Computerized Dynanic Posturography (CDP)

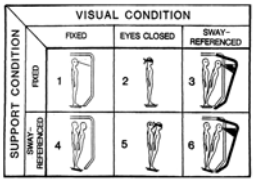
- Measure sway on a platform that can rotate about the ankles and modify visual input.

Neurocom device

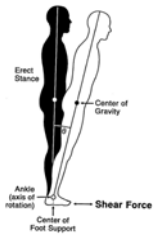
Micromedical device

Computerized Dynanic Posturography (CDP)

- 6 different sensory tests



Many possible disturbances to Balance



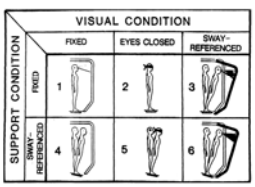
- Sensory inputs
  - Somatosensory
  - Visual
  - Vestibular
- Central
  - Internal model
  - Integration
- Motor
  - Output (weak, spastic)

CDP – current uses

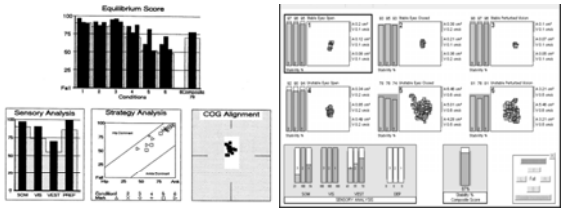
- Objective measure of static balance
- Quantify use of senses to maintain balance
- Detect malingering

CDP: Diagnostic Patterns

- Normal
- Poor balance
- Vestibular
- Central
- Multisensory
- Aphysiologic



CDP: Normal pattern

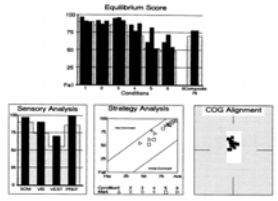


Neurocom device

Micromedical device

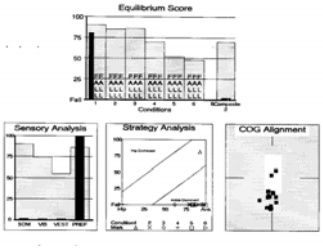
- Scoring
  - Should gradually decline with difficulty
  - Composite > 70

CDP: Normal pattern – doesn't mean balance is perfect



- This patient has severe orthostatic hypotension, but normal CDP – orthostatic HPN should not impair CDP.

CDP – just terrible balance

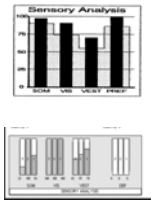


Patient with bilateral vestibular loss.

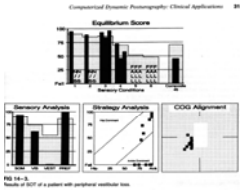
No useful information here other than bad balance.

CDP: Sensory Analysis

- Sensory Analysis – low means
  - Som – somatosensory (stable eyes open vs stable eyes closed)
  - Vis – visual (stable eyes open vs unstable eyes open)
  - Vest – vestibular (stable eyes open vs unstable eyes closed)
  - Pref – uses too much visual (vision perturbed vs eyes closed)



"Vestibular Pattern"



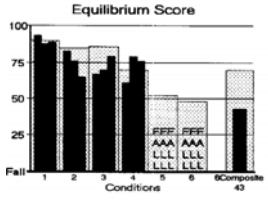
- Also called 5-6 pattern
- Increased sway (decreased score) with unstable support surface, with vision absent or distorted
- Also positive in CNS balance disturbances

Nashner in Jacobson, Newman and Kartush, 1993

Central ataxia – usually another "vestibular pattern"

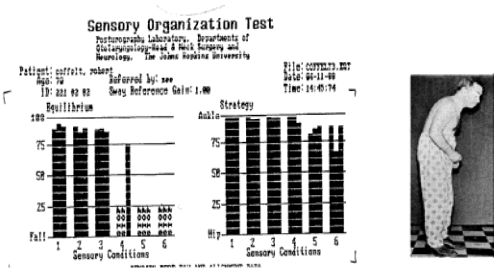
- Many variants – examples
  - Sensory
  - Cerebellar
  - Periventricular Leukomalacia
  - Basal Ganglia
- They all look the close on CDP
- Some are "aphysiologic"

Cerebellar – SCA3



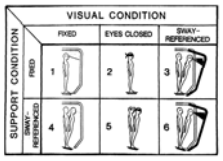
Patient with cerebellar lesion has same pattern as vestibular lesion

PSP – basal ganglia disorder



CDP often detects Malingerers

- Six "sensory tests"--> gradient of difficulty
- Malingerer tries to "fail" test, and adjusts sway to appear very unsteady on all tests
- Malingerer fails easy tests.
- Examiner must not tell subject how to behave.
- Cevette algorithm -- linear discriminant score



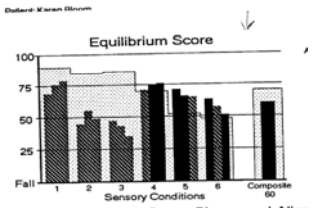
Linear discriminant algorithm (From Cevette et al, 1995)

Aphysiologic Score = -158.2 + (1.94*ST1) + (1.09*ST2) + (1.37*ST4) – (0.15*ST6)

Normal Score = -238.11 + (2.24*ST1) + (1.45*ST2) + (1.7*ST4) – (0.13*ST6)

Vestibular Score = -251.21 + (2.31*ST1) + (1.54*ST2) + (1.89*ST4) – (0.58*ST6)

Aphysiologic Patterns



Patient litigating after blood loss in hospital.

Balance got WORSE months after blood replaced.

Patient performs worse on easy tests than hard tests !

Aphysiologic Patterns

Patient may simply score very poorly – composite < 20, but walks into clinic under own power.

"Aphysiologic" is not the same as malingering

- Algorithms to detect malingering were trained with just a few disorders.
- Patients with organic disorders other than the Cevette algorithm trained may be falsely positive

CDP
Diagnostic Bottom Line

- Sensitive but non-specific
- Detection of malingering is best documented diagnostic use
- May be helpful in sorting out mixed pictures

CDP – as an objective measure of balance

- Quantify sway
- Quantify postural reactions

CDP issues in quantification

- Center of pressure is not center of mass. The hardware doesn't measure sway.
- Sway isn't necessarily bad – error margin is more important
- It is not yet clear how measurements on CDP relate to real world risks of fall.

CDP quantification bottom line

- It's the best we have at present.
- Useful test for disability

Future of CDP

- Diagnostic
  - Larger sets of data in a variety of conditions
  - Map out specific vs. nonspecific patterns
- Quantification of balance
  - Standardized performance by age on relevant measures.