# Diagnostic Protocols for Infants

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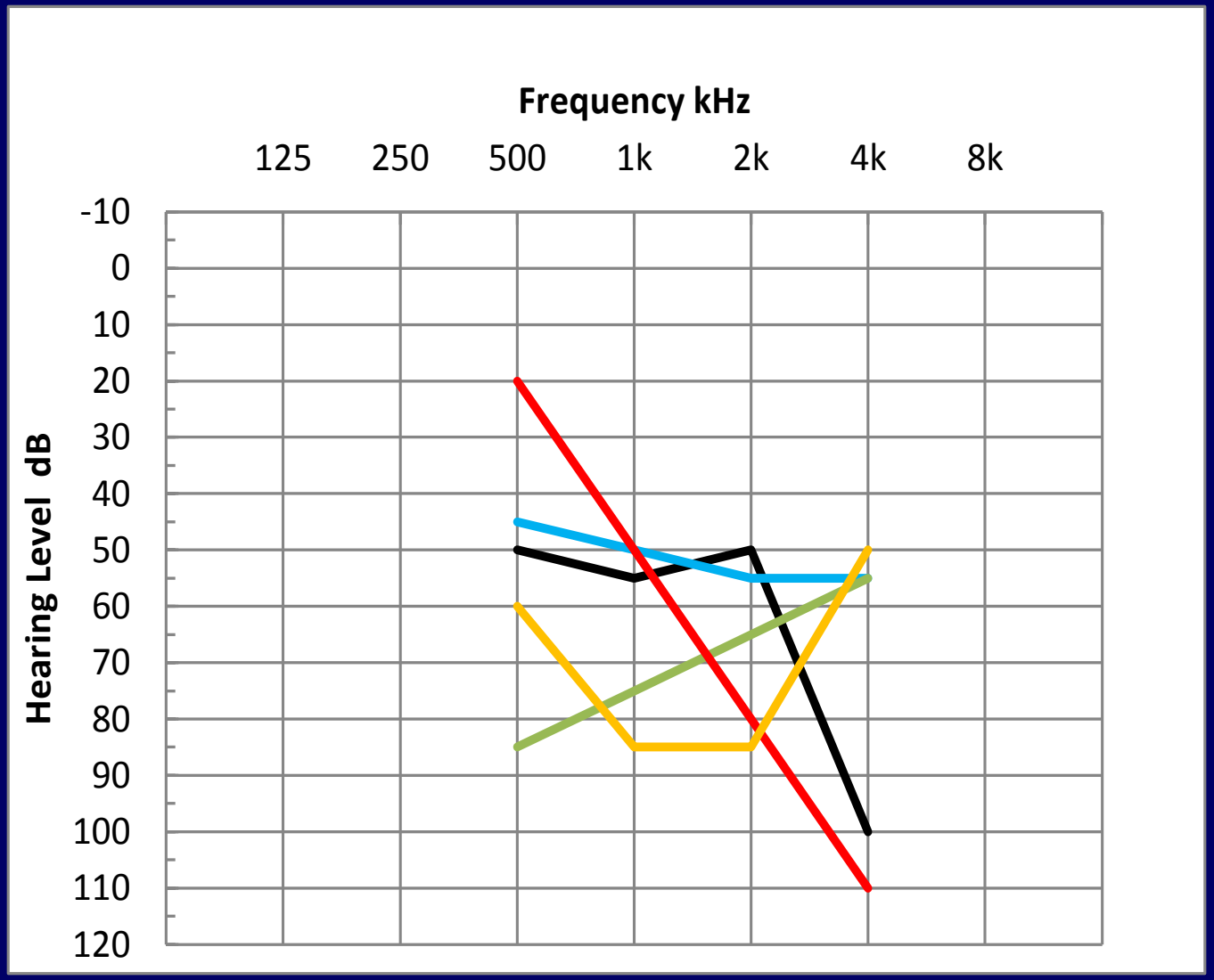
# Challenge: after AABR screen fail or direct high-risk referral:

- Significant hearing loss? YES / NO
- If YES, laterality & type?
  Conductive (T or P), conventional cochlear, ANSD, brainstem neural, any mixture
- Frequency-specific thresholds sufficient to counsel family, specify amplification, implant candidacy, baseline for progression , etc.

