

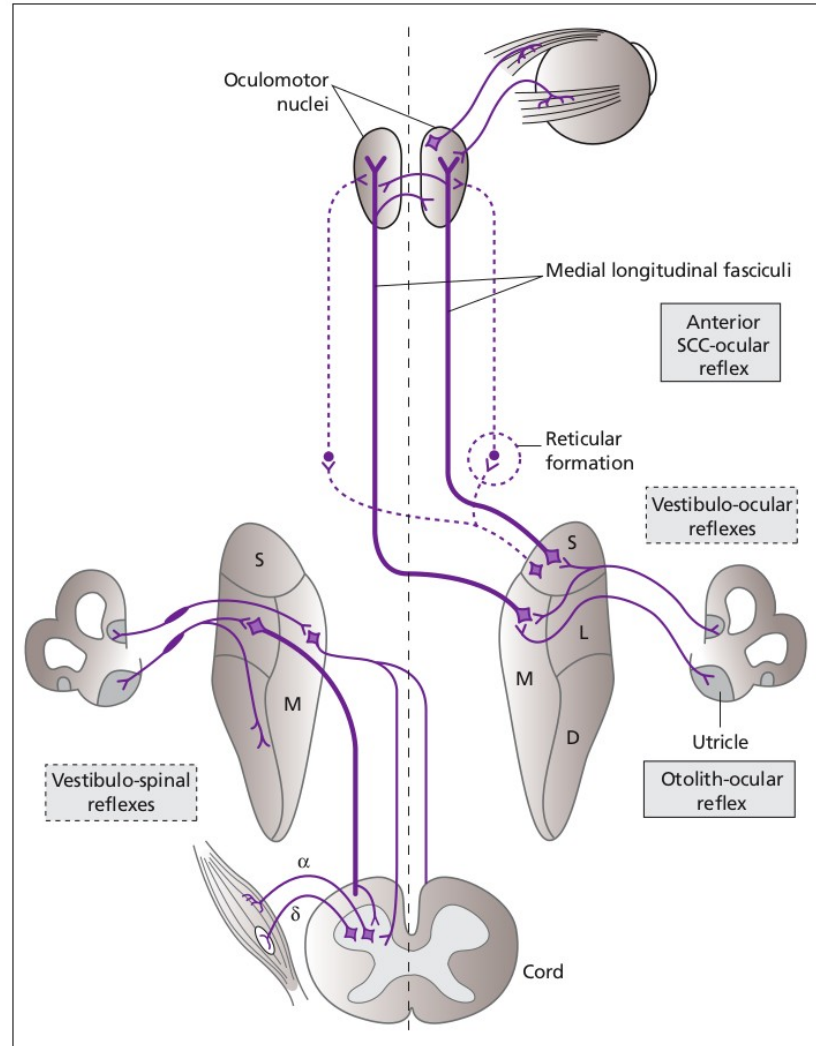
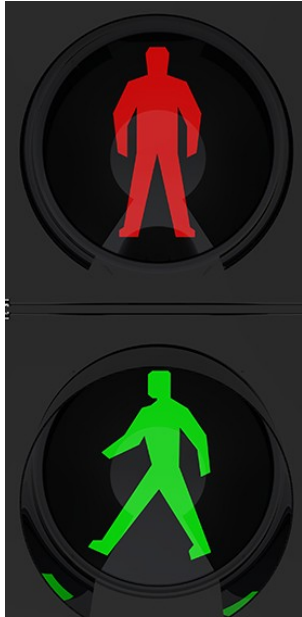
第二次頭暈讀書會

