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
\[ \downarrow \]
Inferior vestibular nerve
\[ \downarrow \]
Vestibular nucleus
\[ \downarrow \]
MVST
\[ \downarrow \]
Accessory nucleus & Nerve
\[ \downarrow \]
Sternocleidomastoid muscle

LVST
\[ \downarrow \]
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
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 1000 Hz)
  - 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 Asymmetric ratio

• If the ratio is more than 33% then asymmetry exists

• 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 AMINOGYCOSIDE OTOTOXICITY
VEMP - Meniere’s disease

Lt

Rt
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.