VESTIBULAR EVOKED MYOGENIC POTENTIALS
ITS INDICATIONS & CURRENT STATUS

VESTIBULAR EVOKED MYOGENIC POTENTIALS

- An otolith(saccule)-mediated short - latency reflex recorded from averaged sternocleidomastoid electromyography in response to clicks or tonebursts.
- Increasingly used in the evaluation of patients with vertigo

- Conventional vestibular assessment - evaluation of horizontal semicircular canal
- VEMP – evaluation of saccule, inferior vestibular nerve & vestibulocollic pathway
- VEMP is a polysynaptic response & helps in the assessment of ***lower brainstem function***, unlike the caloric tests & ABR which assess ***the upper brainstem***

- Saccule and saccular nerves have the lowest threshold to response to acoustic stimuli – ***basis of VEMP test***
- This sound sensitivity is thought to be a remnant from the saccule's use as an organ of hearing in lower animals

HISTORY OF VEMP

- Sound-evoked vestibular responses in humans were described by Tullio (1929) & Von Békésy (1935)
- Townsend et al.noticed the true origin of these potentials was the saccule
- Colebatch and Halmagyi first recorded VEMPs (1992)
- Kovach reintroduced VEMP (1994)
- Clinically used since 1992

VEMP - INDICATIONS

- Indicated in the diagnosis of peripheral and central vestibulopathies
- Differentiation of labyrinthine from retro labyrinthine lesions
- Used to monitor the efficacy of intratympanic gentamycin treatment
- Can be used in intraoperative, neurophysiological monitoring

VEMP - PATHWAYS

Sound stimulation of saccule

↓

Inferior vestibular nerve

↓

Vestibular nucleus

↙ ↘

MVST → Accessory nucleus & Nerve → Sternocleidomastoid muscle

LVST → Leg muscles

VEMPS are ipsilateral

VEMP methods

- Click evoked VEMP – most reproducible, symmetric, and technically easy to perform.
- Air- and bone-conducted short tone bursts
- Bone conduction VEMP
- Galvanic VEMP
- Forehead taps