Postural tests for dizzy patients

雙和醫院 眩暈及平衡障礙中心
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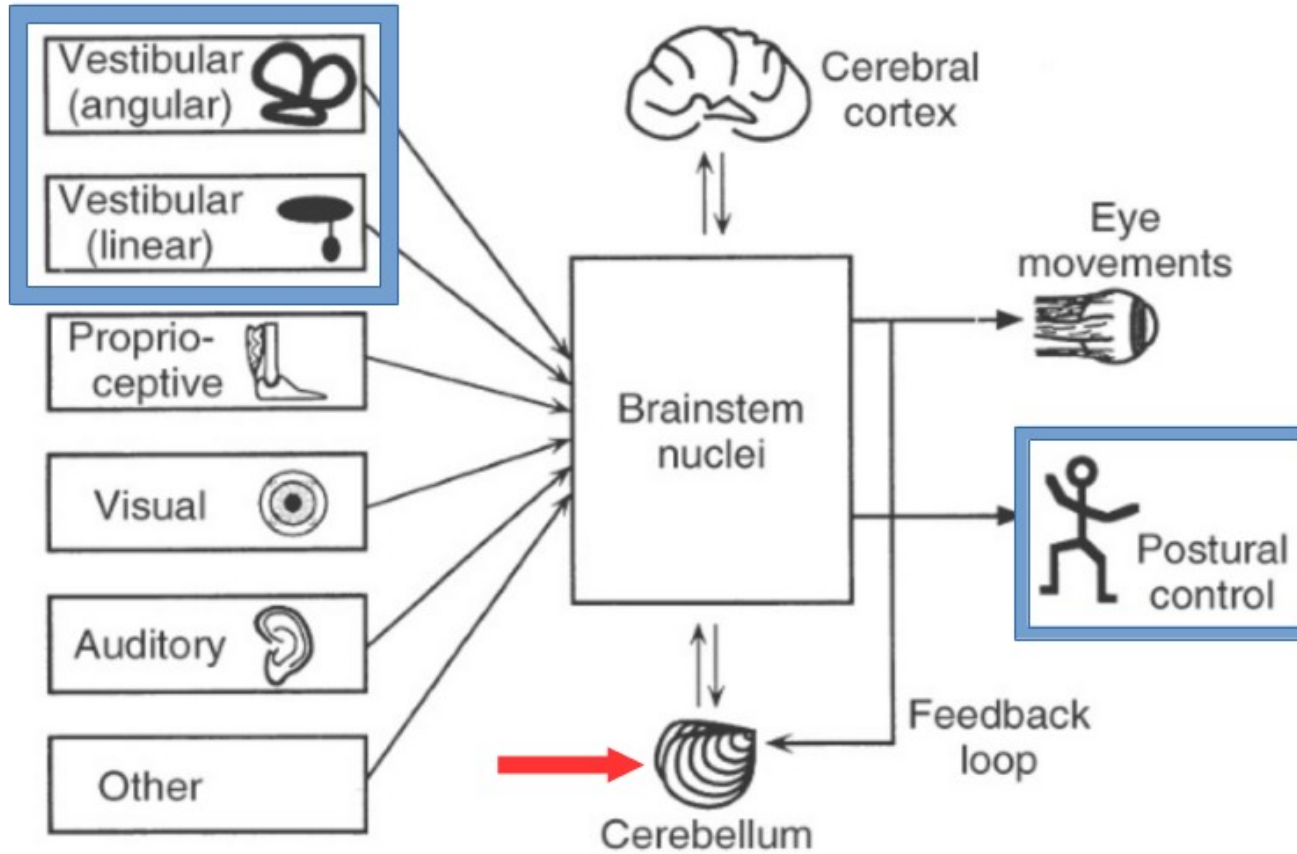
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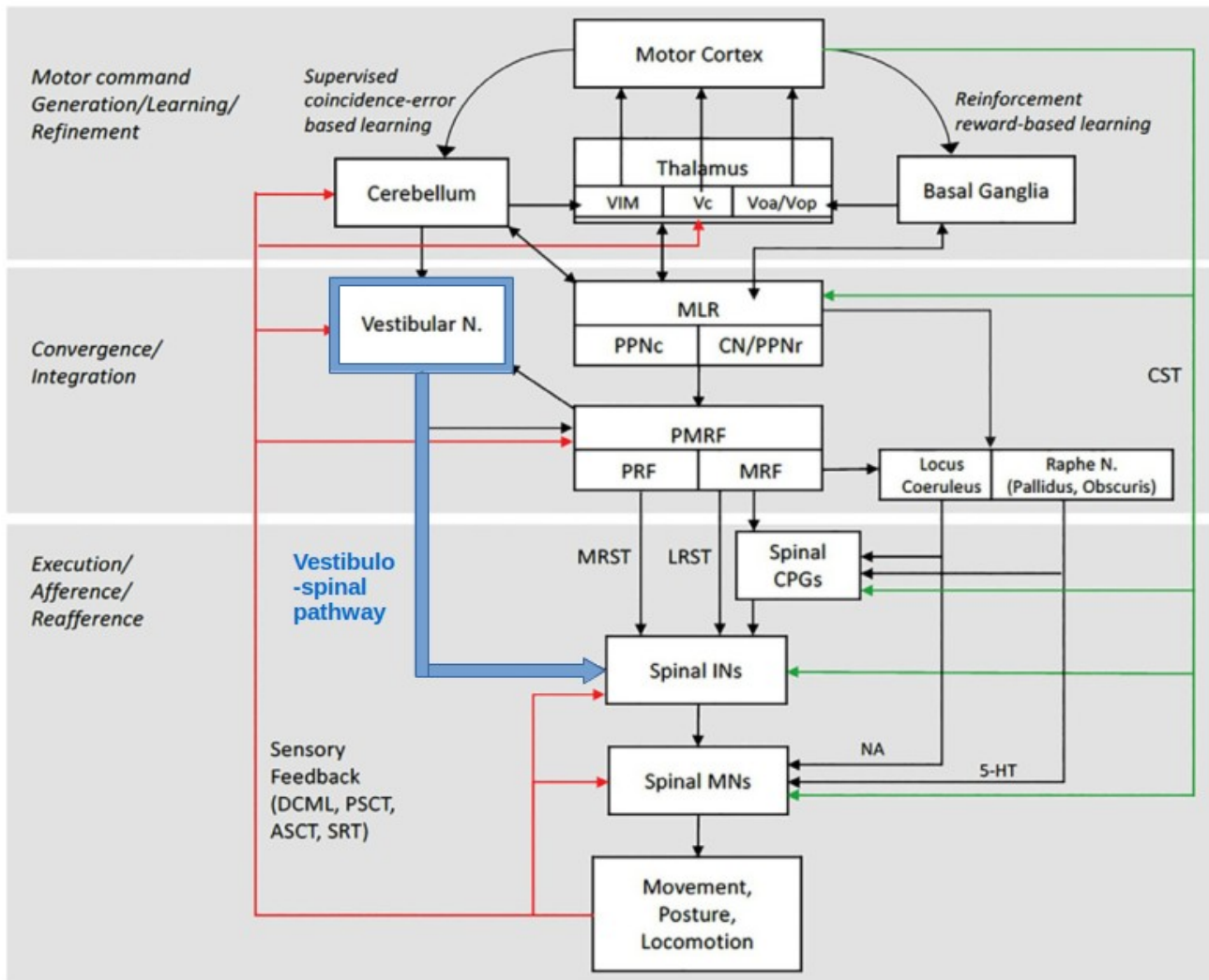
Vestibulo-spinal reflex