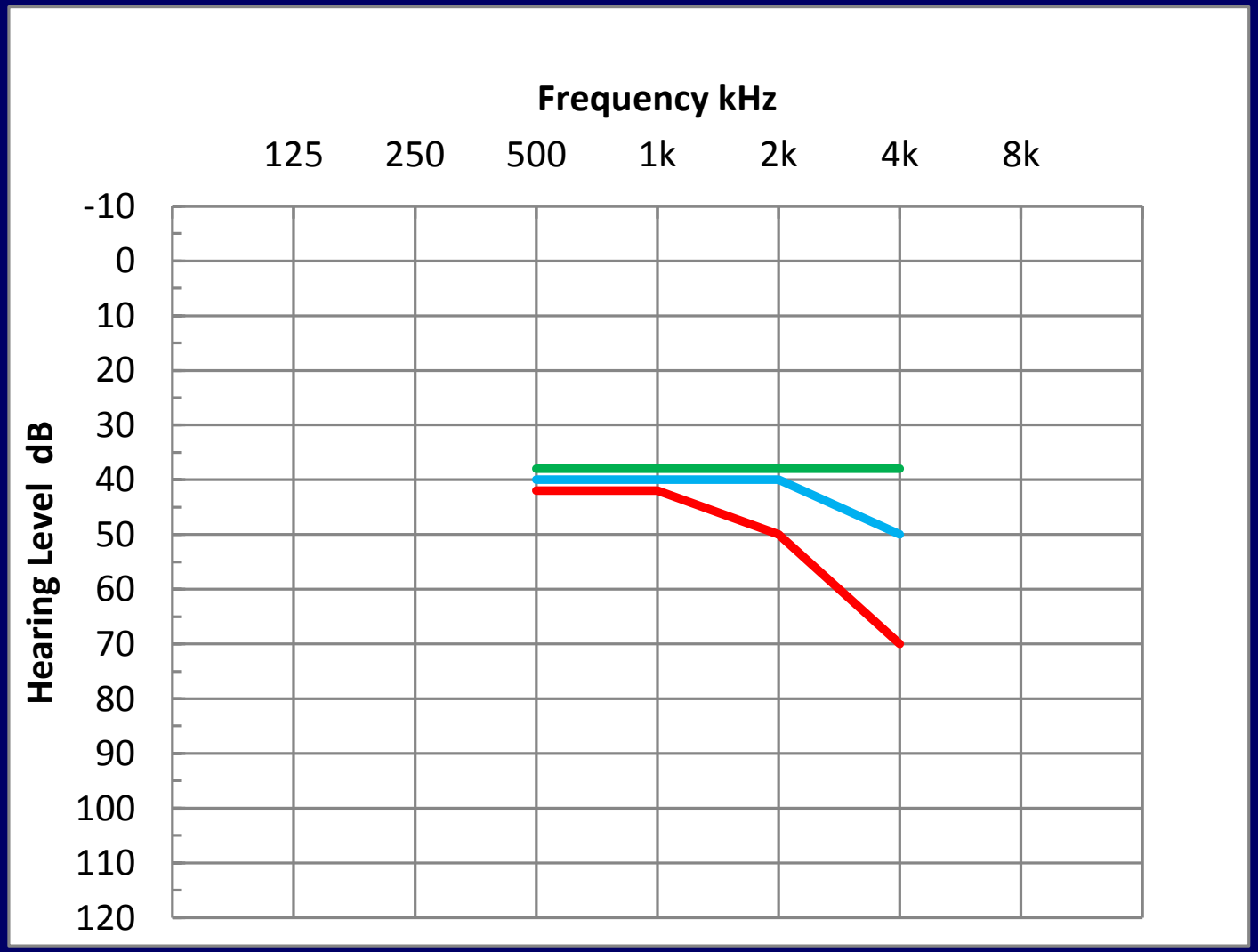
- Accurately & as quickly as possible

# Click ABR threshold 60 dBnHL

## Same amplification…???



# Click ABR threshold 50 dBnHL
# Monitoring: no progression..???



# Dx assessment – context
# Mandatory care standards

- Authorized audiologists with advanced training
- Detailed protocols, contracted adherence
- 3-day minimum hands-on training in protocols
- Expert review of all records until standards achieved
- Off-line expert decision support
- Random, statistics- or event-driven CQI audit
- Adverse event/non-adherence  human resources process
- Low-caseload review process
- Complex case referral to centres of excellence

