Sensorineural Acuity Level (SAL): Ear Specific Bone Conduction in the Masking Dilemma

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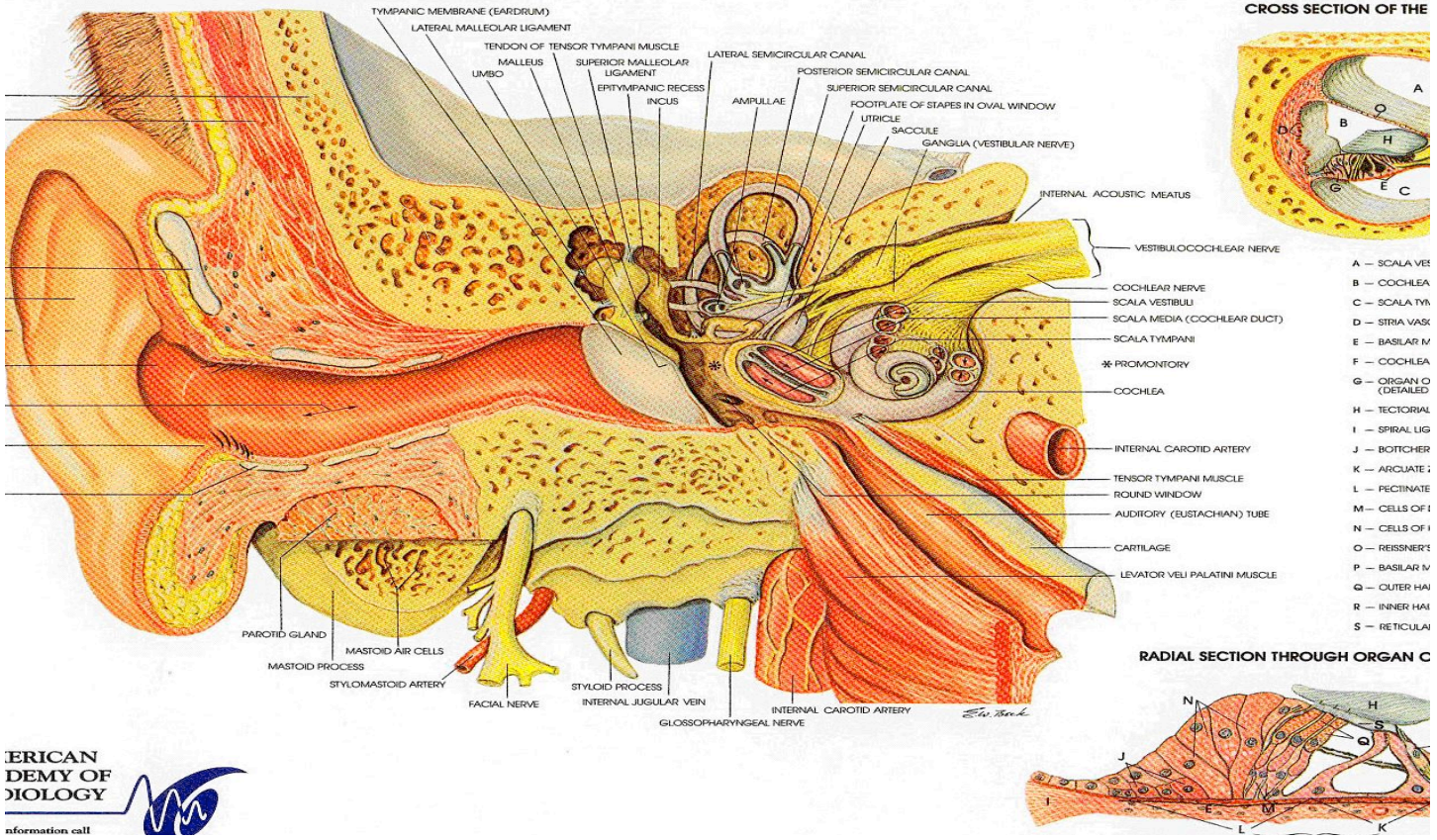
ANATOMY OF THE HUMAN EAR



CROSS SECTION OF THE

A — SCALA VES
B — COCHLEA
C — SCALA TYM
D — STRIA VASC
E — BASILAR M
F — COCHLEA
G — ORGAN O (DETAILED
H — TECTORIAL
I — SPIRAL LIG
J — BOTTCHER
K — ARCUATE
L — PECTINATE
M — CELLS OF
N — CELLS OF
O — REISSNER'S
P — BASILAR M
Q — OUTER HA
R — INNER HA
S — RETICULA