Vestibulo-ocular reflex







Poor tandem gait = cerebellar ataxia?

- Cerebellar disease
- Acute unilateral vestibulopathy
- Elderly subjects
- Obese subjects
- Upper/lower motor neuron weakness
- Parkinsonism
- 50% of patients with essential tremor

Postural tests for dizzy patients

雙和醫院神經科 - 陳致中醫師

- Romberg test
- Sharpened Romberg test
- Romberg test on foam pad
- CTSIB, mCTSIB
- Unipedal stance test
- Balance Error Scoring System
- Tandem gait
- Closed eye tandem gait
- Fukuda stepping test
- Dynamic gait index

Original Romberg test (1853)

The original test

Romberg's test is described on page 227 of the Sieveking translation and it is worth quoting in full:

“I have observed that anaesthesia of the muscles alone, without loss of tactile power, invariably accompanies tabes dorsalis. A simple experiment suffices to determine the fact. If the patient is told to shut his eyes while in the erect posture, he immediately begins to move from side to side and the oscillations soon attain such a pitch that unless supported, he falls to the ground. Even if the trunk is supported, if the patient be sitting and leaning against the back of a chair, the phenomenon takes place to the same extent and he will slip off the chair——. The eyes of such patients are their regulators or feelers”.

Positive Romberg sign

- Proprioception dysfunction, not a cerebellar sign
- Positive test: swaying at the ankles, a corrective step to the side, or fall (Dejong's)
- The essential finding is a difference between standing balance with eyes open and closed
- Feet together? wearing shoes? arm position? how long?
--> no consensus

Romberg test in vestibular diseases

- Barany (1910): Romberg's test might be useful in vestibular disease
 - Patient tend to fall to the side of the lesion
 - Particularly in acute, unilateral vestibular disease
- Insensitive for the identification of a minor or chronic vestibular lesion

Increased swaying in Romberg test (not true positive Romberg)

- Normal elderly
- Vestibular disorder
- Cerebellar disorder
- Hysterical patients (false Romberg sign)
sway from the hips rather than the ankles; not fall and hurt themselves; imbalance can be reduced by distraction

Variations of Romberg test

- Sharpened Romberg test (1944)
- Refined Romberg test (1985)
- Romberg test on foam pad
 - Clinical Test of Sensory Integration and Balance (CTSIB) (1986)
 - Modified CTSIB (mCTSIB) (2004)
 - Modified Romberg test on foam pad (2009)

