

Bilateral vestibulopathy



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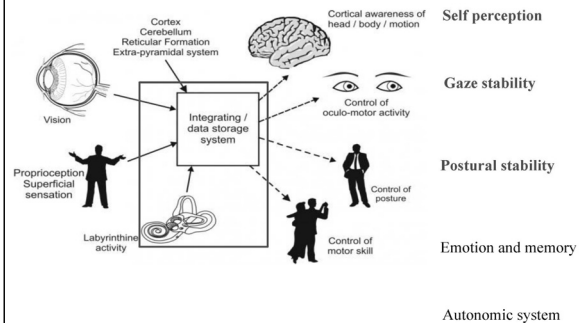
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Vestibular system

- **Sensory information related to motion, equilibrium, and spatial orientation**
- **Maintain upright posture during standing and walking, gaze stabilization**
 - vestibulo-ocular reflex (VOR)
 - vestibulo-spinal reflex (VSR)
 - vestibulo-autonomic reflex (VAR)

Vestibular system

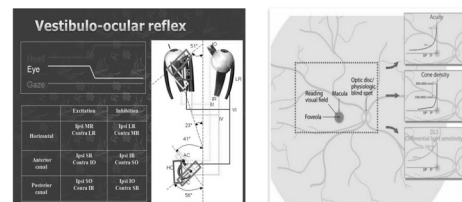


Acute vestibular dysfunction

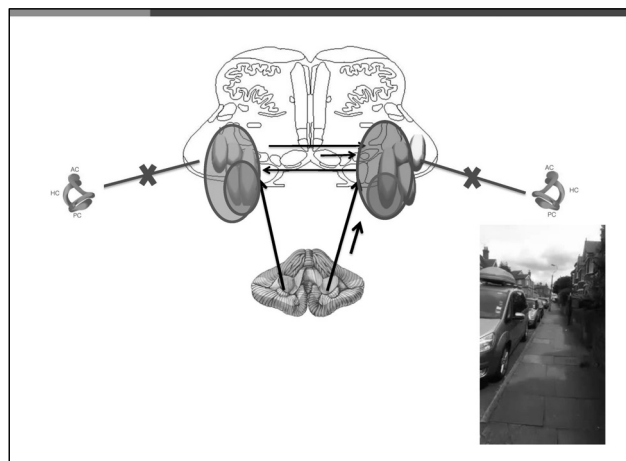
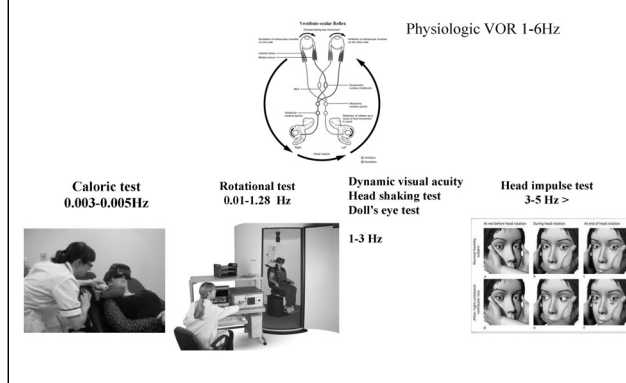
Vestibulo-ocular reflex

Clear vision during head motion

- Holds images of the seen world steady on the retina during brief head rotations or translations
- Eye movement of gaze stabilization



Test of Angular hVOR



Clinical manifestation of BVP

- No continuing distressing vertigo, spontaneous nystagmus, or postural falls
- Sx. Surprisingly well tolerated
 - unsteadiness**
 - movement dependent postural dizziness and **unsteadiness** of stance and gait, which is exacerbated in the dark and when walking on uneven ground
 - oscillopsia**
 - About 40% of patients complain of blurred vision when walking or running
- Difficulties in spatial memory and navigation, loss of hippocampal volume