EQUIPMENT

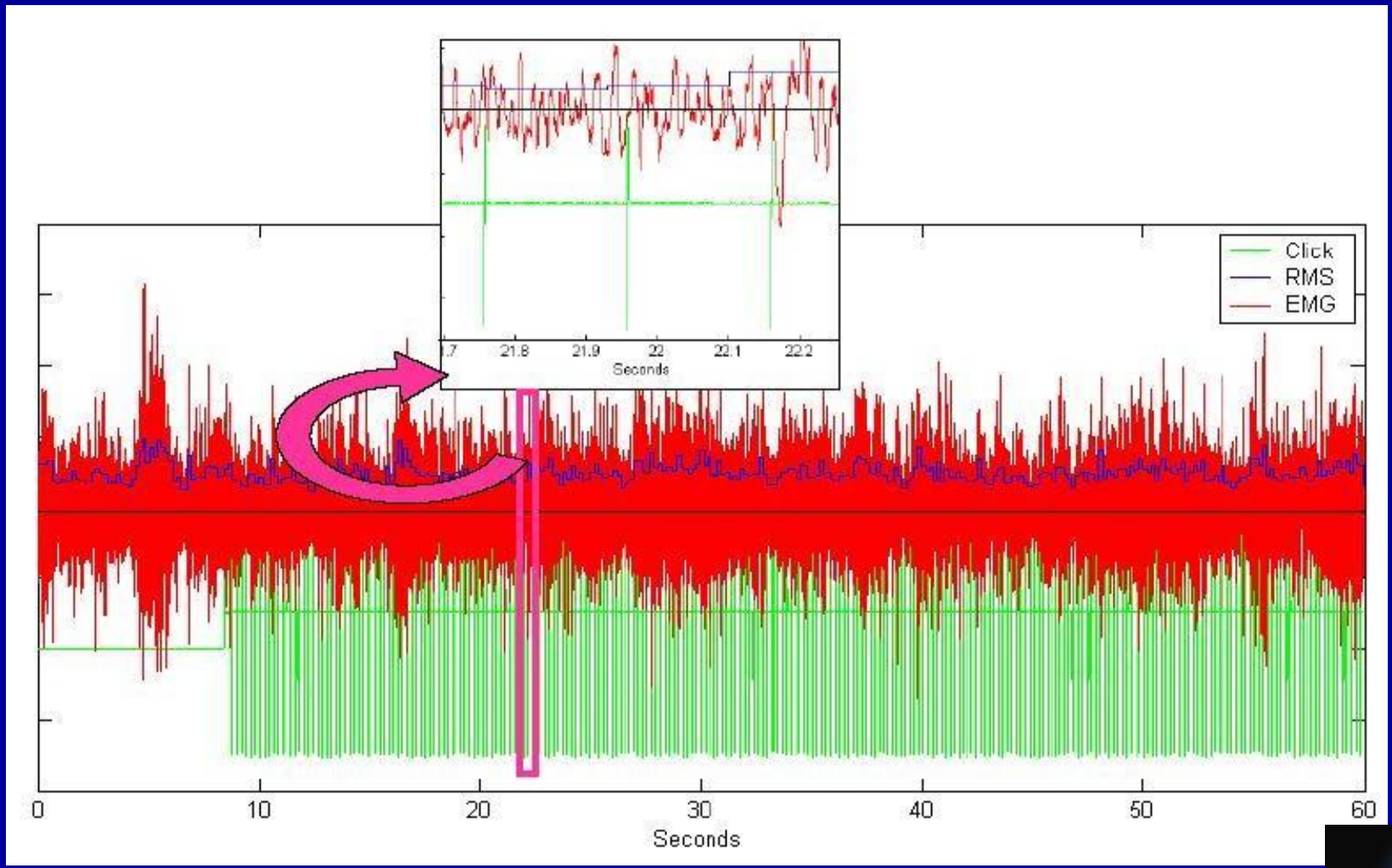
- Evoked response computer
- Sound generator
- Surface electrodes to pick up neck muscle activation

VEMP - technique

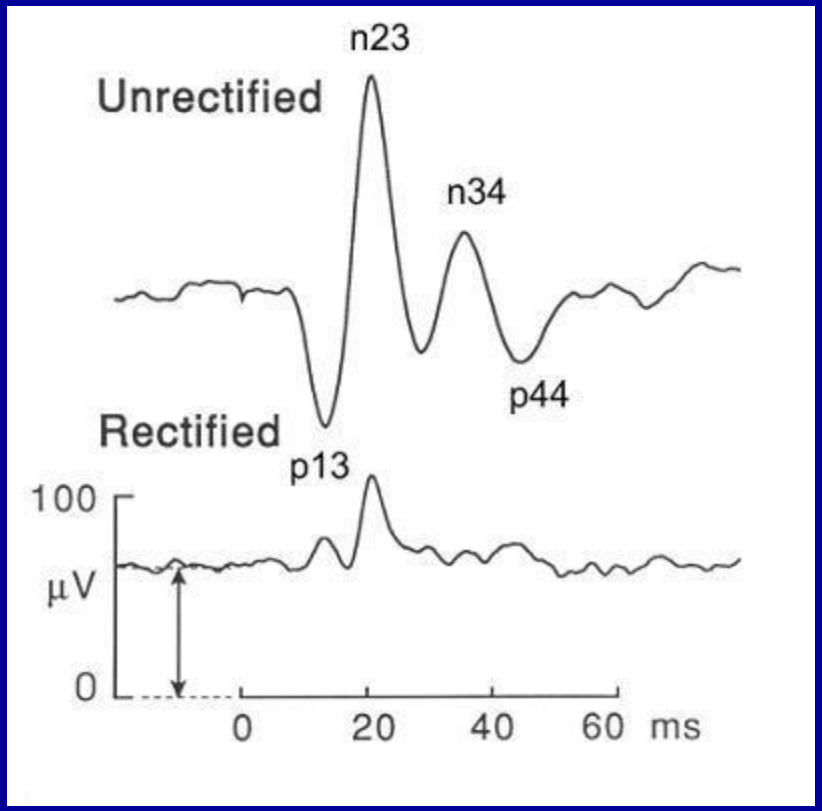
- Subjects are instructed to tense the muscle during runs of acoustic stimulation, relax between runs
- Inserts are preferable to headphones
- The response is ipsilateral, hence bilateral stimuli and bilateral recording is done
- Loud clicks (0.1 msec) or tone bursts (typically 95-100 dB nHL or louder) are repetitively presented to each ear in turn at 200 msec intervals (5/second)
- Optimum frequency: 500 - 1000 Hz
- 3 repetitions on each side