RADIAL SECTION THROUGH ORGAN C

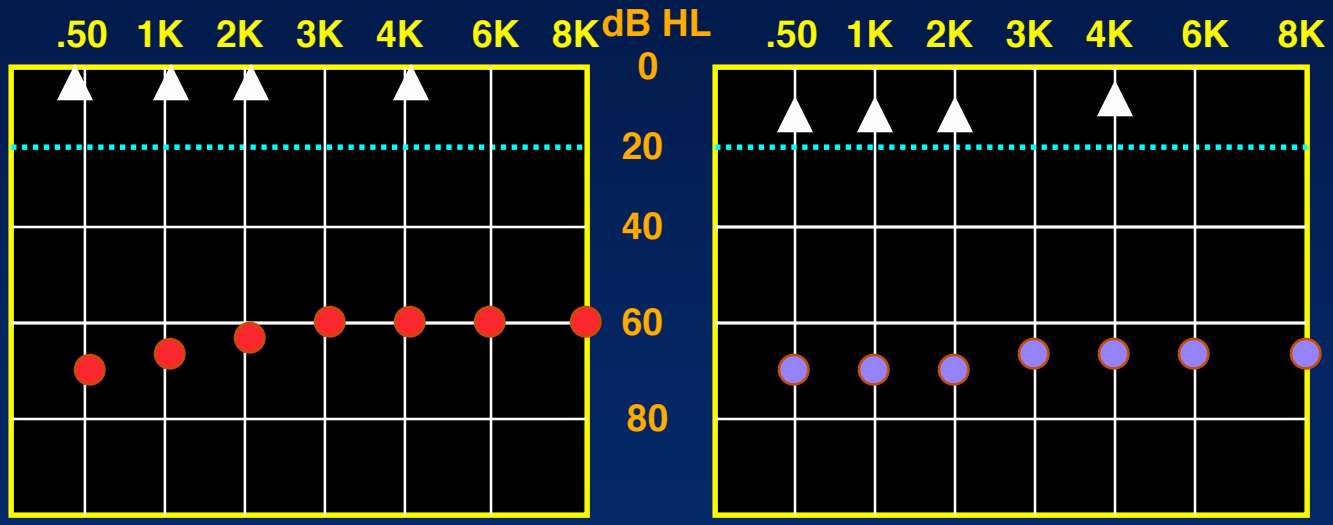
ERICAN
DEMY OF
DIOLOGY

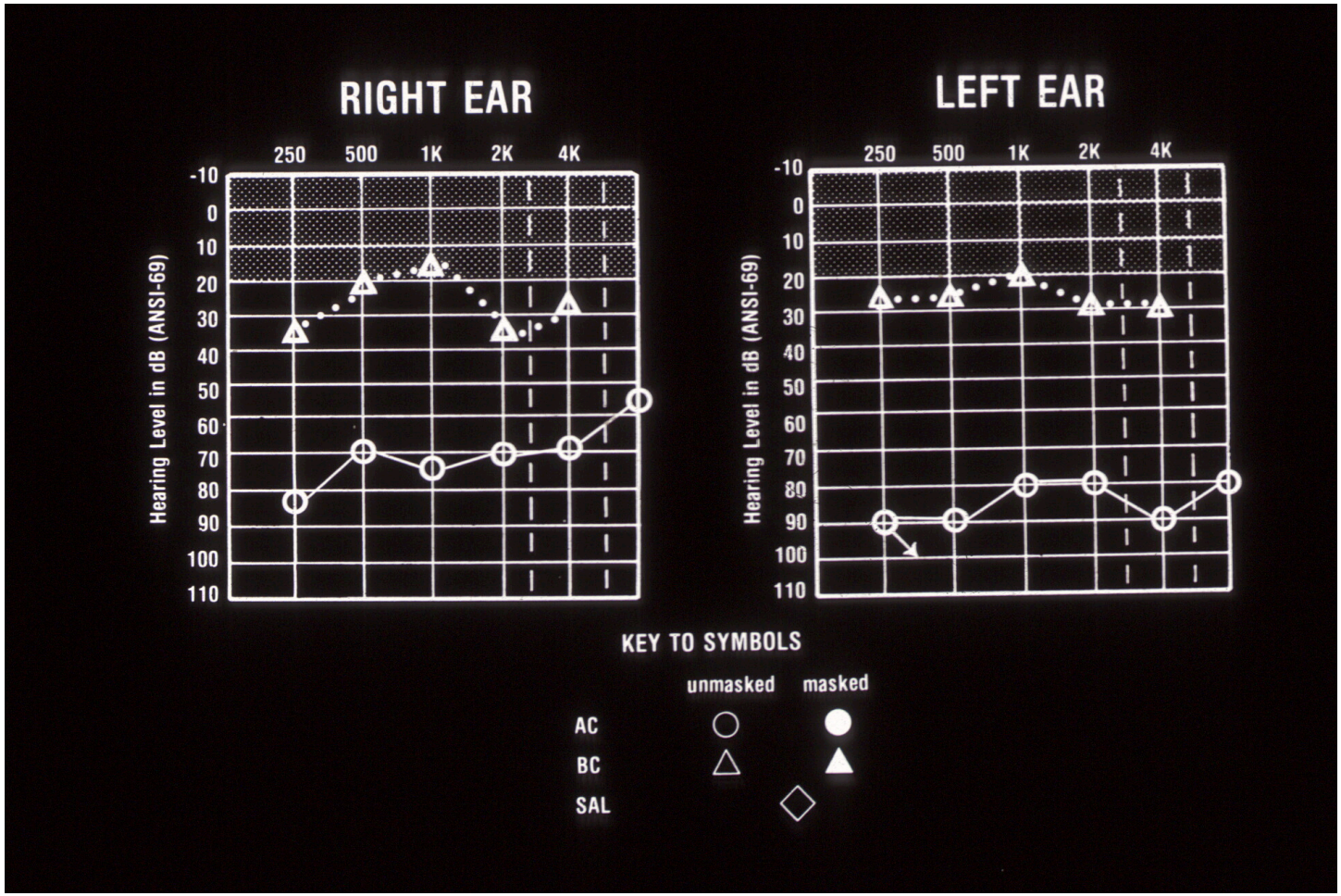
nformation call

The Masking Dilemma: Clinical Entities Associated with Bilateral Conductive Hearing Loss

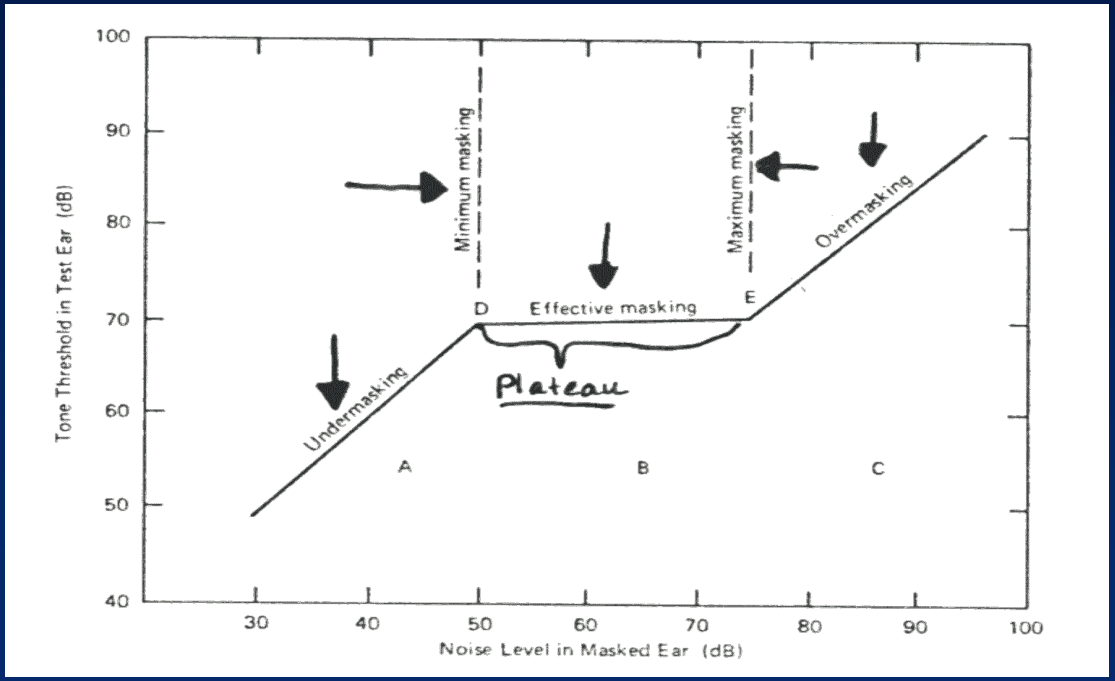
- Aural atresia
- Otosclerosis/fixation of the ossicular chain
- Otitis media
- Discontinuity of the ossicular chain

THE MASKING DILEMMA:
When Enough Masking is Too Much Masking




RIGHT EAR
LEFT EAR
250
500
1K
2K
4K
-10
0
10
20
30
40
50
60
70
80
90
100
110
Hearing Level in dB (ANSI-69)
KEY TO SYMBOLS
unmasked
masked
AC
BC
SAL

