damaged



...VERTIGO...



- If both vestibular labyrinths are damaged, INSTABILITY and not vertigo is the primary symptom. This happens because the vestibular system becomes insensitive to any destabilizing force



...INSTABILITY

...



Physiological processes that need to be tested:-

- VESTIBULO SPINAL reflex system
- VESTIBULO OCULAR reflex system
- CEREBELLAR system
- COGNITIVE system
- Central and peripheral nervous system



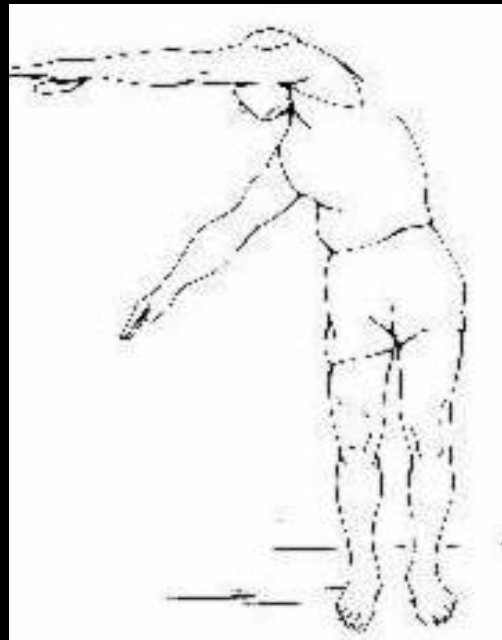
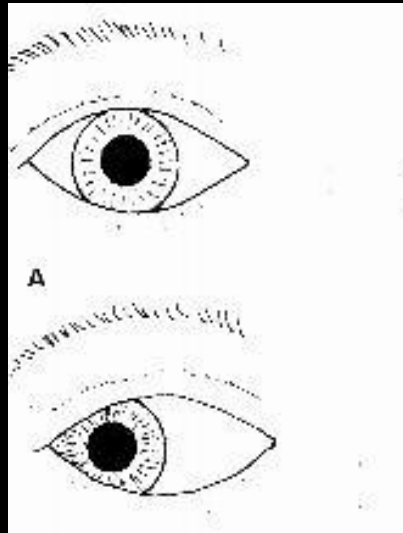
The perfect functioning of all these systems and the structural / functional integrity of the neural pathways have to be ascertained while investigating the balance system

What do we need to find out?

- Is the balance system serving the functions of :-
 - 1) *Gaze Stabilisation ;*
 - 2) *Perfect perception of the vertical and horizontal ;*
 - 3) *Postural stability ?*
- Are the sensory system (inputs to the balance system) and the motor output systems in perfect order structurally and functionally?
- Are the neural pathways that connect the different structures in order?