- Myogenic potentials are amplified, bandpass filtered (5-1K Hz), and averaged for at least 100 presentations
- The response evoked in the neck EMG is averaged and presented as a VEMP
- VEMP is recorded in the first 30 ms after the stimulus
- The latency, amplitude, and threshold for the p13-n23 wave is measured

NORMAL VEMP


Click
RMS
EMG
21.8
21.9
22
22.1
22.2
Seconds
0
10
20
30
40
50
60
Seconds

NORMAL VEMP



The initial biphasic p13 and n23 response is larger

The late response (n34 and p44) represents cochlear stimulation.

VEMP measures

- **Threshold - most clinically useful**

  - measures threshold in four different frequencies (250,500,750 and 1000Hz)

  - third window in the inner ear - decreased threshold
- **Latency** - prolonged in multiple sclerosis
- **Amplitude** - measured from the P13 to N23

  - fairly variable response, even between ears of the same patient

ABNORMAL VEMP

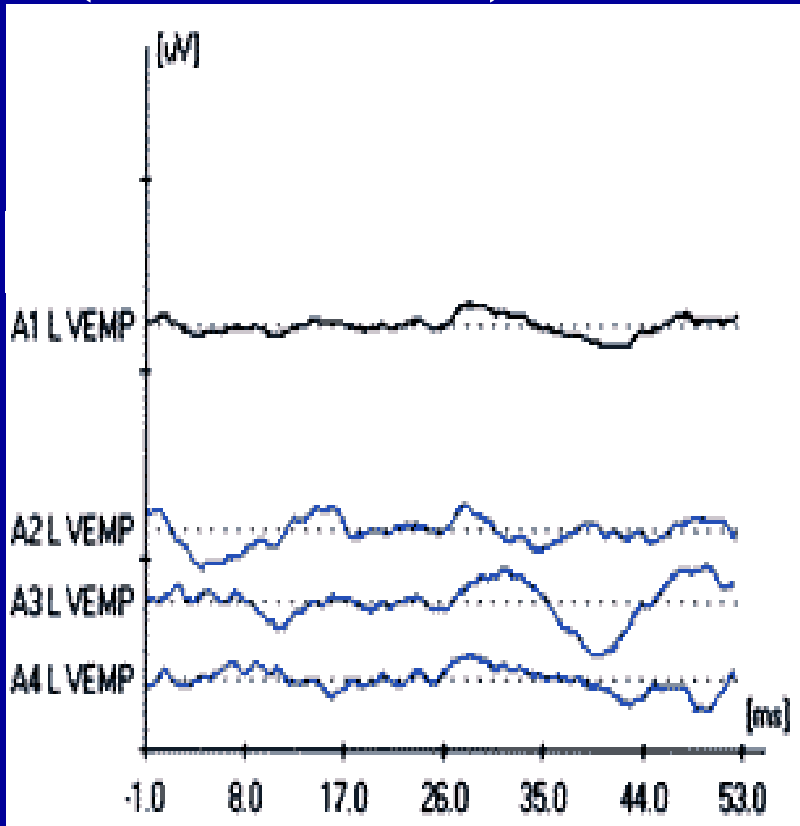
- Asymmetry is calculated by Amplitude Asymetric ratio
- If the ratio is more than 33% then asymmetry exsists
- Absent (no reproducible wave, or P1 latency outside of norms)