# Present diagnostic tools

- Tonepip ABR (air & bone conduction)
- Brainstem (80 Hz) ASSR: single/multiple-frequency
- Click ABR & cochlear microphonic (CM)
- Long-latency cortical potentials

- OAE (Distortion Product or Transient): 1-6 kHz
- Tympanometry:1 kHz probe < 6 m, 226 Hz older
- Middle-ear muscle reflexes: ipsi, 1k or white noise
- (wideband reflectance)

# ASSR opinions & facts

- What is it? Overlapped ABR fast & slow components..
- Severe-profound? dBnHL/Vestibular/damage…
- More frequency-specific? Cochlea, not acoustics…
- Multi-frequency? Yes, interaction, level differences..
- Higher rate? Yes, efficiency but neuro variability
- More objective? Yes, but no waveshape info…
- Bone conduction? No good norms; artifact…
- No efficiency comparisons with good methodology
- Adult data irrelevant in young infants
- Possible use as initial 'Dx screen'
- Must be followed with tonepip ABR AC, BC

# Protocols

- Without PE & CQI, program will not survive
- Cannot evaluate what is unknown or diverse
- Cannot improve what cannot be evaluated
- Aggregate results from diverse procedures are meaningless
- Are key to Effectiveness, Equity, Efficiency
- Challenging to develop & implement

# What protocols do & do not:

- Large volume of evidence, extract key elements
- Promote minimum standards, skills growth
- Avoid major errors (serious adverse events)
- Do not threaten case individuality or practise freedom, IF WELL-DESIGNED

# Barriers to guideline/protocol 'adherence'

Cabana M et al, JAMA 1999;282(15):1458-65

| | |
|---|---|
| Lack of awareness | Protocol? What protocol? |
| Lack of familiarity | Haven't read it yet |
| Lack of agreement | Wrong. Irrelevant |
| Lack of self-efficacy | I can't manage it |
| Low outcome expectancy | No point. Won't work |
| Previous-practice inertia | I know what I'm doing |
| External barriers | Haven't got the time |
| Guideline barriers | Hard to use, inconvenient |
| Environment barriers | Not enough resources |

# Good protocols are:

- Evidence-based as much as possible
- Relevant, rational & practicable
- Tried and tested
- Have mandatory & discretional components
- Very specific, complete & well-justified
- Clear and well-organized for quick lookup
- Strongly, constant support & reinforcement
- Current, responsive to provider feedback

# Strategic principles – the 'endless diagnosis' problem

- Assume only one more measurement…
- Limit your objectives..tests, ear, AC/BC, f, levels
- Every measurement must impact management..
- Major questions first, progressive refinement later
- Use what you already know
- Fewer definite answers are more useful….
- Completeness is rarely important – move on

- Consider:  AC2k30dB -, 60 dB +, BC2k30 - …..

# Tactical lessons learned

| | |
|---|---|
| Test: | Do ABR first, usually |
| Ear: | Depends |
| Route: | AC then go to BC early |
| Freq: | 2k then 500, then ? 1k, 4k |
| Levels: | 25 dBEHL, up 30, down 10/20, 5dB only >70 |
| Averages: | Search: 1-2, 1-2000, |
| | Bracket: upper 2-3, lower 1-2 |
| Judgment: | MUST use residual noise level for -, |
| | SNR & replication for + |