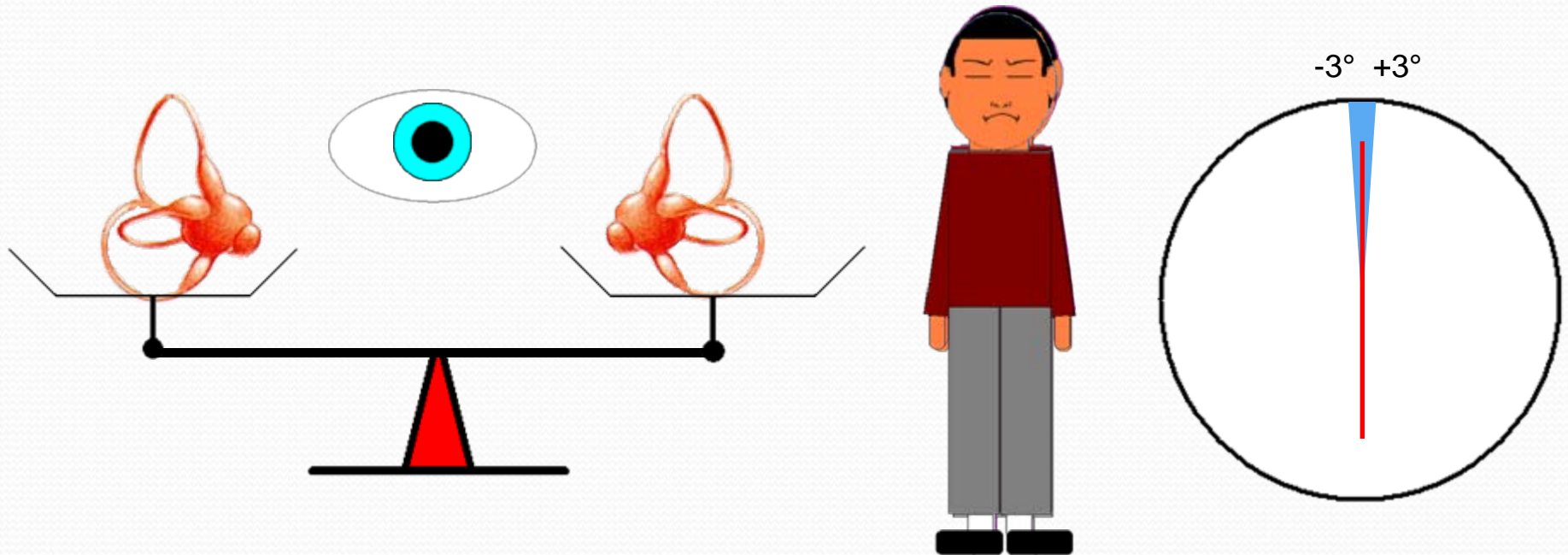


Vestibular labyrinth exerts a tonic contraction of the eye / body muscles by virtue of which eyes stay in the midline and body maintains erect posture



In a Vestibular damage of the left side

- in case of sudden & uncompensated left vestibulopathy, the healthy right labyrinth takes the upperhand; *there is a RIGHT beating nystagmus, patient falls towards the LEFT, sense of verticality tilts toward this affected i.e., LEFT side..*



-in case of a compensated vestibular deficit and in slowly progressive vestibular deficit, *the nystagmus disappears or is absent, the patient gradually becomes steady & does not fall towards the affected side and sense of verticality returns*

In a Central vestibular damage

Patients usually get

- an instability
- difficulty in walking without support
- weakness of the limbs
- usually no spinning or rotating sensation





Evaluation of a patient of vertigo / imbalance is done by a 3 pronged approach

- History Taking
- **Clinical examination**
- Investigations



To assess the balance system

we have to test-

1. Parts of central & peripheral nervous system
esp the oculomotor system.
2. The vestibulo-spinal reflex system.
3. The vestibulo-ocular reflex system.
4. The cerebellar system.

Clinical Tests in Neurology

- # Thorough clinical exam of the EARS*
- # Brief exam of CRANIAL NERVES.*
- # Brief exam of NEUROLOGICAL system*
deep tendon reflexes / Babinski sign /
muscle strength / sensory test of face and limbs
- # Thorough exam of **BALANCE SYSTEM.***



Thorough exam of BALANCE SYSTEM

- ☞ Tests of the limbs & trunk to assess VESTIBULO-SPINAL system.
- ☞ Tests for eye movements to assess VESTIBULO-OCULAR system.
- ☞ Tests to assess CEREBELLAR function
- ☞ Tests to assess OCULOMOTOR function



TESTS of the LIMBS & TRUNK (VESTIBULO-SPINAL tests)