Attenuated or absent VEMP

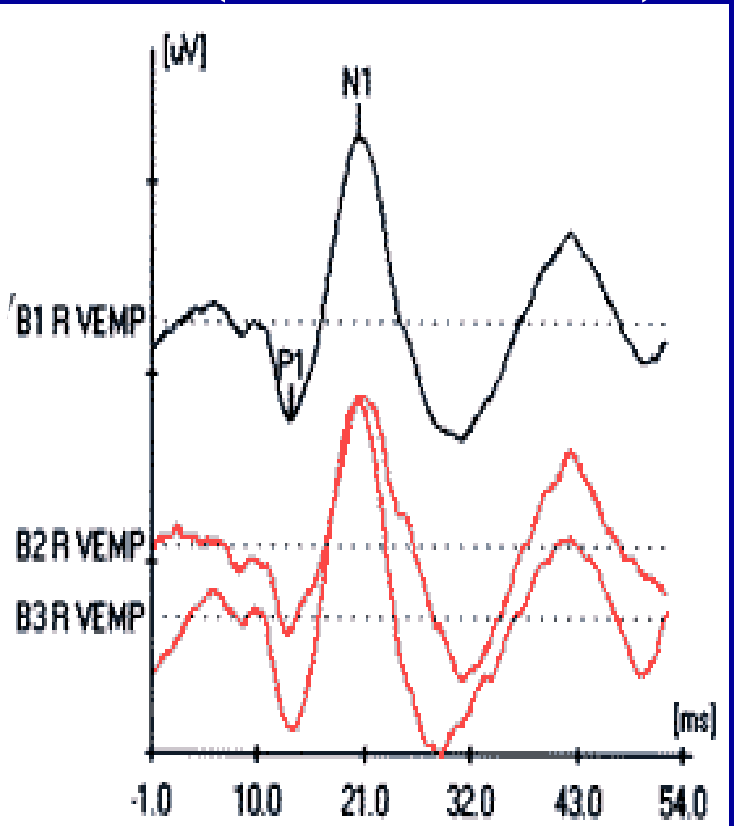
- Conductive loss
- Herpes zoster oticus
- Meniere`s disease
- Aminoglycoside ototoxicity
- Vestibular schwannoma
- Post cochlear implantation
- Basilar artery migraine
- Cogan’s syndrome
- Mondini malformation
- Vestibular neuritis
- Idiopathic bilateral vestibulopathy (IBV)