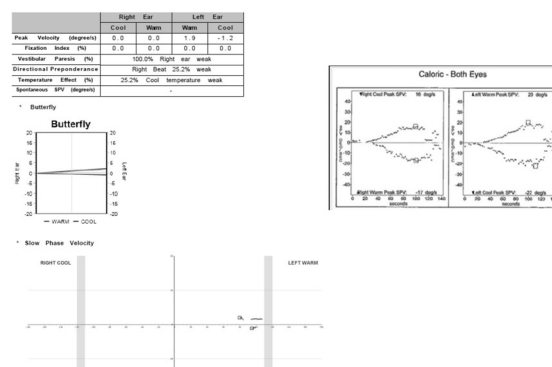
Case presentation

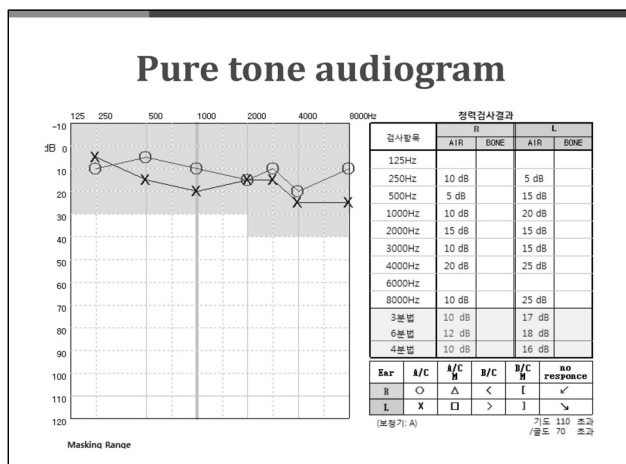
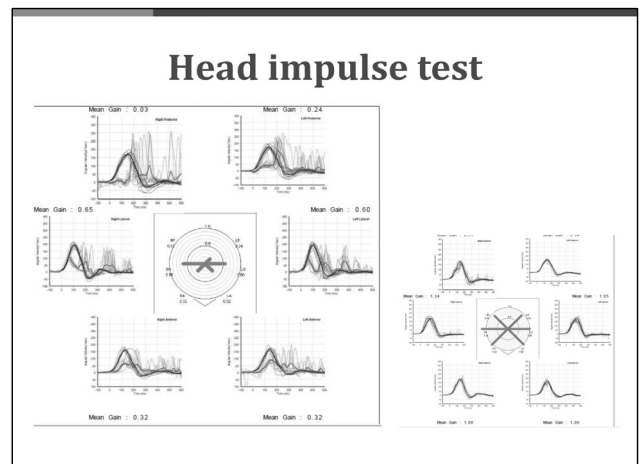
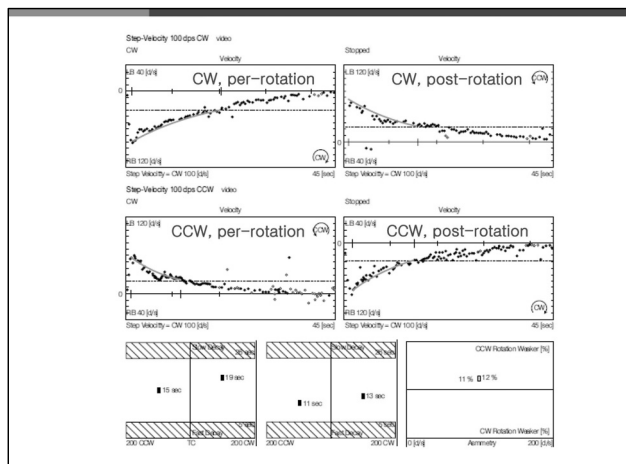
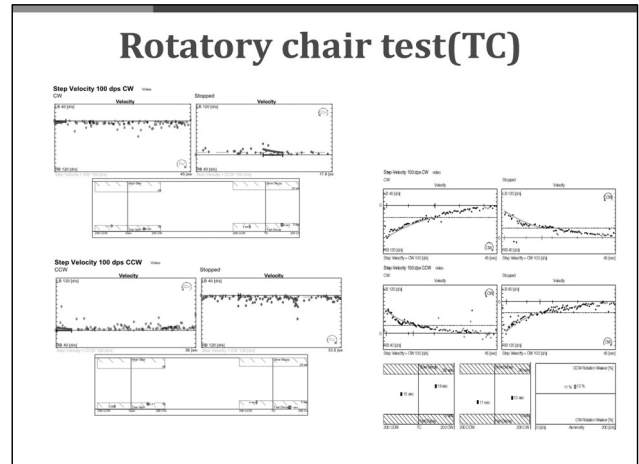
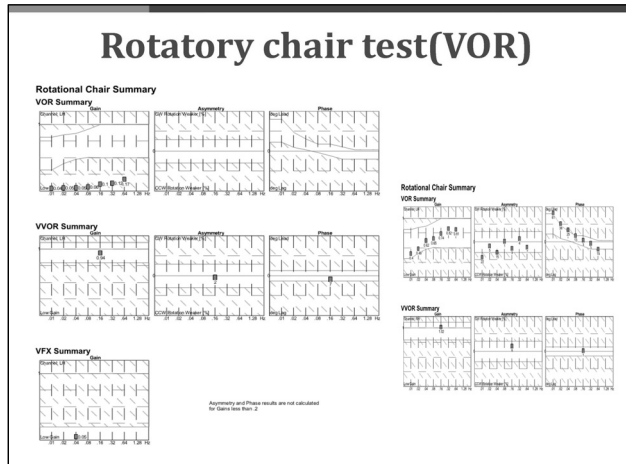
- F/49
- P.Hx left knee pyogenic arthritis
 - 2018.02.19 – 03.09 gentamycin IV
 - 2018.03.14 total synovectomy with debridement and irrigation
- 2018년 3월말부터 unsteadiness, oscillopsia