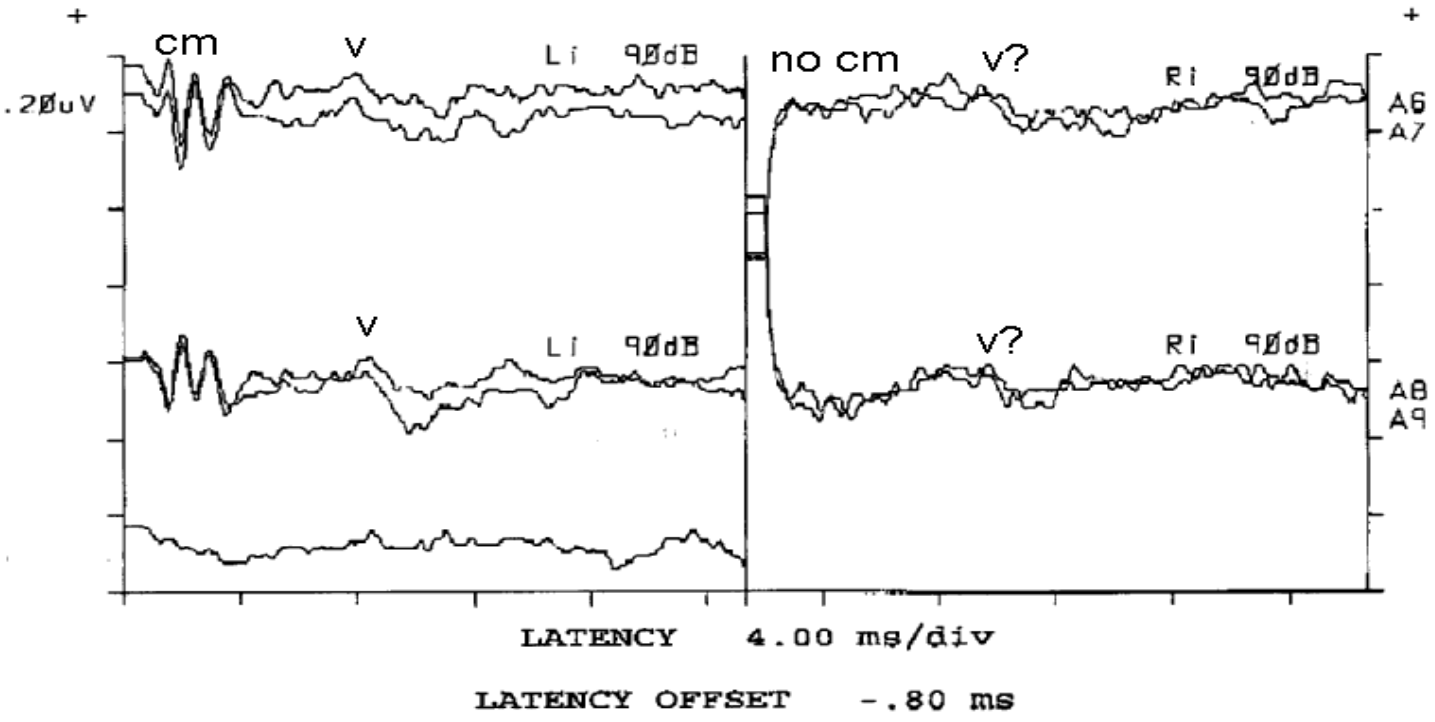
# ANSD: *still* a diagnostic challenge

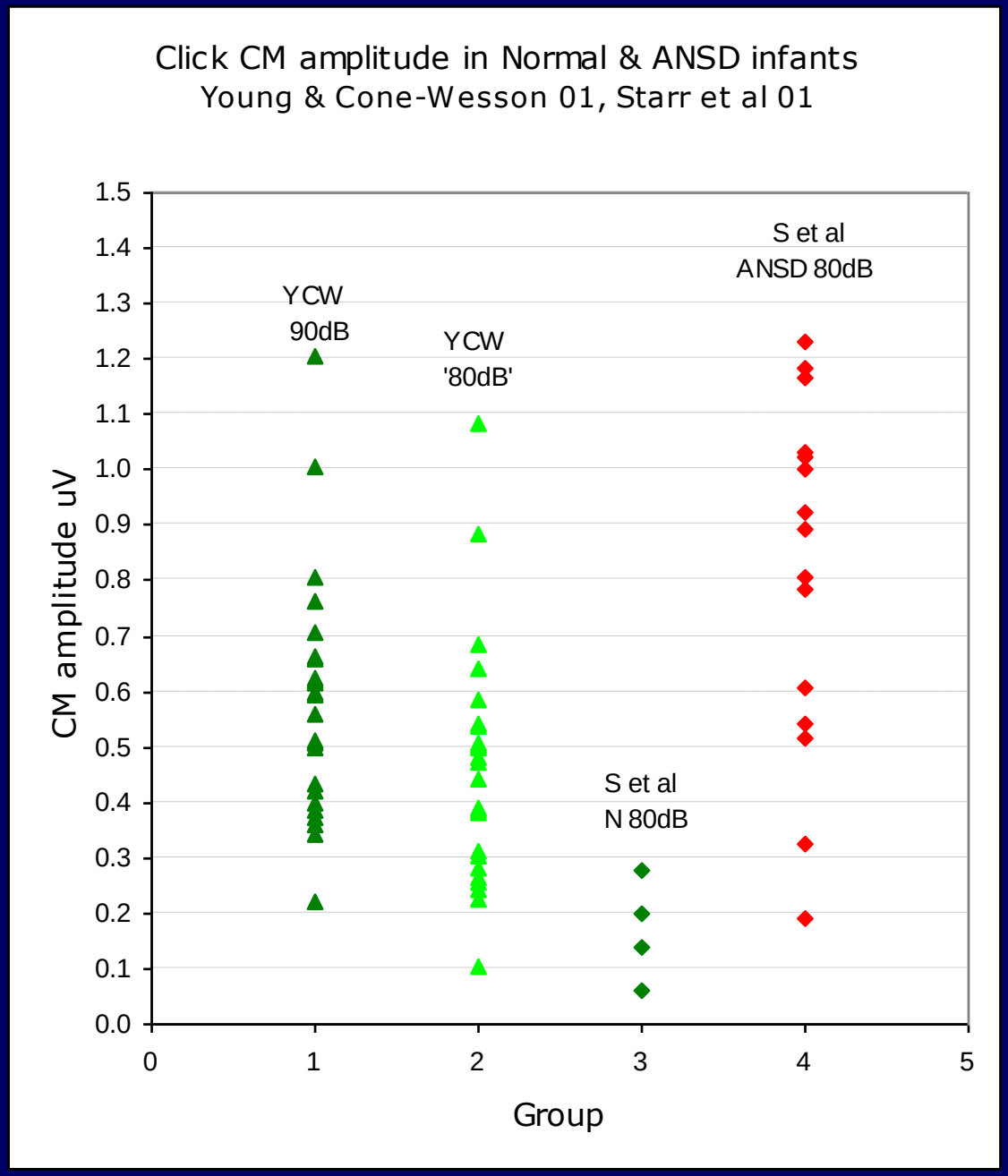
- Disentangling ANSD, OHC SHL & CHL
- Normal OAE & absent ABR: rule-in
- Absent OAE, large oscillatory CM & no ABR: rule-in
- Air-bone gap: no OAE or CM – cannot diagnose
- Present CM does NOT rule out OHC SHL
- What is an abnormal ABR?
- Little data on CM/ABR relationships in OHC SHL
- Rarefaction-condensation strange effects…
- Recent IHC evidence in premature babies
- Frequency-specific ANSD?
- Recording bandwidth increase needed…
- Use of late obligatory cortical AEPs