Sharpened Romberg test



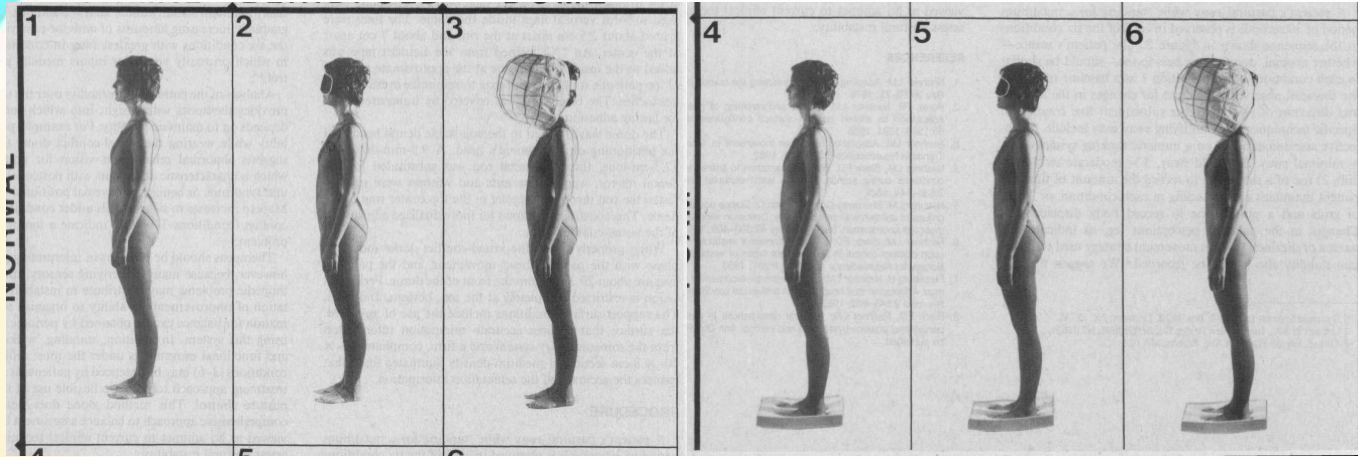
Eye-closed tandem stance

- 1948
- To make Romberg test more sensitive and specific for vestibular disorders

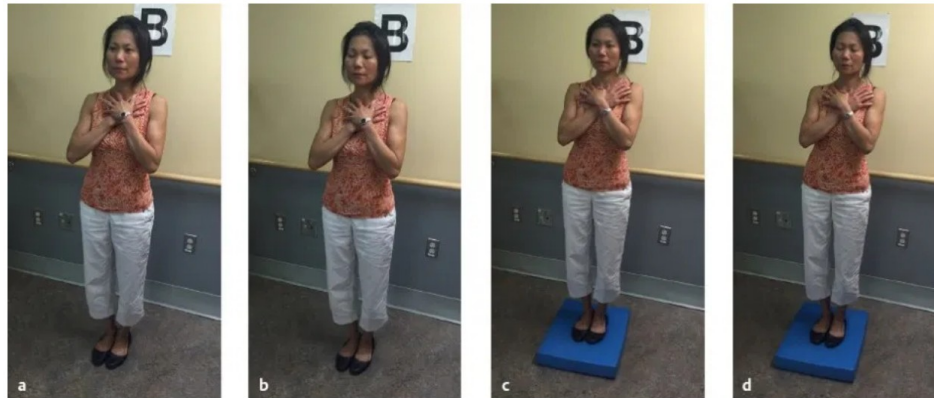
Romberg test on foam pad

- To eliminate visual and somatosensory input
- Mainly probes the vestibulospinal reflexes
- Even healthy subjects show increased sway on foam (without falling)
- Very sensitive to identify patients with unilateral or bilateral vestibular loss.
- Also positive in patients with midline cerebellar disorders.

CTSIB (Shumway-Cook & Horak, 1986)



mCTSIB (Wrisley & Whitney, 2004)



Unipedal Stance Test (UPST)

