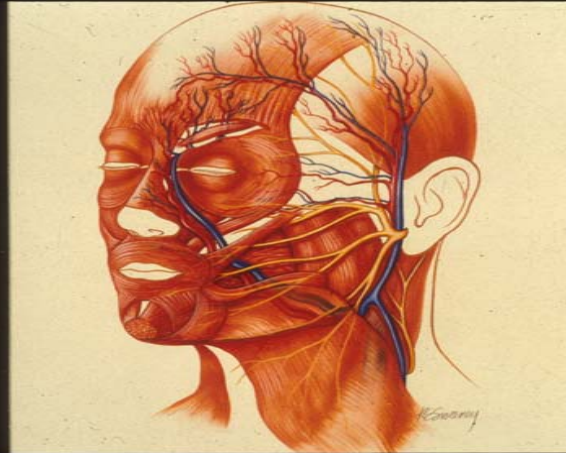


Electroneuronography (ENoG) in Audiology: Continuing a Tradition and Within the Scope of Practice

- ❑ First reported in 1974**
- ❑ Introduced clinically (and term coined) by Swiss neurotologist Ugo Fisch**
- ❑ Evoked electromyographic response from distal 7th cranial (facial) nerve**
- ❑ Quantifies degeneration of facial nerve**
- ❑ Applied in different pathologies, e.g., Bell's palsy, traumatic facial nerve injury**

Facial Nerve: Anatomy

(see figures 17-1 and 17-2 on pp. 557 & 558 in HBAERs)



Ugo Fisch



Professor Ugo Fisch (right) and Dr Phillip Chang in the operating theatre.

Electroneuronography (ENoG): Original Literature

- ❑ Fisch U. Facial paralysis in fractures of the petrous bone. Laryngoscope 84: 1974
- ❑ Fisch U. Maximal nerve excitability testing vs. electroneuronography*. Arch Otolaryngol 106: 1980

** technically facial nerve EMG*

Electroneuronography (ENoG): Terminology of Facial Nerve Injury

❑ Neuropraxia

- paralysis but no degeneration, e.g., Bell's palsy
- nerve structurally intact

❑ Axonotmesis

- nerve damage but not severed
- peripheral (distal) degeneration
- good prognosis

❑ Neurotmesis

- nerve separated (severed)
- poor prognosis

Clinical Assessment of Facial Nerve Function

- ❑ clinical examination, e.g., House Brackmann system
- ❑ Hilger testing (bedside with clinical observation)
- ❑ electromyography (EMG) by neurology
- ❑ antidromic nerve potentials
- ❑ evoked accelerometry
- ❑ acoustic reflexes
- ❑ magnetic resonance imaging (MRI)
- ❑ electroneuronography

Clinical Assessment of Facial Nerve Function: House Brackmann Grading System (1)

Grade	Description	Features
I	normal	- normal function of entire face
II	mild dsyfunction	- slight weakness - normal tone and symmetry
III	moderate dysx	- obvious difference between sides - normal symmetry at rest - eye closure with effort - weak mouth with maximum effort

Clinical Assessment of Facial Nerve Function: House Brackmann Grading System (2)

Grade	Description	Features
IV	moderate- severe dysfunction	<ul style="list-style-type: none">- obvious weakness- disfiguring asymmetry- normal symmetry and tone at rest- incomplete eye closure
V	severe dysfunction	<ul style="list-style-type: none">- barely perceptible motion- asymmetry at rest- incomplete eye closure
VI	total paralysis	<ul style="list-style-type: none">- no movement