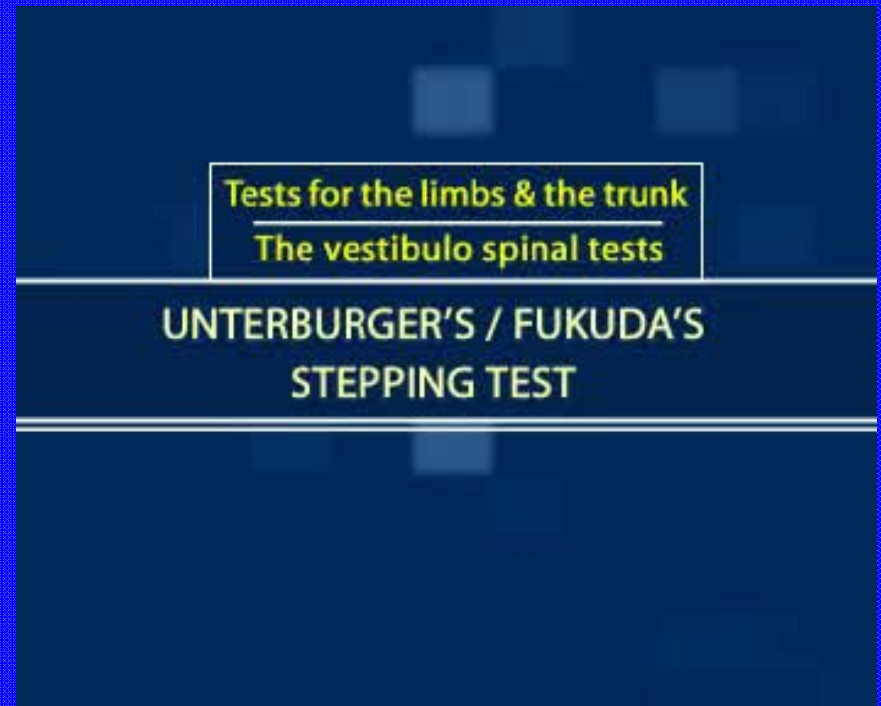
1. Standing test / Romberg's test.
2. Walking test.
3. Unterburger's Stepping test.
4. Past pointing test.
5. Fukuda's Writing test.
6. Tests for Incoordination (cerebellar tests)
 - finger nose test.
 - heel knee test.
 - rapidly alternating tasks test

VESTIBULO-SPINAL TESTS

Unterburger's Stepping Test

Pt. steps on the same spot 90 times in 1 min. with eyes closed and arms extended.

Rotation / Deviation / Side to side sway looked for.

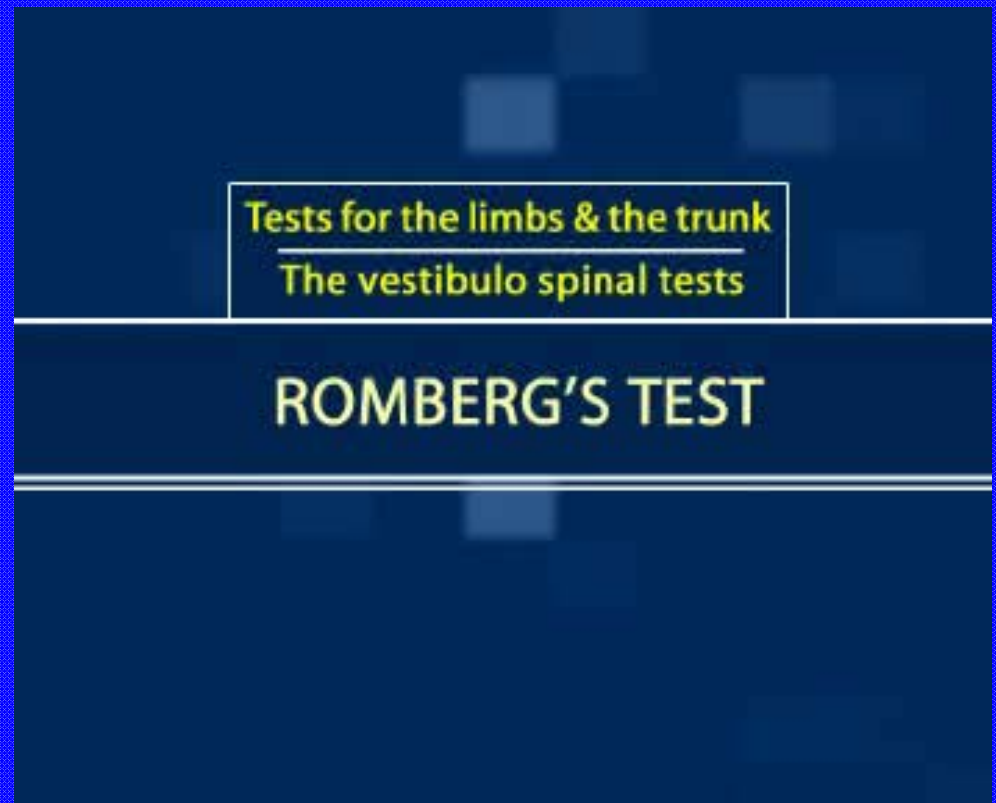


VESTIBULO-SPINAL TESTS

Romberg's Test

*Pt. stands with eyes closed
and feet close together.*

*- any tendency to fall looked for
- just gyrations are not abnormal*



VESTIBULO-SPINAL TESTS

The Cerebellar Tests *(tests for incoordination)*

- *Finger Nose Test*
- *Rapidly Alternating Task Test*
- *Heel Knee Test*

FINGER-NOSE TEST
&
HEEL-KNEE TEST

Thorough exam of BALANCE SYSTEM

- ☞ Tests of the limbs & trunk to assess VESTIBULO-SPINAL system.
- ☞ Tests for eye movements to assess VESTIBULO-OCULAR system.