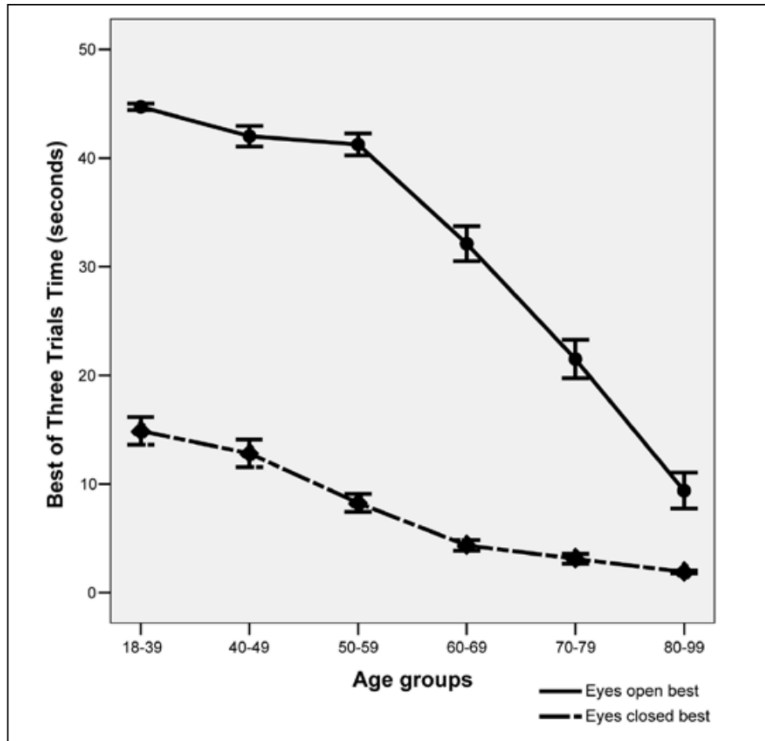


Figure 1. Best of three Trials Eyes Open vs. Eyes Closed Unipedal Stance Test Time (sec).

- Low localization value: cerebellar, vestibular, parkinsonism, concussion, weakness, joint...
- >10 sec --> intact balance

14. STANDING ON ONE LEG

INSTRUCTIONS: Stand on one leg as long as you can without holding.

- () 4 able to lift leg independently and hold >10 seconds
- () 3 able to lift leg independently and hold 5-10 seconds
- () 2 able to lift leg independently and hold = or >3 seconds
- () 1 tries to lift leg unable to hold 3 seconds but remains standing independently
- () 0 unable to try or needs assist to prevent fall

BERG BALANCE SCALE

Balance Error Scoring System (BESS)

- 1999, Sports Medicine, University of Pittsburgh (DOI: 10.1123/jsr.8.2.71)
- Count numbers of error in 20 seconds
- Reliable for assessing postural stability in the absence of computerized systems

Table 1. *BESS errors*

Lifting hands off of the iliac crest
Eye opening
Stepping, stumbling, or falling
Moving the hip into more than 30 degrees of flexion or abduction
Lifting the forefoot or heel
Remaining out of the testing position for more than 5 seconds



Tandem gait

- Traditionally, a cerebellar function test
- May be difficult for the elderly or obese subjects
- Abnormal in acute unilateral vestibulopathy
- May also be abnormal in peripheral neuropathies, parkinsonism, and other neurodegenerative conditions
- Abnormal in up to 50% of patients with essential tremor (Singer C, 1994)
- No standardized test protocol (length/steps, arm position...)
- **Closed-eye tandem walking:** a difficult maneuver with high value as a screening test. (Dejong's)