The Hood Plateau Method for Effective Masking: Not a solution for the dreaded masking dilemma



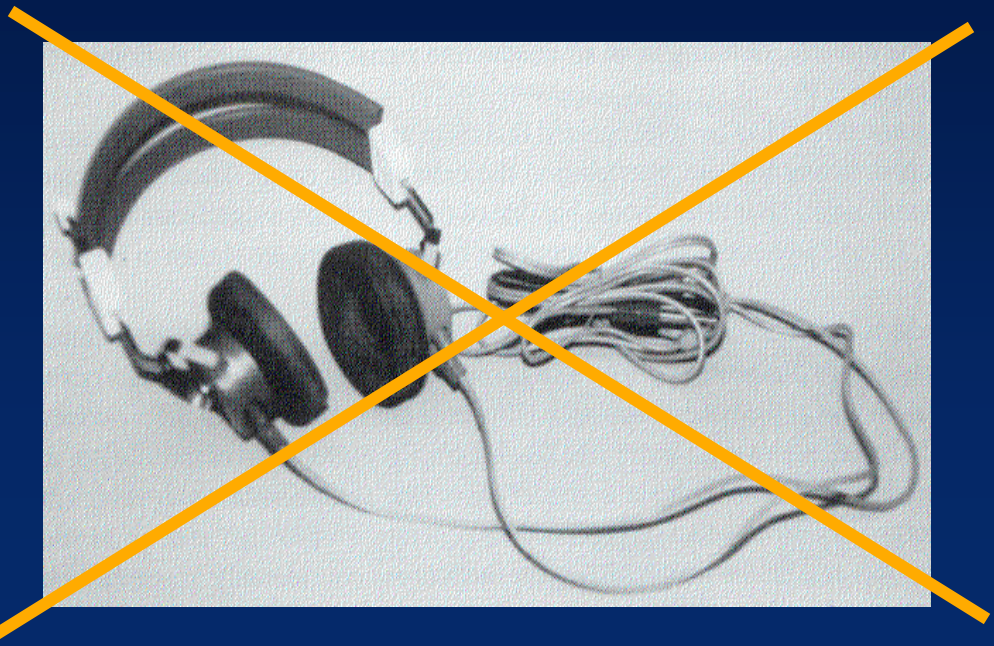
The SAL Technique: Selected References

- Rainville MJ. Nouvelle methode d'assourdissement pour le releve des courbes de conduction osseuse. *J de Francais Oto-Laryngologie 4:* 1955
- Jerger J & Tillman T. A new method for the clinical determination of sensori-neural acuity level (SAL). *Arch Otolaryngol 71:* 1960
- Keys JW & Milburn B. The sensorineural acuity level (SAL) technique. *Arch Otolaryngol 73:* 1961
- Tillman TW. Clinical applicability of the SAL test. *Arch Otolaryngol 78:* 1963
- Burke KS, Creston JE, Marsh AJ & Shutts RE. Variability of threshold shift in SAL technique. *Arch Otolaryngol 80:* 1964
- Jerger J & Jerger S. Critical evaluation of SAL audiometry. *J Speech Hear Res 8:* 1965

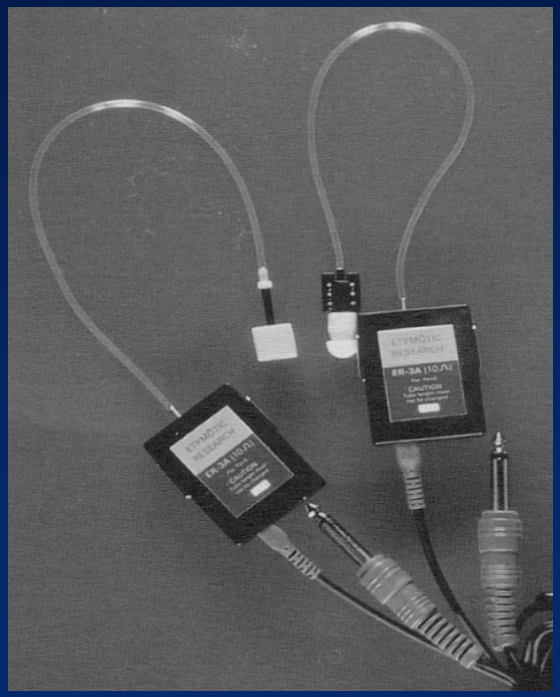
The SAL Technique: Step-by-Step (1)