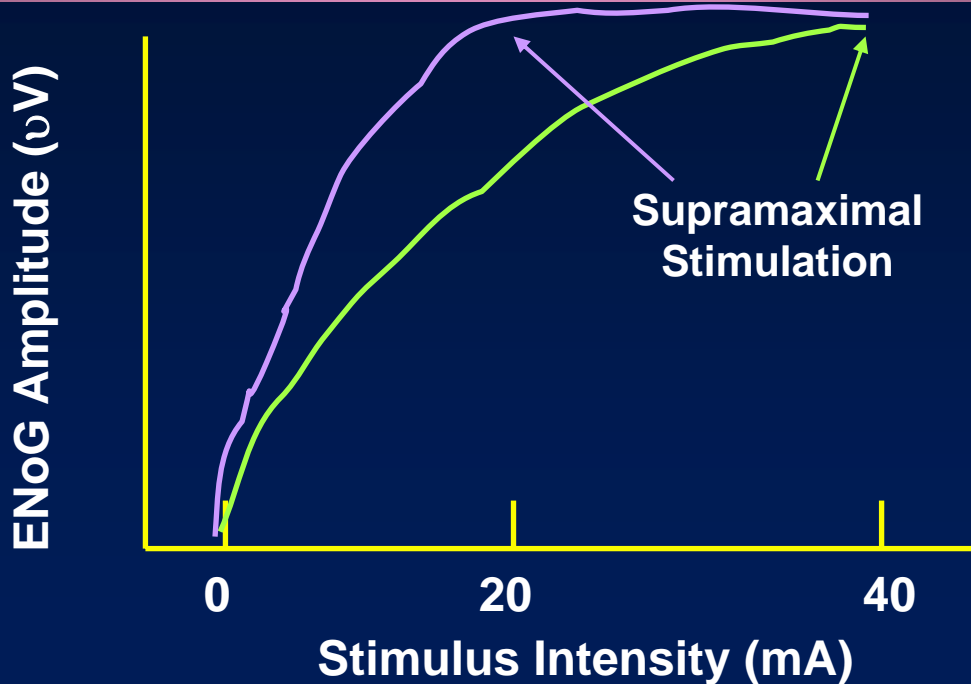
ENoG Test Protocol: Stimulus Parameters

- ❑ Transducer:** pair of electrodes
- ❑ Site:** stylomastoid foramen (main trunk)
- ❑ Orientation:** anode (+) anterior (“black back”)
- ❑ Type:** constant current pulse
- ❑ Mode:** continuous
- ❑ Duration:** 0.2 msec (200 μ sec)
- ❑ Rate:** 1.1/sec
- ❑ Laterality:** unilateral (uninvolved side first)
- ❑ Intensity:** to produce supramaximal response (usually > 10 mA)

ENoG Test Protocol: Acquisition Parameters

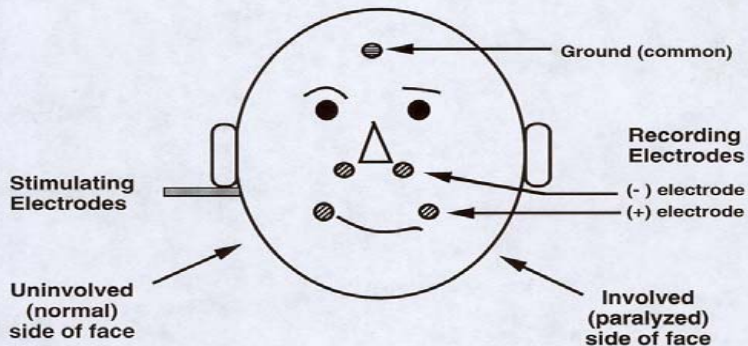
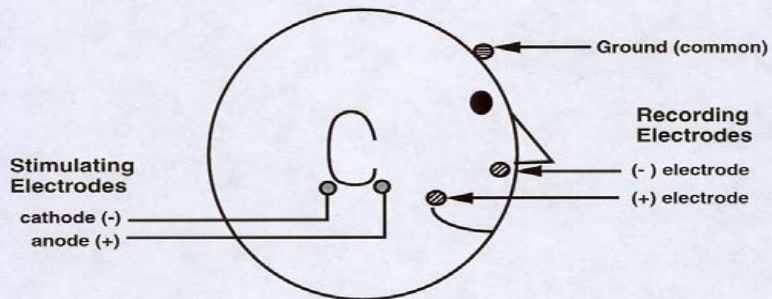
- ❑ Analysis time: 20 msec**
- ❑ Filter settings: 3 to 3000 Hz**
- ❑ Notch filter: no**
- ❑ Amplification: X 5000 or less**
- ❑ Electrodes: ipsilateral nasolabial fold
(ground on forehead)**
- ❑ Impedance: < 5K ohms**
- ❑ Sweeps: 1 to 20**

ENoG Stimulus Parameters: Supramaximal Stimulation



ELECTRONEURONOGRAPHY (ENoG)