Conductive hearing loss

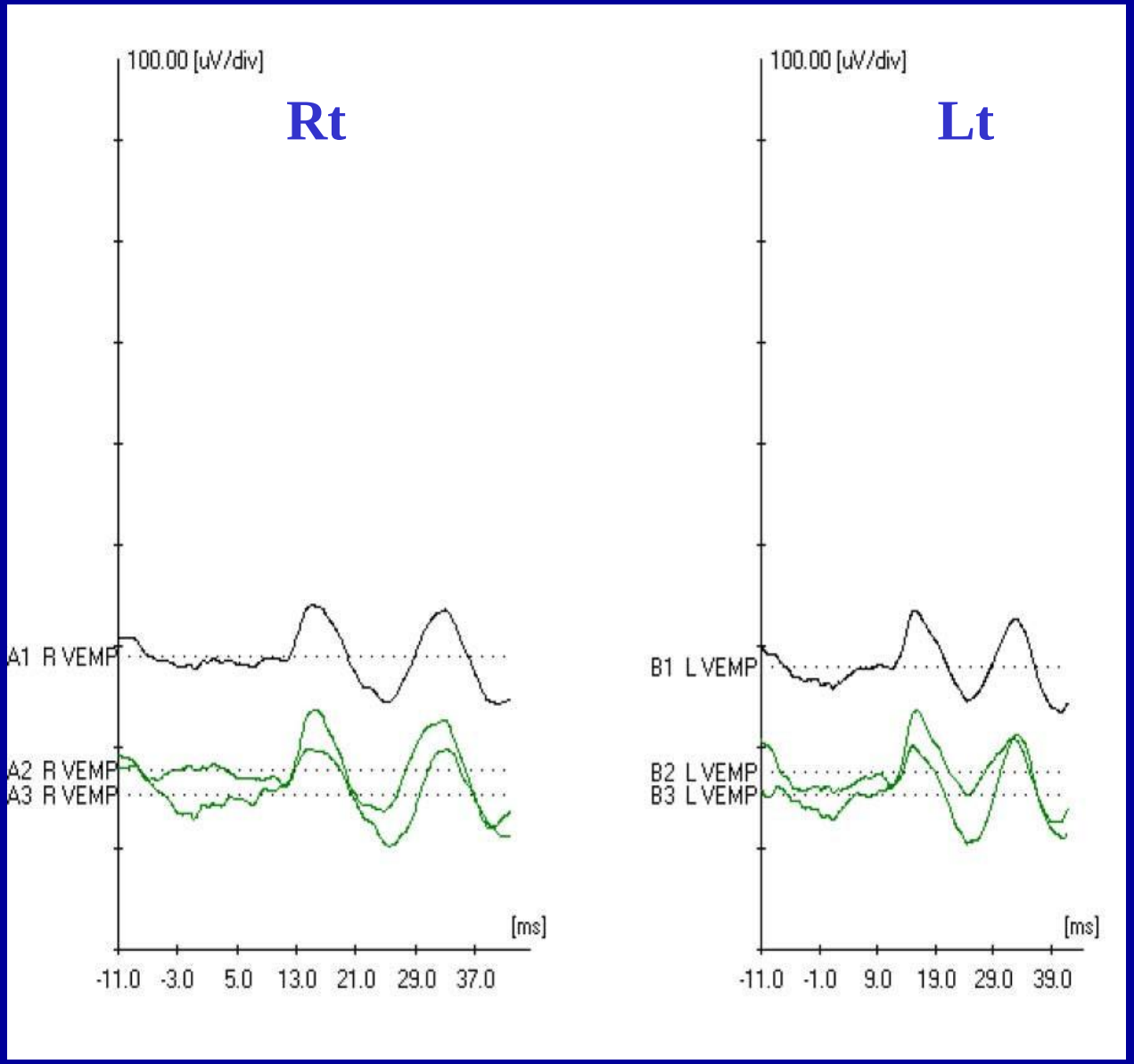
Left ear
(Absent VEMP)