- Equipment
  - audiometer with capability to present narrow band noise signal via bone conduction
  - insert earphones (Etymotic Research ER-3)
  - bone oscillator dedicated for SAL procedure
  - adjustable headband for forehead bone oscillator placement
- Normative data collection
  - 10 normal hearing subjects
  - determine air conduction thresholds in quiet for each ear
  - determine air conduction thresholds with maximum masking presented via bone conduction
  - calculate average normal “shift” in air conduction thresholds from quiet to bone/noise condition (usually 55 to 60 dB)

TDH (39, 49, 59) Earphones: Outdated and Outperformed (by insert earphones)



ER-3A Insert Earphones

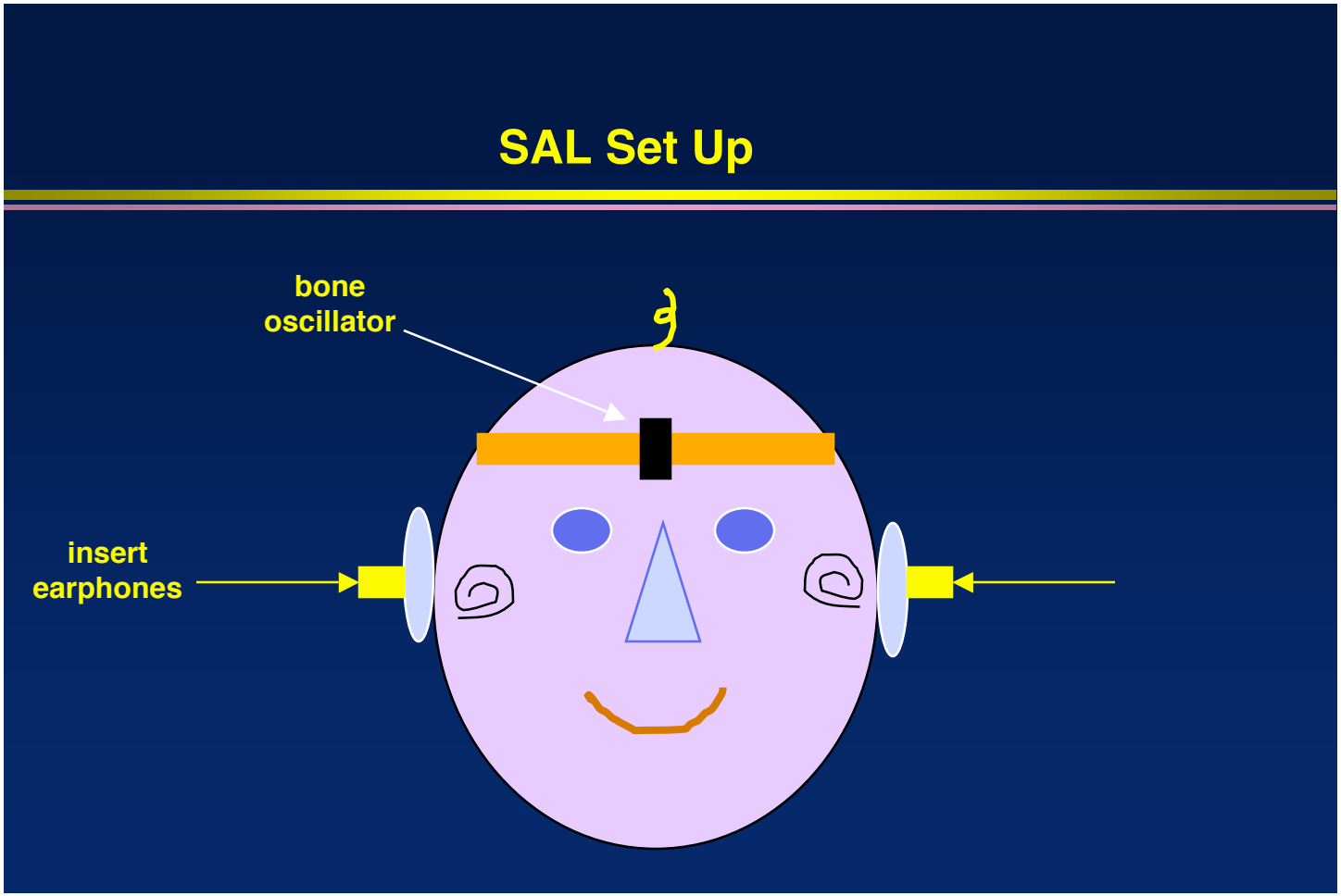


A Few of the Many Advantages of Insert (ER-3A) Earphones vs. Supra-Aural Earphones

- General
  - increased inter-aural attenuation
  - increased ambient noise attenuation
  - smoother frequency response
  - elimination of ear canal collapse
  - increased patient comfort
  - improved aural hygiene (disposable after single use)
  - more precise placement (increased reliability)
- ABR specifically
  - reduced transducer ringing
  - reduced stimulus artifact (with separation of transducer from inverting electrode)
  - can be adapted to use with TIPtrodes