Stepping tests

- Unterberger, 1926; Fukuda, 1959

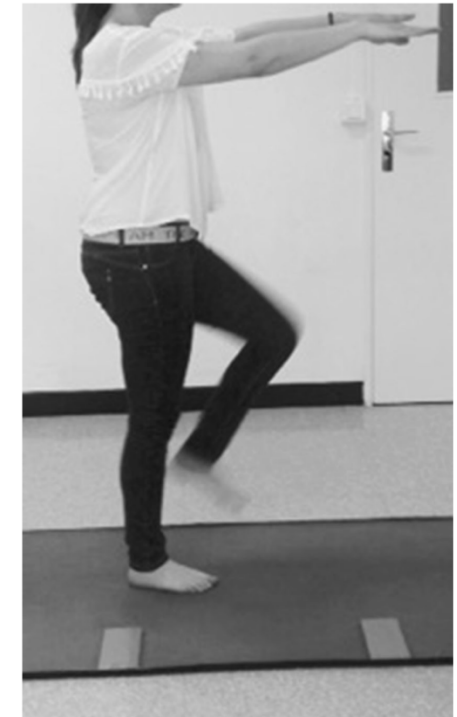
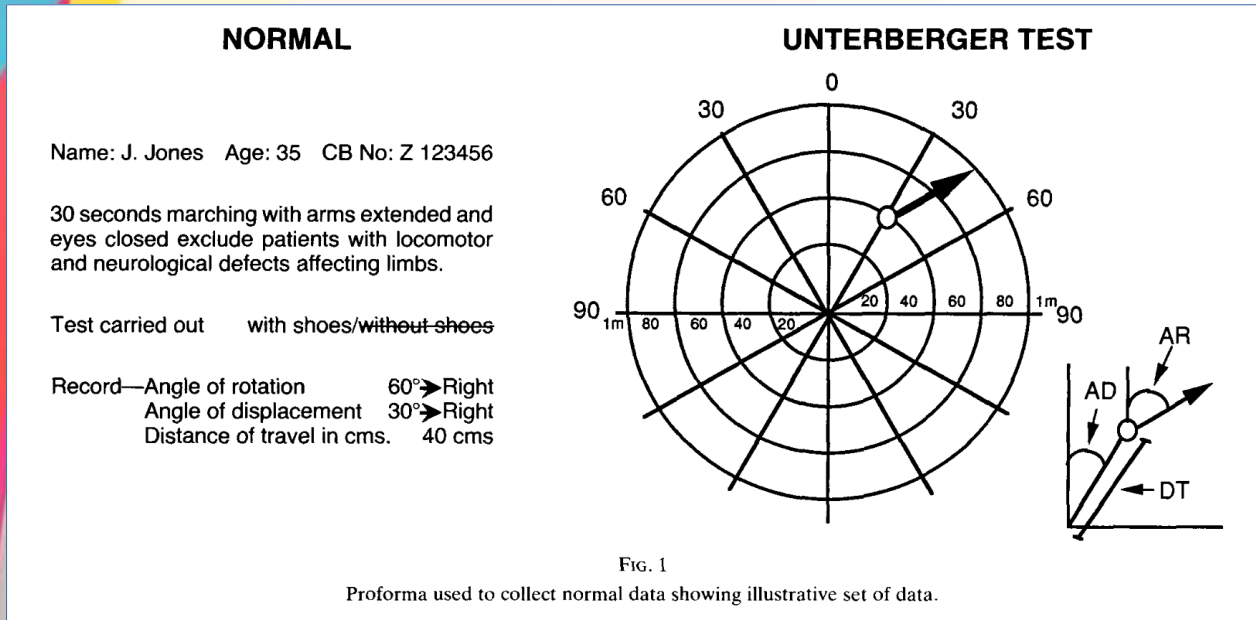


Fig. 3 The Fukuda-Utenberger stepping test is a dynamic balance test

Fukuda stepping test

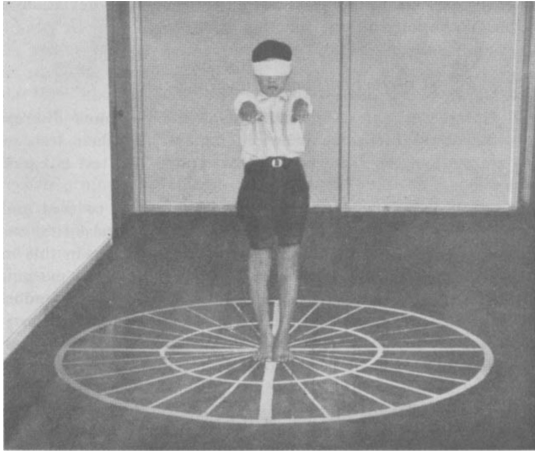


FIG. 1 a.

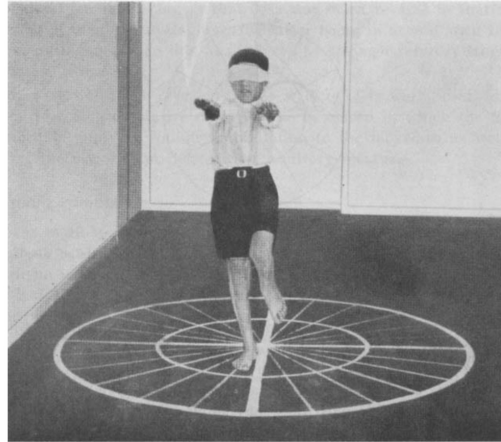


FIG. 1 b.

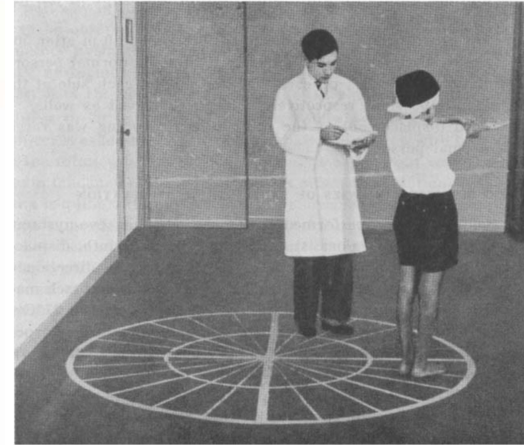
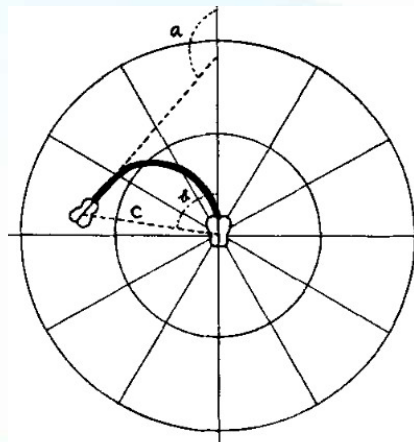


FIG. 1 c.