Abnormal Spontaneous Eye Movements

Vestibular system exerts a tonic contraction of the extra-ocular muscles. Hence, disorders of the vestibular system usually cause abnormal involuntary eye movements

Evaluation of abnormal spontaneous eye movements is an important part of clinical evaluation of the balance system

TESTS for eye movements

(VESTIBULO-OCULAR tests)

1. Abnormal spontaneous eye movements
2. Abnormal provoked eye movements.

VESTIBUL-OCULAR TESTS

Types of abnormal spontaneous eye movements

Nystagmus

Ocular bobbing

Ocular flutter

Ocular myoclonus

Opsoclonus



OCULAR-BOBBING

OCULAR-FLUTTER

OCULAR-MYOCLONUS

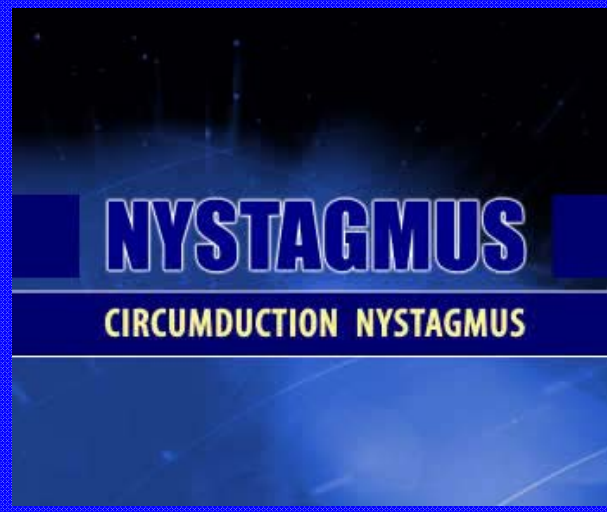
Characters of nystagmus

special types of nystagmus

Disconjugate nystagmus



Circumduction nystagmus



Nystagmus in one eye



Characters of nystagmus

special types of nystagmus



NYSTAGMUS

The diagram shows a dark background with a grid of light points. A series of white lines represent the path of the eyes, showing a series of upward jumps (saccades) followed by slower downward drifts, characteristic of up-beating nystagmus.

VERTICALLY UP-BEATING NYSTAGMUS



NYSTAGMUS

The diagram shows a dark background with a grid of light points. A series of white lines represent the path of the eyes, showing a series of downward jumps (saccades) followed by slower upward drifts, characteristic of down-beating nystagmus.

VERTICALLY DOWN-BEATING NYSTAGMUS



NYSTAGMUS

The diagram shows a dark background with a grid of light points. A series of white lines represent the path of the eyes, showing a series of alternating horizontal jumps (saccades) in opposite directions, characteristic of periodic alternating nystagmus.

PERIODIC ALTERNATING NYSTAGMUS

Characters of nystagmus

special types of nystagmus

NYSTAGMUS

SEE-SAW NYSTAGMUS

NYSTAGMUS

REBOUND NYSTAGMUS

NYSTAGMUS

NYSTAGMUS IN ABDUCTION

VESTIBULO-OCULAR TESTS (contd)

Tests for provoked nystagmus

- # gaze nystagmus test

- # head impulse test

- # positional / positioning nyst. test

- # labyrinthine fistula test

- # head-shaking nystagmus test

VESTIBULO-OCULAR TESTS

Tests for provoked nystagmus

Gaze nystagmus test:-

Any nystagmus abnormally induced by looking 30° away from mid-point rt / lt / up / dn is looked for