Conventional Bone Conduction Audiometry: Thresholds by BC and Masking by AC

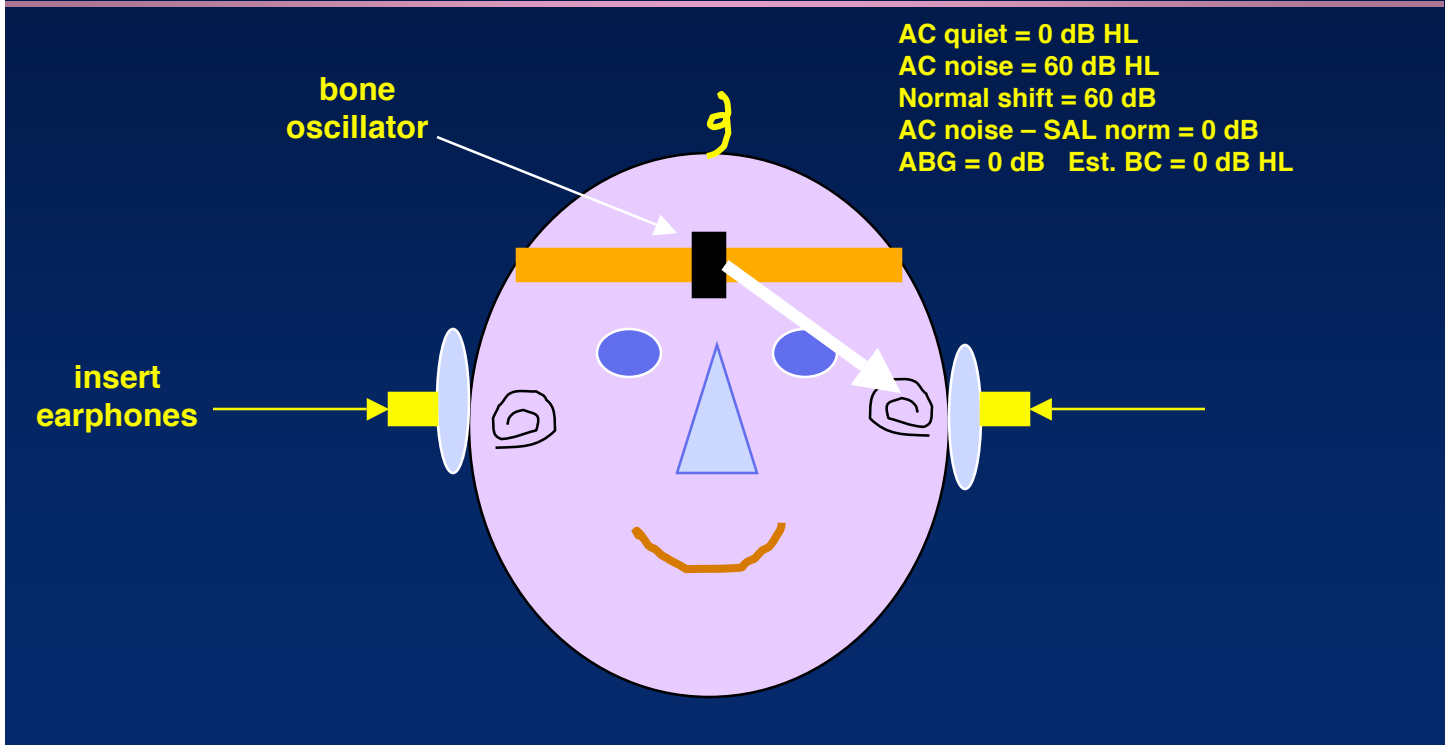
SAL Set Up



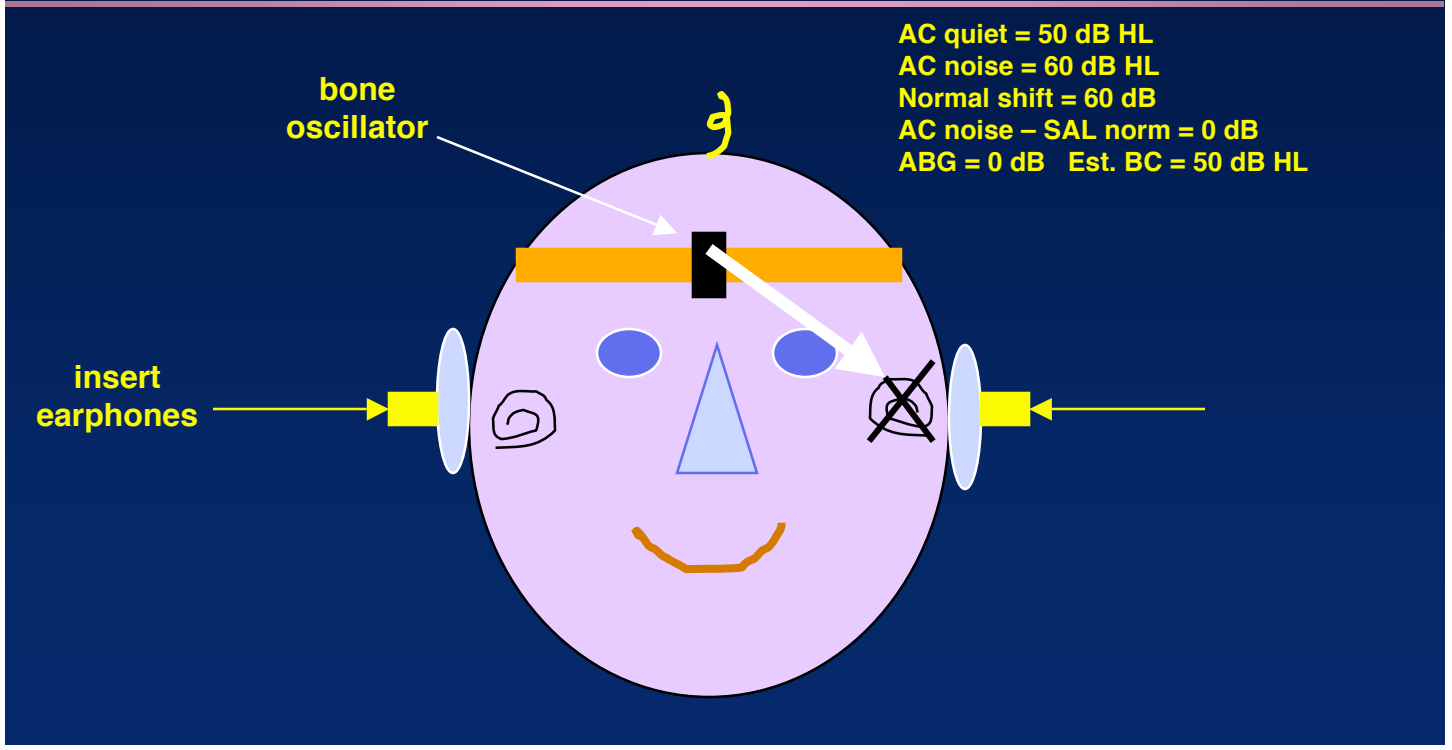
The SAL Technique: Step-by-Step (2)

- Clinical procedure
  - place insert earphones
  - place bone oscillator with adjustable headband
  - determine air conduction thresholds in quiet for each ear
  - determine air conduction thresholds with maximum masking presented via bone conduction
  - calculate patient's "shift" from air conduction thresholds in quiet to the bone conducted noise condition
  - Subtract patient's shift (in dB) from air conduction thresholds in quiet (for each frequency and/or speech reception threshold
  - Estimated bone conduction hearing thresholds = air conduction thresholds in quiet – shift produced by bone conduction noise