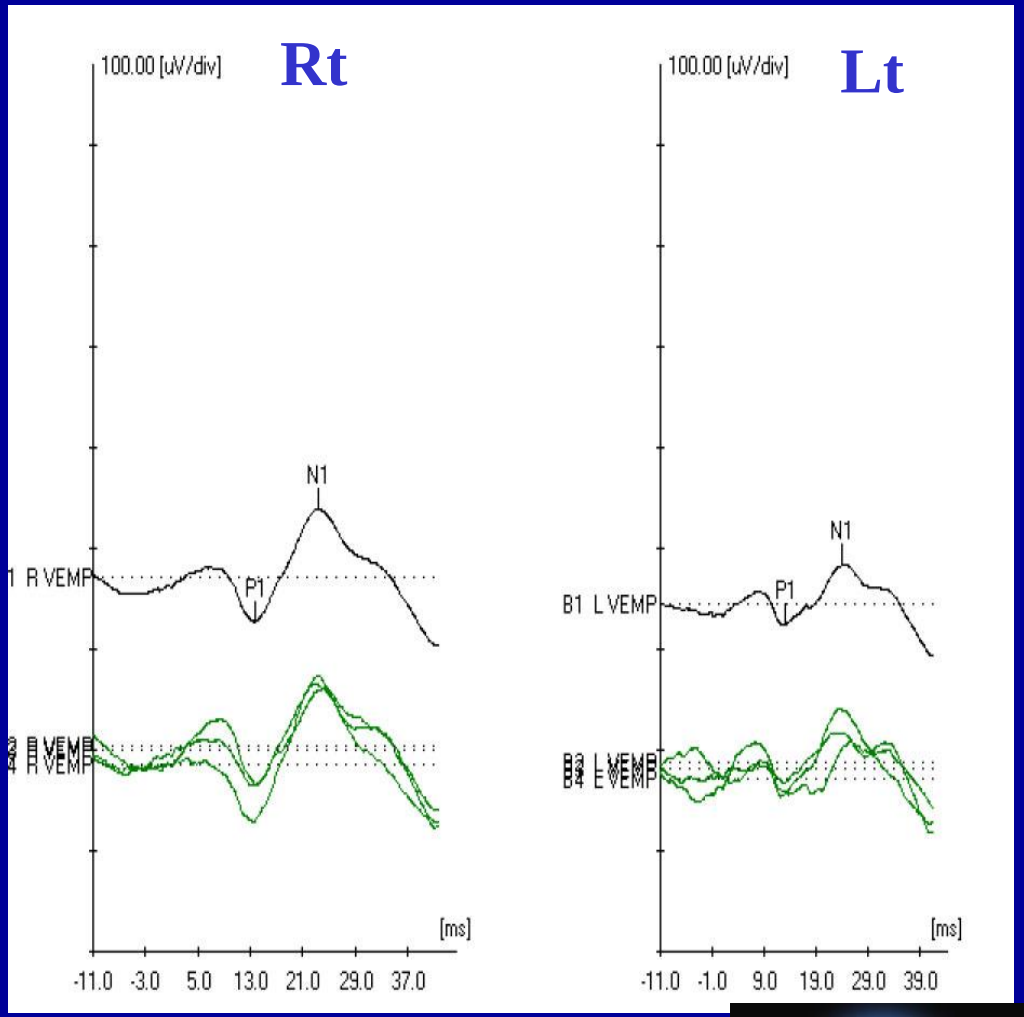
Right ear
(Normal VEMP)