- evaluates gaze holding function

- nystagmus in any position of gaze is abnormal and suggests a CNS lesion



NYSTAGMUS

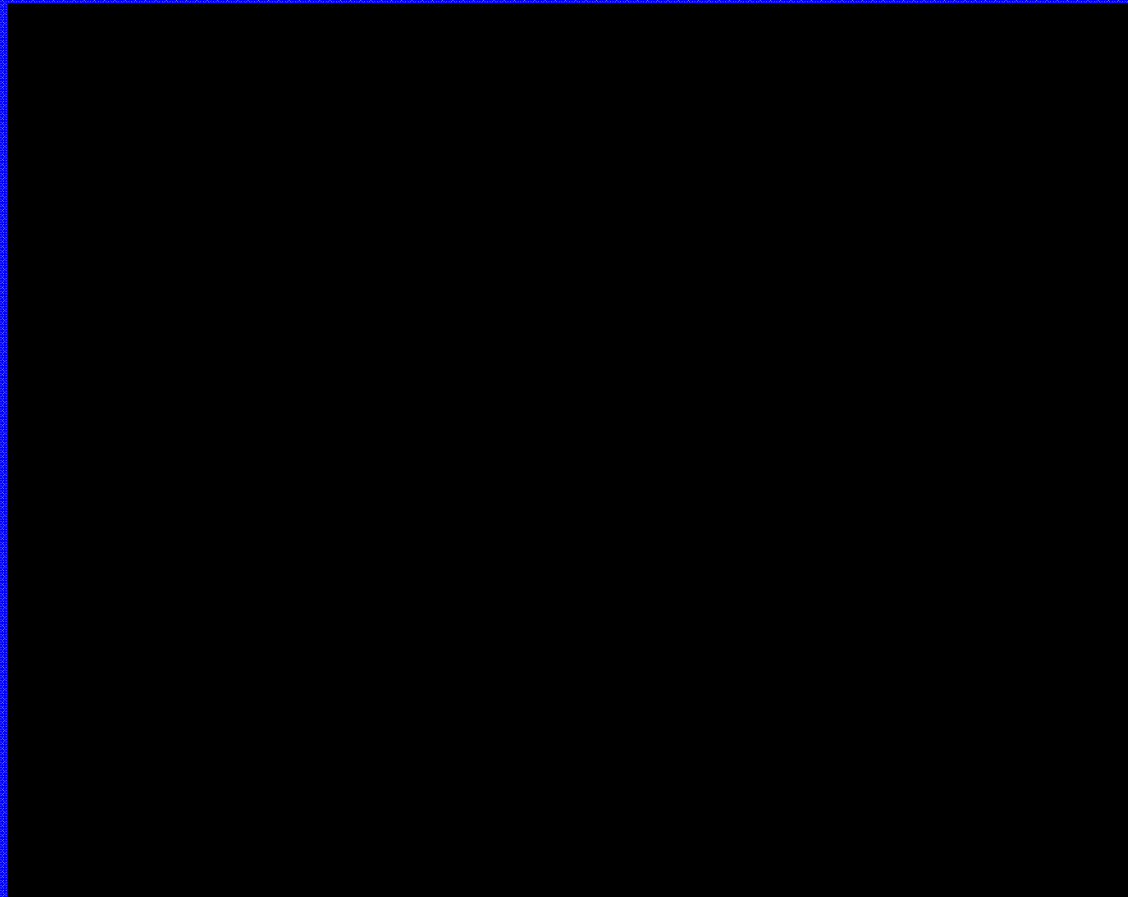
TEST FOR GAZE NYSTAGMUS

VESTIBULO-OCULAR TESTS

Tests for provoked nystagmus

Head Impulse test:-

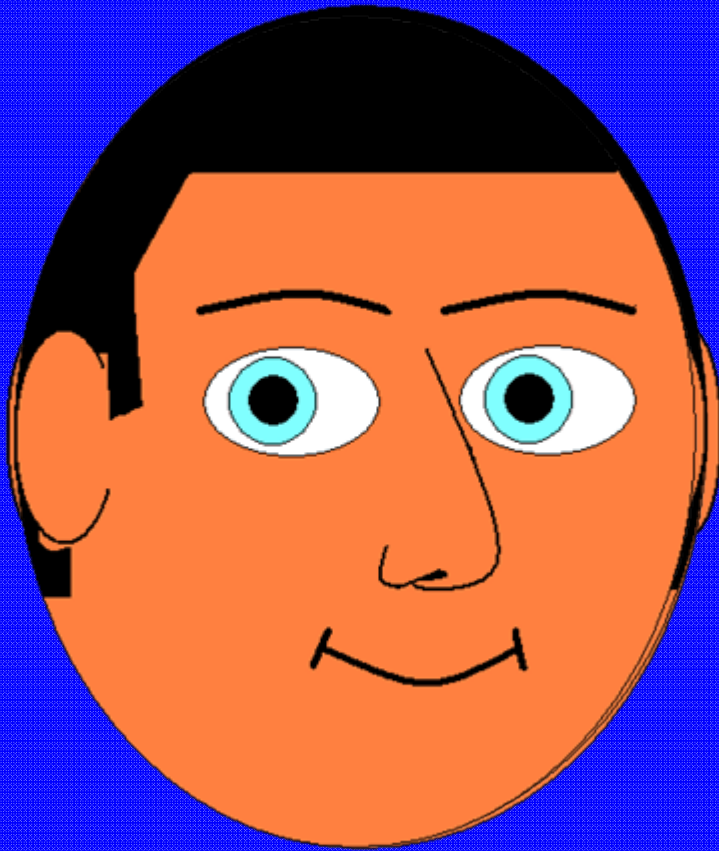
- evaluates the Vestibulo-Ocular Reflex (VOR) gain of the 3 semi-circular canals of both sides
- considered to be one of the best and most reliable bedside tests to assess labyrinthine function



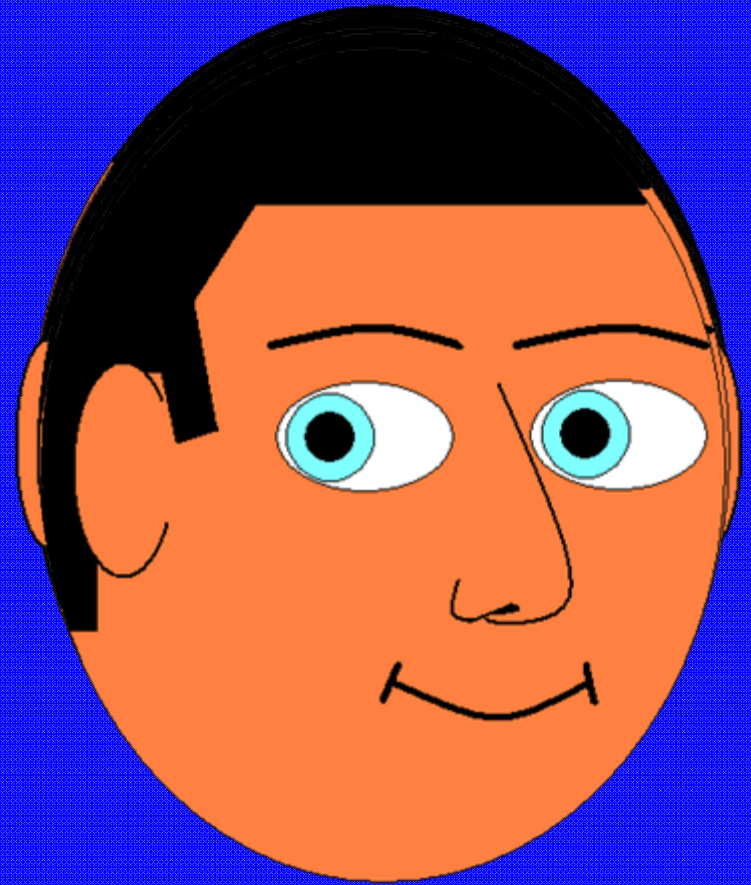


Head Impulse test

HIT normal & pathological: observations



NORMAL



PATHOLOGICAL

VESTIBULO-OCULAR TESTS

Tests for provoked nystagmus

Positional and Positioning tests:- *Any nystagmus abnormally induced by change of position is looked for*

NYSTAGMUS

POSITIONAL & POSITIONING TESTS

&

TESTS FOR OTOLITHIC FUNCTION

VESTIBULO-OCULAR TESTS

Tests for provoked nystagmus

Head Shaking test: *-Any nystagmus abnormally induced by head shaking is looked for*

-pt asked to keep eyes closed and head shaken side to side for 20 times

-then pt asked to immediately open the eyes

-any nystagmus looked for

-It beating nystagmus suggests a rt peripheral vestibular lesion and vice versa

VOR may be jeopardized by primary eye defects unrelated to vestibular system *viz.*