# ?ANSD, CM & ?conductive

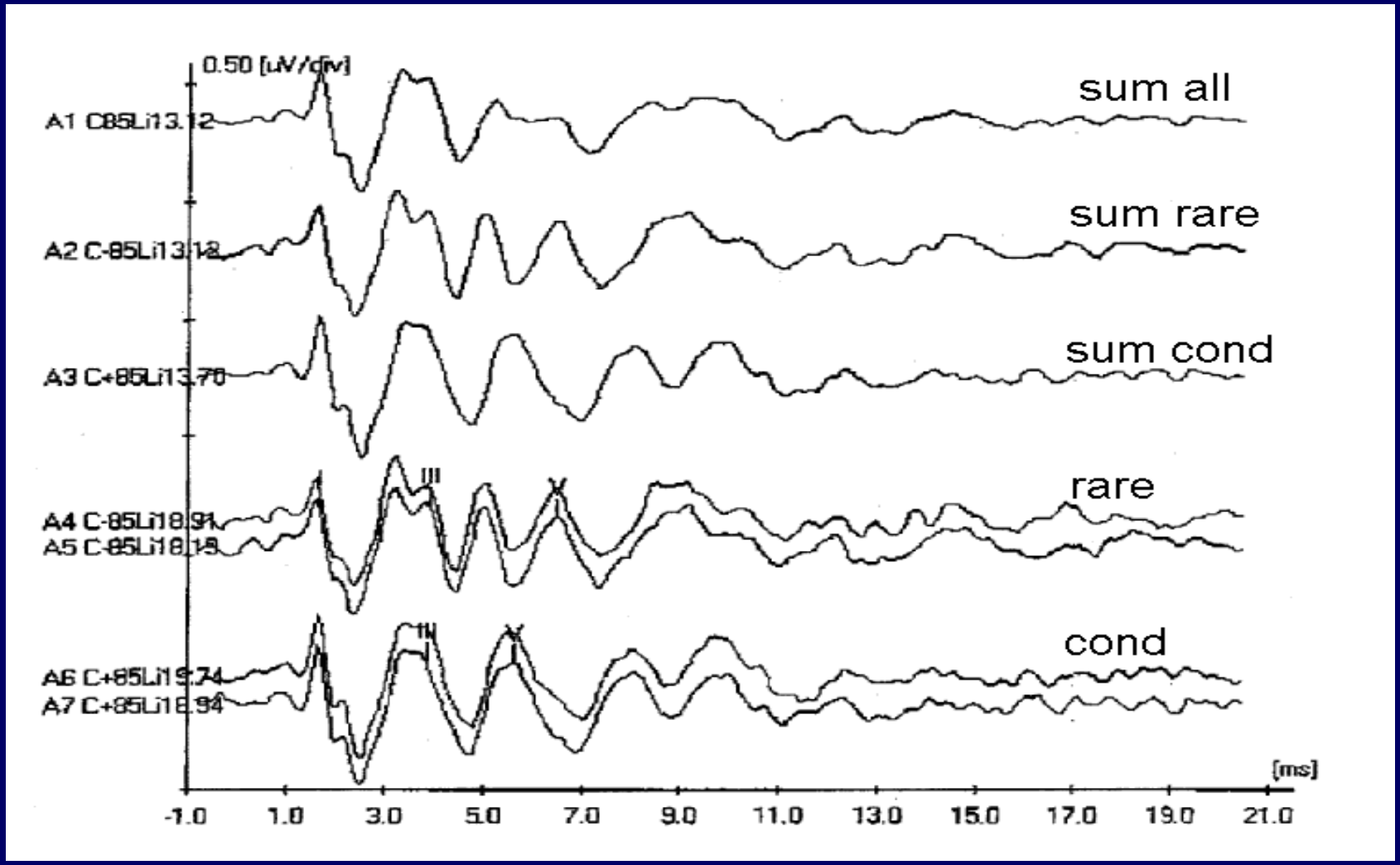
Click ABRs, 3m infant, HBr + exchange

Flat tymps, no OAE, no MEMR bilaterally
2k ABR dBEHL 80 L 90+ R, BC absent at 45 dBnHL