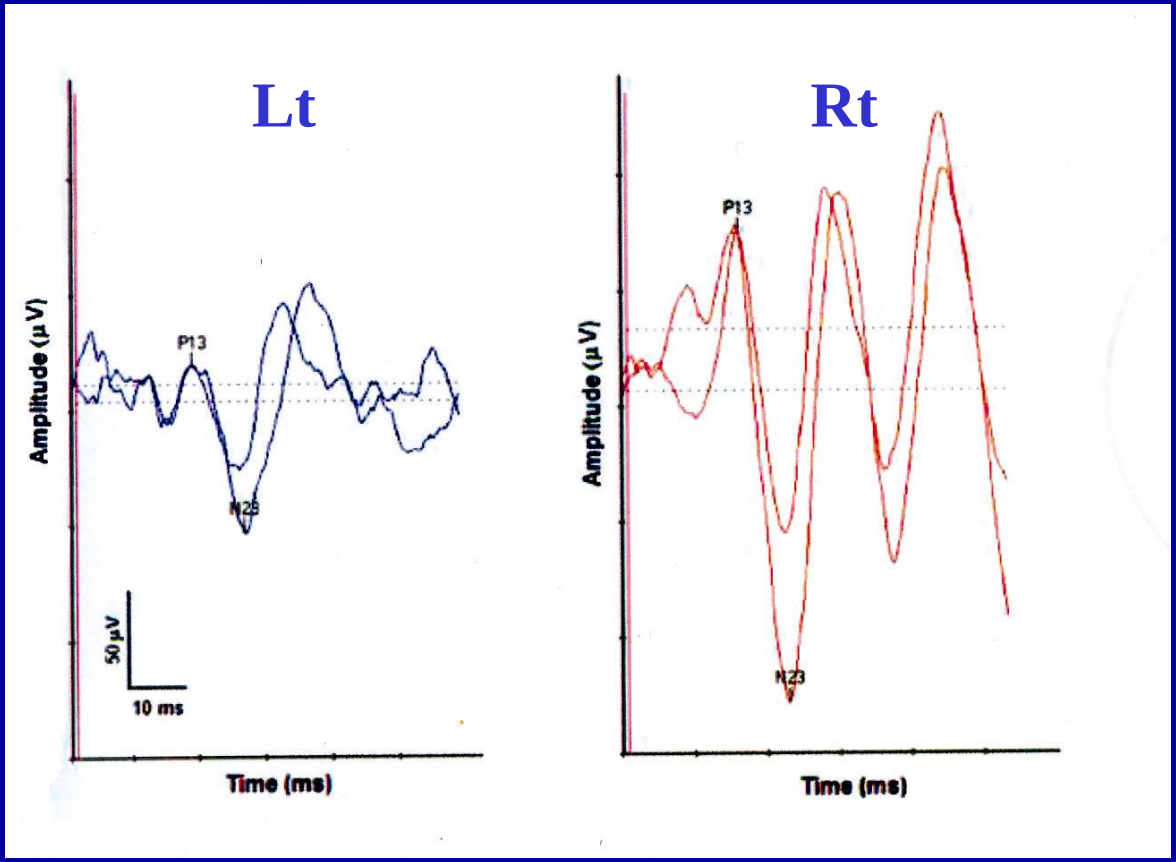
BILATERAL AMINOGLYCOSIDE OTOTOXICITY



LEFT ACOUSTIC NEUROMA



VEMP - Meniere's disease



Meniere’s disease

- VEMP amplitudes can be increased in early Meniere's disease
- Absent VEMPs in advanced disease may represent collapse of the saccule
- Altered VEMP after administering glycerol