A: angle of rotation
B: angle of displacement
C: distance of displacement

- Speed: 110 steps per minute
- 50 or 100 steps
- The examiner must not speak to the subject during stepping
- Normal 50-step test: < 30 degree of rotation, < 50 cm of forward displacement
- Normal 100-step test: < 45 degree of rotation, < 100 cm of forward displacement

Interpretation of Fukuda test

- Abnormal results → asymmetric vestibulospinal reflex tone from **peripheral** or **central** causes
- Moderately to highly reliable in showing unilateral vestibular weakness (questionable!)
- **Confounding factors:** musculo-skeletal asymmetries including leg-length discrepancy, sciatica, muscle imbalance, or asymmetric joint problems from the hip down.

Limitations of Fukuda test

- Not lesion side specific
 - abnormal deviation toward the side of the lesion (45 deg or more deviation) occurred in 50.0% of cases; abnormal deviation toward the intact side in 24.6% of cases. (Zhang & Wang, 2011)
- Not very sensitive
 - FST was only sensitive in detecting vestibular weakness when the weakness was severe (75% weakness) on ENG (Honaker & Shepard, 2012)
 - No significant difference in parameters between the normal and canal parietic groups.(Hickey et al., 1990)
- Not sensitive for chronic cases
 - FST abnormality decreased with time following the vestibular defect. (Honaker & Shepard, 2012)
- Results of the test should be interpreted with caution and used only in conjunction with other modes of evaluation

Dynamic Gait Index (DGI)

- 1995, by Shumway-Cook and Woollacott (Seattle)
- 8 gait tasks, each performance from 0 (poor) to 3 (excellent); total scores 0-24
- 10-15 min for each subject
- low score (<19) -> high risk of falling
- walking at normal speeds
- walking at different speeds
- walking with horizontal head movements
- walking with vertical head movements
- turning quickly
- walking around objects
- walking over objects
- climbing stairs.
- 0 = unable to perform or severe impairment
- 1 = moderate impairment
- 2 = mild impairment
- 3 = normal (Shumway-Cook and Woollacott, 1995).

DYNAMIC GAIT INDEX

The Dynamic Gait Index was developed by Anne Shumway-Cook (1995) and has been used with older adults to determine their likelihood of falling. Scores of 19 and less are related to falls in older adults. It tests 8 facets of gait and can be used with an assistive device.

Patient Name: _____

Rater: _____

- A. Gait level surface
- B. Change in gait speed
- C. Gait with horizontal head turns
- D. Gait with vertical head turns
- E. Gait and pivot turn
- F. Step over obstacle
- G. Step around obstacle
- H. Stairs

Date	Date	Date	Date

TOTAL SCORE

Patient Name: _____ Signature: _____ Date: _____

A. Gait Level Surface

Instructions: Walk at your normal speed from her to the next mark (20 feet). Check th lowest category that applies.

- 0. Severe Impairment: Cannot walk 20 ft. without assistance, severe gait deviations, or imbalance.
- 1. Moderate Impairment: Walks 20 feet, slow speed, abnormal gait pattern, evidence for imbalance.
- 2. Mild Impairment: Walks 20 feet, uses assistive devices, slower speed, mild gait deviations.
- 3. Normal: Walks 20 feet, no assistive devices, good speed, no evidence of imbalance, normal gait pattern.

B. Change in Gait Speed

Instructions: Begin walking at your normal pace (for 5 ft.). When I tell you "GO", walk as fast as you can (for 5 ft.). When I tell you "SLOW", walk as slowly as you can (for 5 ft.). Check the lowest category that applies.

- 0. Severe Impairment: Cannot change speeds, or loses balance and has to reach for wall or be caught.
- 1. Moderate Impairment: Makes only minor adjustments to walking speed or accomplishes a change in speed with significant gait deviations, or changes speed but has significant gait deviations, or changes speed but loses balance but is able to recover and continue walking.
- 2. Mild Impairment: Able to change speed but demonstrates mild gait deviations, or no gait deviations but unable to achieve a significant change in velocity, or uses an assitive device.
- 3. Normal: Able to smoothly change walking speed without loss of balance or gait deviation. Shows significant difference in walking speeds between normal, fast, and slow speeds.