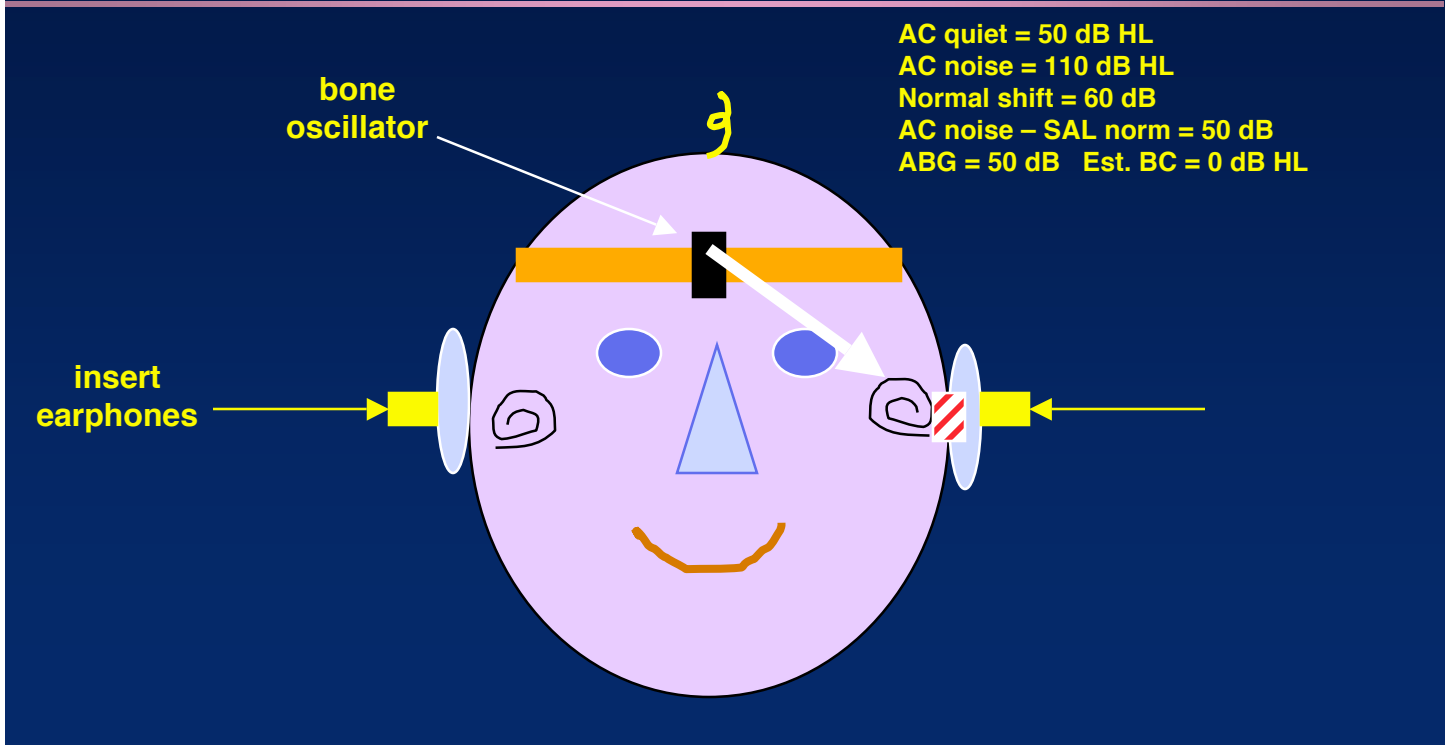
Example of SAL in Normal Hearing



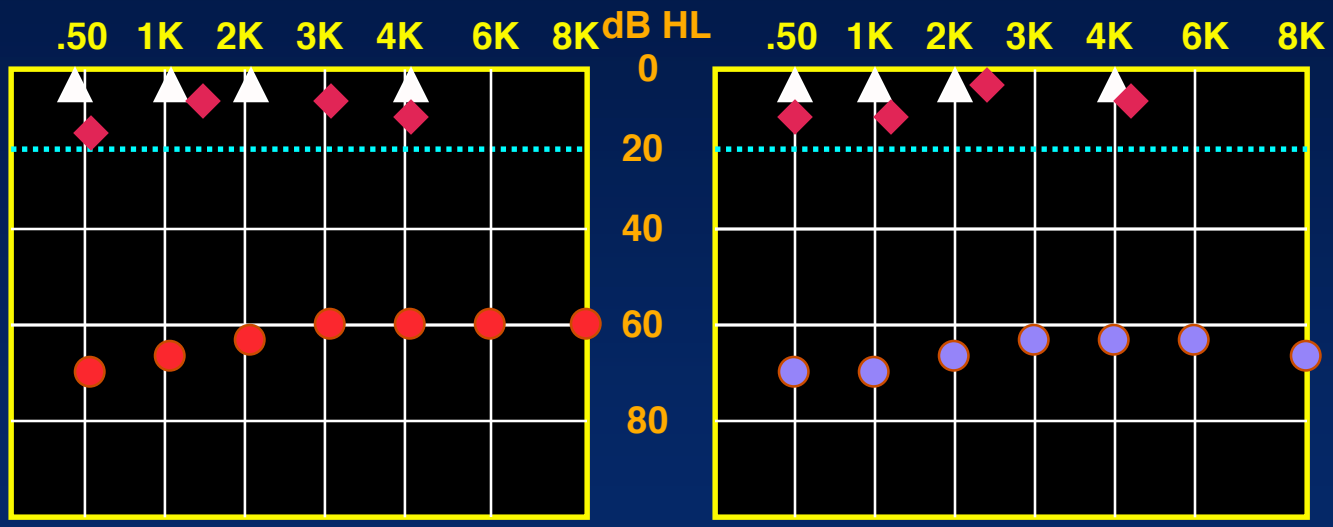
Example of SAL in Sensory Hearing Loss



Example of SAL in Conductive Hearing Loss



THE MASKING DILEMMA:
Solved by SAL



James Jerger
"Father of Diagnostic Audiology"