Neuro-otologic examination

- Spontaneous nystagmus(-)
- Gaze-evoked nystagmus (-)
- Bedside head impulse test (+/+)**
- Dynamic visual acuity (+)**
- Romberg test (-/-)
- Limb ataxia (-/-)
- DTR : symmetric normoactive
- Tandem gait : bilateral sway

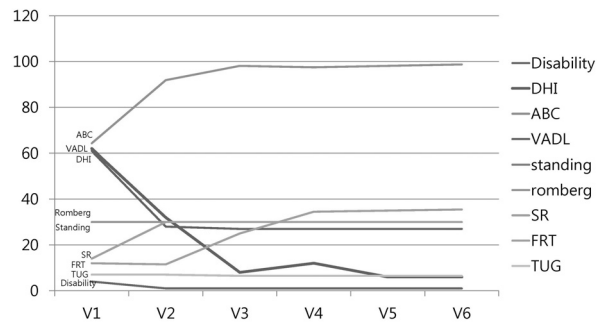
Caloric test



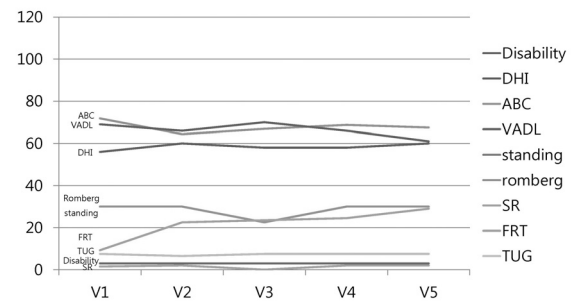


- ### Clinical summary
- Bilateral vestibulopathy due to ototoxic drug (gentamicin)
 - Treatment
 - prevention of ototoxic drugs
 - vestibular rehabilitation therapy (VRT)
 - sensory substitution

Vestibular rehabilitation for BVP



vestibular rehabilitation for BVP



Diagnostic Criteria of BVP

Table 1. Diagnostic criteria for bilateral and probable bilateral vestibulopathy according to the Classification Committee of the Bárány Society

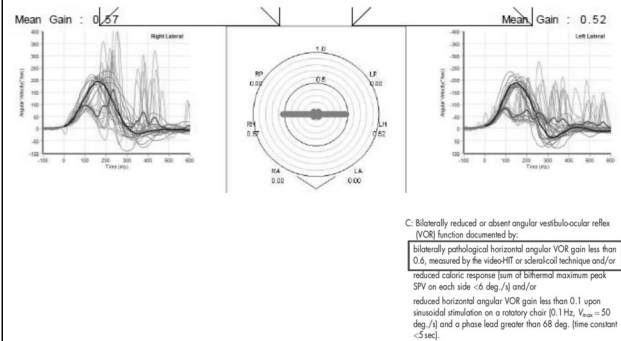
Bilateral vestibulopathy

- A. Chronic vestibular syndrome with the following symptoms
- (1) Unsteadiness when walking or standing plus at least one of 2 or 3
 - (2) Movement-induced blurred vision or oscillopsia during walking or quick head/body movements and/or
 - (3) Worsening of unsteadiness in darkness and/or on uneven ground
- B. No symptoms while sitting or lying down under static conditions
- C. Bilaterally reduced or absent angular vestibulo-ocular reflex (VOR) function documented by:
bilaterally pathological horizontal angular VOR gain less than 0.6, measured by the video-HIT or scleralcal technique and/or reduced caloric response (sum of bithermal maximum peak SPV on each side <6 deg./s) and/or reduced horizontal angular VOR gain less than 0.1 upon sinusoidal stimulation on a rotatory chair (0.1 Hz, V_{max} = 50 deg./s) and a phase lead greater than 68 deg. (time constant <5 sec).
- D. Not better accounted for by another disease