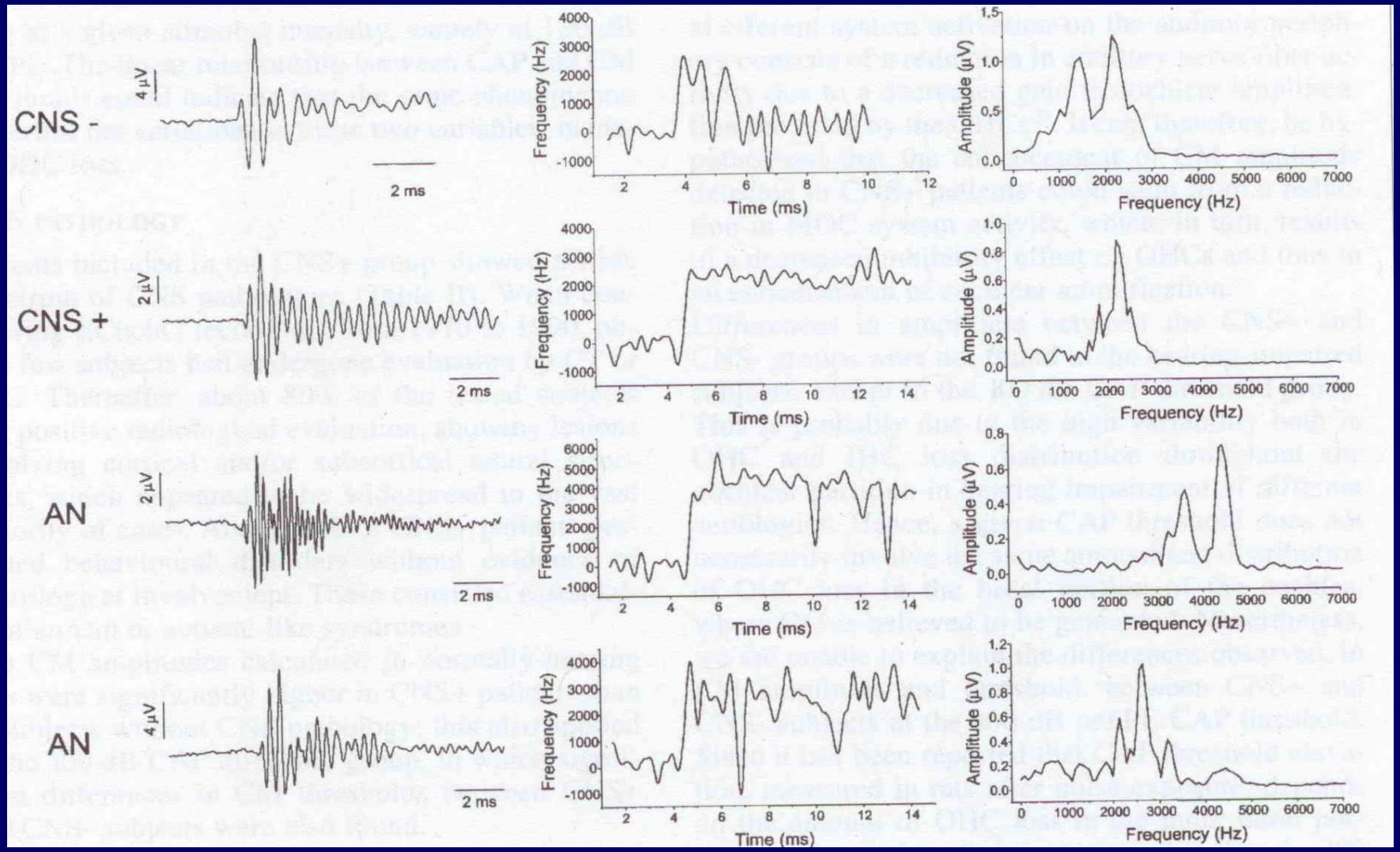

Click CM amplitude in Normal & ANSD infants
Young & Cone-Wesson 01, Starr et al 01
CM amplitude uV
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
YCW
90dB
YCW
'80dB'
S et al
N 80dB
S et al
ANSD 80dB
0
1
2
3
4
5
Group