- Ocular malalignment
- Decreased range of eye movements
- Defective smooth pursuit system
- Convergence disorders
- Defective saccadic system
- Defective optokinetic system
- Reduced pupillary reactivity

All prevent the execution of a perfect VOR

Eye tests relevant to Vest. System

- Identification of HEAD TILT

Head Tilt

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graph TD; HT[Head Tilt] --- CT[Contraversive tilt]; HT --- IT[Ipsiversive tilt];
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Contraversive tilt

- lesions in medial long. fasciculus
- superior oblique muscle paresis

Ipsiversive tilt

- peripheral vest. lesions
- lower ponto-medullary lesions

MEASUREMENT OF HEAD TILT

Test for Heterotropia – COVER test

(to detect misalignment of visual axes)

- pt. fixates both eyes at near target (1ft)
 - fixate at distant target (20 ft)
 - one eye covered
 - any movement of other eye looked for while pt. fixates eye continuously on distant target
- + ve test indicates
MISALIGNMENT



TEST TO DETECT MISALIGNMENT
OF VISUAL AXIS



Test for SMOOTH PURSUIT

- pt. visually tracks a target moving at 15 – 20°/sec
18 inches in front horizontally & vertically
- any jerky eye movement looked for
- presence of saccades indicate a disorder in the smooth pursuit system *(e.g., cerebellar disorder like spinocerebellar ataxia)*



TEST TO SMOOTH PURSUIT

EYE TESTS (contd.)

VERGENCE test

- examiner holds index finger 18 inches in front of patient`s eyes
- slowly brings the finger towards patient`s bridge of nose

Normal response

- *near vision triad viz.*
- *eyes converge towards midline*
- *accommodation for near vision*
- *pupillary constriction*

Absence of any one suggests
VERGENCE disorder

VERGENCE TEST

EYE TESTS (contd)

SACCADE test

- patient looks back and forth between 2 objects (examiner`s fingers) placed 2 ft. away from each other in horizontal and vertical axes
- *to look for*
 - *any to & fro eye movement on reaching target before fixation*
 - *any oscillation*

Abnormality suggests
central vestibular lesion



SACCADE TEST

Clinical Neurotological Tests

DIZZINESS SIMULATION TEST BATTERY

1. Orthostatic hypotension
2. Potentiated Valsalva maneuver
3. Carotid Sinus Stimulation
4. Neck-twist
5. Walking & turning
6. Hyperventilation

DIZZINESS SIMULATION TEST BATTERY

1. Orthostatic hypotension :-
 - BP measured in- SUPINE
 - IMMEDIATE STANDING
 - 3 minutes later STANDING
2. Potentiated Valsalva maneuver :-
 - SQATS- 30secs.
 - STRAINS with CLOSED GLOTTIS
3. Carotid Sinus Stimulation :-
 - Unilaterally CAROTID SINUS MASSAGED
 - for 15secs.

4. Hyperventilation :-

Pt. BREATHES deeply x 3 minutes

5. Neck Twist :-

ROTATE in each direction x 15secs.

Dizziness indicates either-

Kinked vertebral artery

Cervicogenic dizziness

Vestibular disorder

6. Walking & Turning :-

WALK in one direction then
ABRUPTLY TURN in reverse
direction.

*Dizziness indicates- Multisensory deficit Gait
apraxia.*



The minimum clinical tests required:-

1. Brief NEUROLOGICAL Exam
 - Cr Nv. 3, 4, 5 (esp. corneal reflex), 6, 7
 - Knee & Ankle jerks
 - Planter response
 - Motor-sensory loss of upper / lower limbs & trunk
 - Neck movement
2. VESTIBULO-SPINAL TESTS
 - Standing test
 - Stepping test
 - Cerebellar tests
3. VESTIBULO-OCULAR TESTS
 - Spont. nystagmus & other abnormal eye movement
 - Gaze nystagmus
 - Positional / Positioning tests
 - Head shaking tests



If a very thorough **history-taking** and a detailed clinical test is done, a proper diagnosis is possible in 80-85% of disequilibrium patients.

The sophisticated neurotological investigations like VNG, VHIT, VEMP, CCG, SVV, Posturography and imaging necessary in about 15 to 20% patients only



*if you are still awake, please
wake up the person beside
you...*

THANK YOU