Diagnostic criteria for probable bilateral vestibulopathy

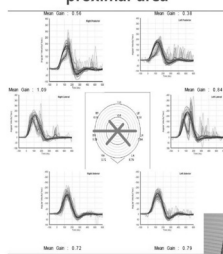
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- B. No symptoms while sitting or lying down under static conditions
- C. Bilaterally pathological horizontal bedside head impulse test
- D. Not better accounted for by another disease

VOR: Head impulse test

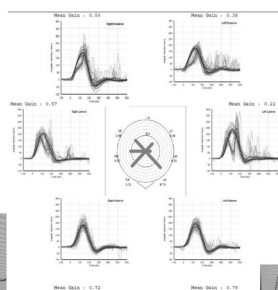


Gain of video HIT

proximal area

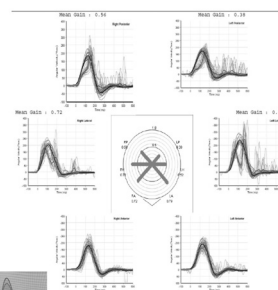


Peak velocity

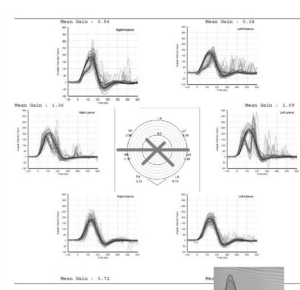


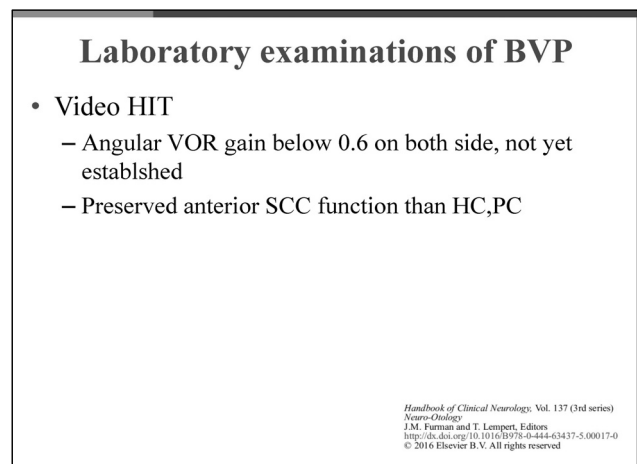
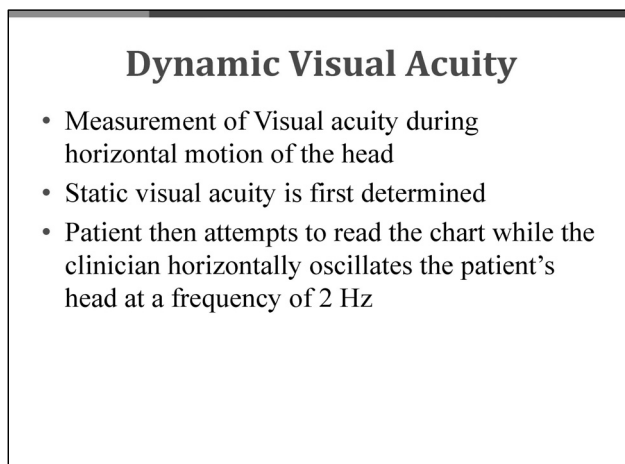
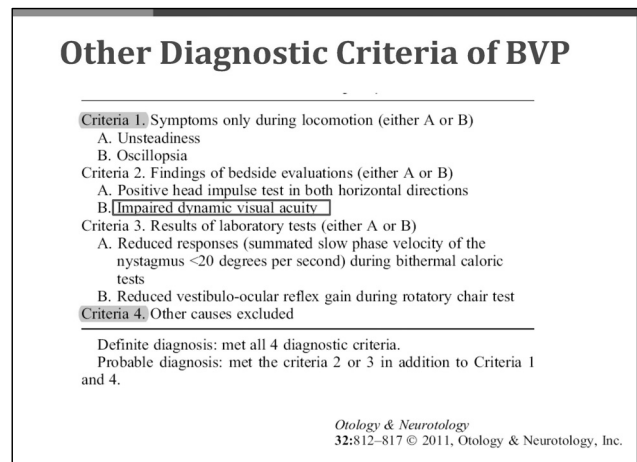
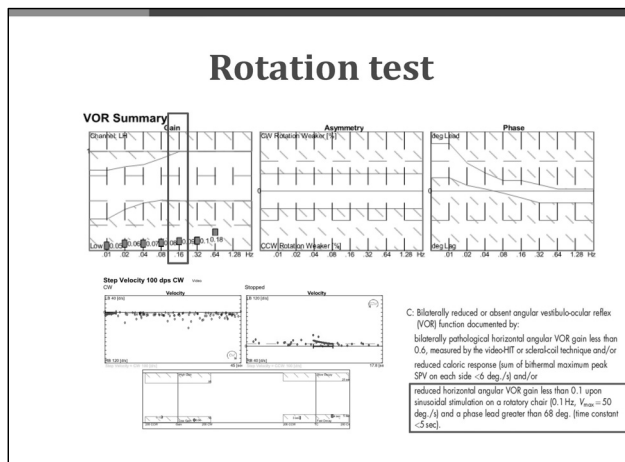
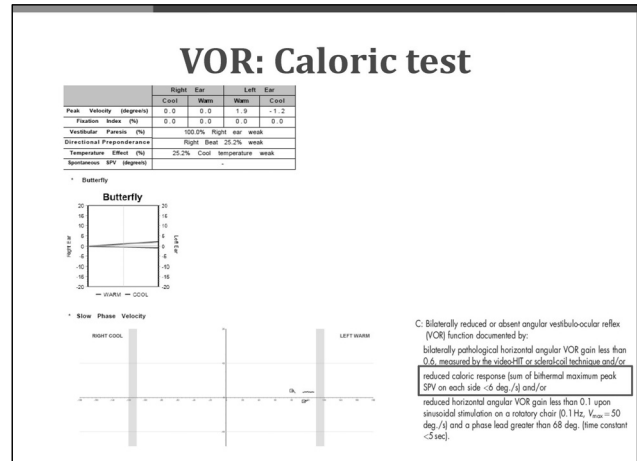
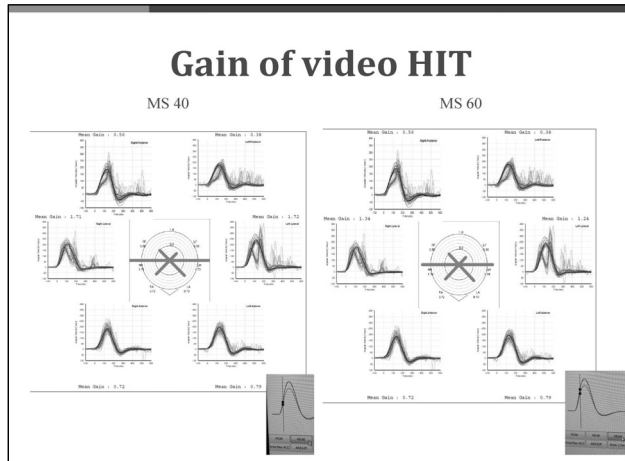
Gain of video HIT