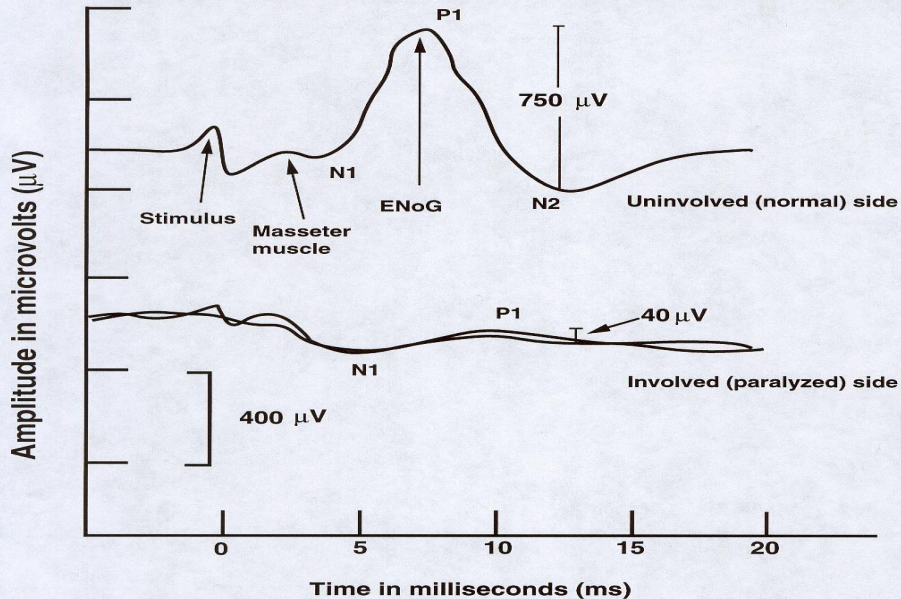
Stimulating and Recording Electrode Sites



*TIP: test this side first and use
ENoG values as a reference*

Electroneuronography (ENoG) Analysis:

Analysis: "Significant degeneration in facial nerve response"



$$\text{Percent degeneration} = 100 - \frac{\text{amplitude on involved side of face } (\mu\text{V})}{\text{amplitude on uninvolved side of face } (\mu\text{V})} \times 100$$

$$\text{Percent degeneration} = 100 - \frac{40 \mu\text{V}}{750 \mu\text{V}} \times 100 = 95\%$$

ENoG: Timing of Test Sessions

- ❑ Defer initial recording until > 3 days (> 72 hours) after onset for development of Wallerian degeneration**
- ❑ Within first 72 hours patient will have paralysis but intact distal facial nerve function**
- ❑ Repeat ENoG every 4 to 5 days to document either improvement or further degeneration**
- ❑ Degeneration of > 90% (poor side < 10% of good side) is significant (may warrant aggressive management)**
- ❑ Normal, stable or improving ENoG indicates good prognosis**
- ❑ ENoG > 21 days after onset has limited clinical value**

ENoG Recording: Trouble Shooting

❑ Symptom

- no response bilaterally

❑ Problem

- chemical paralysis (in the O.R. or ICU)
- improper electrode placement

❑ Solution

- reverse neuromuscular blocking agent medically
- verify correct electrode placement

ENoG Recording: Trouble Shooting

❑ Symptom

- poor response bilaterally

❑ Problem

- edema at stimulation side (in trauma)
- tenderness/pain precludes adequate stimulus
electrode pressure

❑ Solution

- relief pain
- defer recording to later time

ENoG Recording: Trouble Shooting

❑ Symptom

- poor response bilaterally**

❑ Problem

- obese patient**
- ineffective stimulation**
- bilateral dysfunction or injury**

❑ Solution

- apply more pressure to stimulating electrodes**
- use needle electrodes**
- compare patient ENoG amplitudes to normal data**

ENoG Recording: Trouble Shooting

❑ Symptom

- poor response unilaterally

❑ Problem

- inappropriate stimulus site

❑ Solution

- relocate stimulating electrodes
- increase stimulus intensity to supramax level

ENoG Recording: Trouble Shooting

❑ Symptom

- excessive artifact rejection (cannot average)

❑ Problem

- stimulus artifact
- very large normal response

❑ Solution

- increase distance between stimulus and recording electrodes
- avoid crossing of stimulus and recording electrode wires
- use post-stimulus delay
- decrease amplification (gain)

ENoG Recording: Trouble Shooting

❑ Symptom

- early response (peak before 6 msec)

❑ Problem

- masseter muscle response

❑ Solution

- move stimulating electrode posteriorly

Facial Nerve Assessment and Intra-operative Monitoring in Audiology