VEMP

Increased

- Superior SCC dehiscence syndrome
- Perilymphatic fistula

Asymmetrical amplitudes

- Tullio's phenomenon
- Spasmodic torticollis

Delayed

- Technical error /elderly
- Central lesions

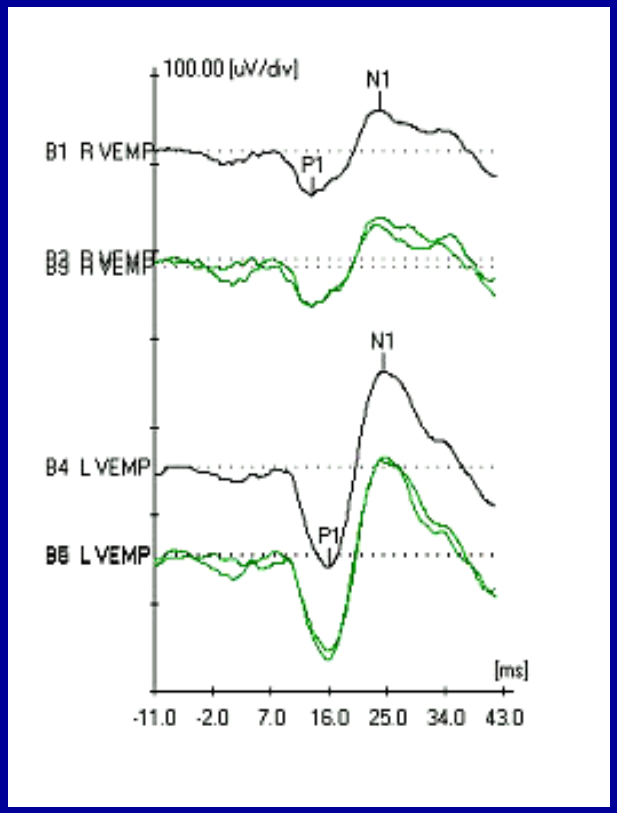
-Brainstem stroke

-Multiple sclerosis

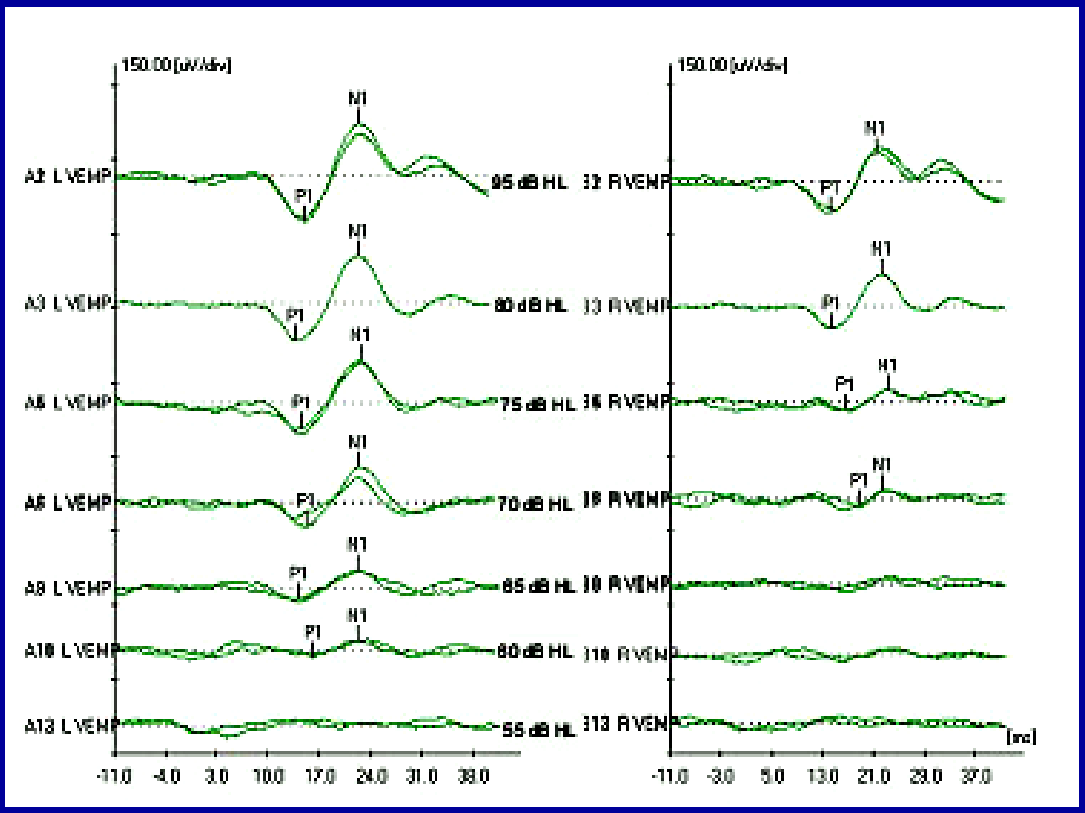
-Spinocerebellar degeneration

-Migraine

LEFT SUPERIOR SEMICIRCULAR DEHISCENCE



Lt Rt



VEMP - ADVANTAGES

- Specific vestibular sensory system (saccule) is assessed
- Retained in patients with profound SNHL
- Used in infants (latencies are shorter)
- Highly sensitive in the early diagnosis of retrocochlear lesions
- Robust, reproducible screening test of otolith function
- Minimal test time
- Easy to obtain & interpret
- Non-invasive, bedside test
- Does not cause discomfort

LIMITATIONS

- Conductive hearing loss obliterates VEMP's - an absent VEMP does not mean absent saccule function
- A person with a present VEMP and conductive hearing loss may have Superior semicircular canal dehiscence

CONCLUSION

- VEMP is a sound - evoked muscle reflex, or sonomotor response that can be recorded using evoked potential techniques by acoustical stimulation of the saccule
- VEMP has become an important investigative modality in the evaluation of patients with balance disorders

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