Area to zero



Total area





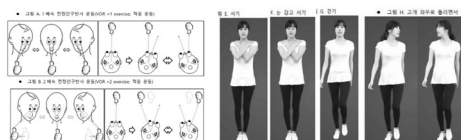
Laboratory examinations of BVP

- c,oVEMP
 - Saccular function less affected than horizontal SCC
 - Utricular function correlated with horizontal canal function
- Autonomic function test

*Handbook of Clinical Neurology, Vol. 137 (3rd series)
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Treatment of BVP: traditional VRT

- Goal
 - Improve gaze, posture stability, minimize falls, decreased dizzy sense
- Improvement
 - May be adaptation, habituation, and sensory substitution, reweighting of CNS
- 1) Exercises



Treatment of BVP: VRT

- 2) Visual stimuli: OKN, SP, Saccades
- 3) visual biofeedback training
- 4) virtual rehabilitation



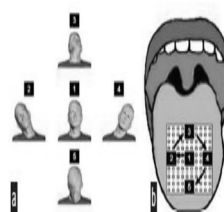
Visual feedback training screen



Treatment of BVP

Sensory substitution devices

BrainPort balance device
: Electrotactile stimulation of the tongue

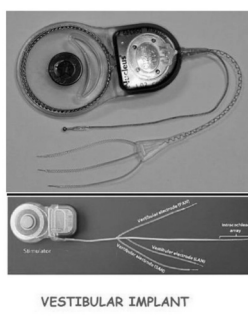


Head-mounted vestibular improvement prosthesis
: low-amplitude vibration stimulation on the scalp



Treatment of BVP

Vestibular implant



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