# Infant ABR: rare/cond diff, no CM

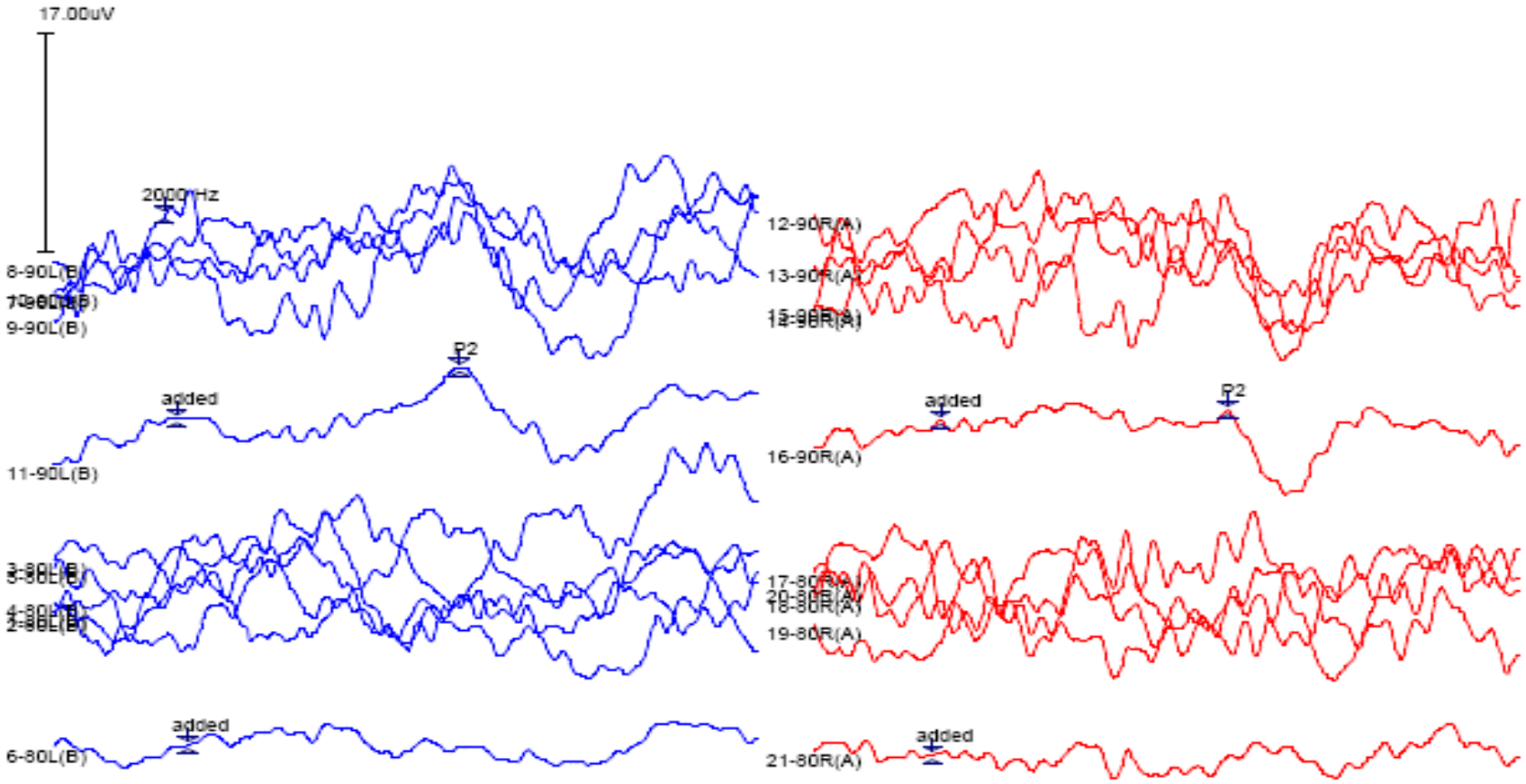


# CM duration / frequency

## Santarelli et al 2006



# Cortical AEPs from sleeping young infant




**Courtesy of Renee Janssen**

**British Columbia Early Hearing Program**

# GRACIAS *DOS* MIL

ADIOS Y BUENA SUERTE