C. Gait with Horizontal Head Turns

Instructions: Begin walking at your normal pace. When I tell you "look right", keep walking straight, but turn your head to the right. Keep looking to the right until I tell you "look left", then keep walking straight and turn your head to the left. Keep your head to the left until I tell you "look straight". then keep walking straight but return your head to the center. Check the lowest category that applies.

- 0. Severe Impairment: Performs task with severe disruptions of gait (i.e. - staggers outside 15 inch path, loses balance, stops, reaches for wall).
- 1. Moderate Impairment: Performs head turns with moderate change in gait velocity, slows down, staggers but revovers, can continue to walk.
- 2. Mild Impairment: Performs head tum smoothly with slight change in gait velocity (i.e. - minor disruption to smooth gait path or uses walking aid).
- 3. Normal: Performs head turns smoothly with no change in gait.

D. Gait with Vertical Head Turns

Instructions: Begin walking at your normal pace. When I tell you "look up", keep walking straight, but tip your head and look up. Keep looking up until I tell you "look down", then keep walking straight and turn your head down. Kepp your head down until I tell you "look staright", then keep walking straight but return your head to the center. Check the lowest category that applies.

- 0. Severe Impairment: Performs task with severe disruptions of gait (i.e. - staggers outside 15 inch path, loses balance, stops, reaches for wall).
- 1. Moderate Impairment: Performs task with moderate change in gait velocity, slows down, staggers but recovers, can continue to walk.
- 2. Mild Impairment: Performs task with slight change in gait velocity (i.e. - minor disruption to smooth gait path or uses walking aid).
- 3. Normal: Performs head turns with no change in gait.

E. Gait and Pivot Turn

Instructions: Begin walking at your normal pace. When I tell you "stop and tum", tum as quickly as you can to face the opposite direction and stop. Check the lowest category that applies.

- 0. Severe Impairment: Cannot turn safely, requires assistance to tum and stop.
- 1. Moderate Impairment: Turns slowly, requires verbal cueing, requires several small steps to catch balance following turn.
- 2. Mild Impairment: Pivot turns safely in greater than 3 seconds and stops with no loss of balance.
- 3. Normal: Pivots and turns safely within 3 seconds and stops quickly with no loss of balance.

F. Step over Obstacle

Instructions: Begin walking at your normal speed. When you come to the shoebox, step over it, not around it, and keep walking. Check the lowest category that applies.

- 0. Severe Impairment: Cannot perform activity without assistance.
- 1. Moderate Impairment: Able to step over box, but must stop, then step over. May require verbal cueing.
- 2. Mild Impairment: Able to step over box, but must slow down and adjust steps to clear box safely.
- 3. Normal: Able to step over box without changing gait speed; no evidence of imbalance.

G. Step around Obstacles

Instructions: Begin walking at you normal speed. When you come to the first cone (about 6 ft. away), walk around the right side of it. When you come to the second cone (about 6 ft. past first cone), walk around it to the left. Check the lowest category that applies.

- 0. Severe Impairment: Unable to clear cones, walks into one or both cones, or reqires physical assistance.
- 1. Moderate Impairment: Able to clear cones but must significantly slow speed to accomplish task, or reqires verbal cueing
- 2. Mild Impairment: Able to step around both cones, but must slow down and adjust steps to clear cones.
- 3. Normal: Able to walk around cones safely without changing gait speed; no evidence of imbalance.

H. Stairs

Instructions: Walk up these stairs as you would at home (i.e. - using the rail if necessary) At the top, turn around and walk down. Check the lowest category that applies.

- 0. Severe Impairment: Cannot perform safely.
- 1. Moderate Impairment: Two feet to a stair, must use rail.
- 2. Mild Impairment: Alternating feet, must use rail.
- 3. Normal: Alternating feet, no rail.

Do they help in your diagnosis?

- Abnormal

- central lesion
- acute unilateral peripheral vestibulopathy
- episodic vestibular disorders during attack
- chronic uncompensated peripheral vestibulopathy
- bilateral vestibulopathy

- Normal

- functional dizziness
- non-vestibular dizziness
- BPPV
- compensated peripheral vestibulopathy
- episodic vestibular disorders between attacks

Take Home Message

- Postural tests are valuable in assessing postural stability of dizzy patients
- They may help in your diagnosis... sometimes.
- Factors other than central and peripheral vestibular systems need to be considered too
- Standardized protocols and cutoff values are usually lacking