

Audiogram



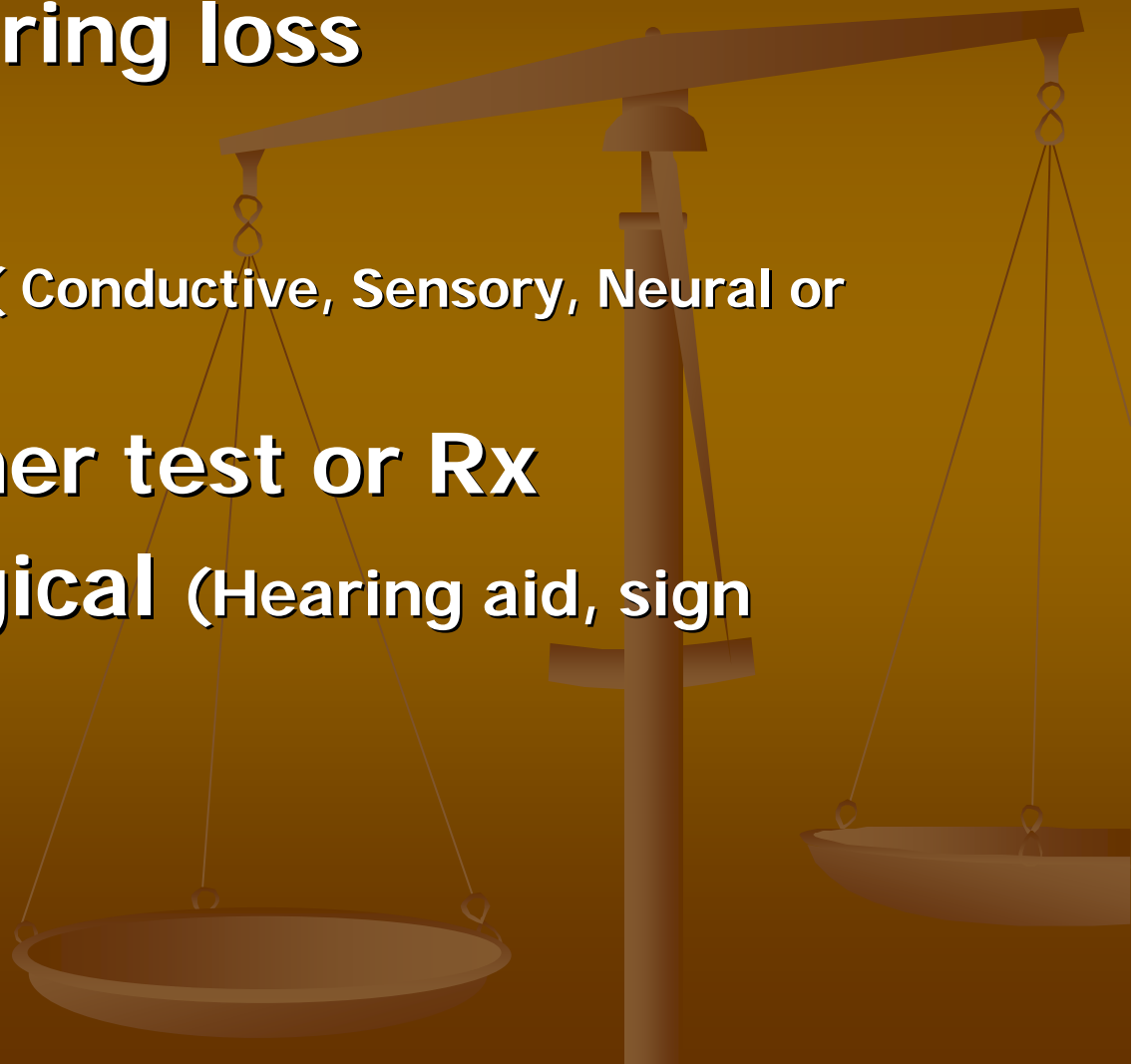
***Dr. Abdulrahman Hagr MBBS FRCS(c)
Assistant Professor King Saud University***

Otolaryngology Consultant

***Otologist, Neurotologist & Skull Base Surgeon
King Abdulaziz Hospital***

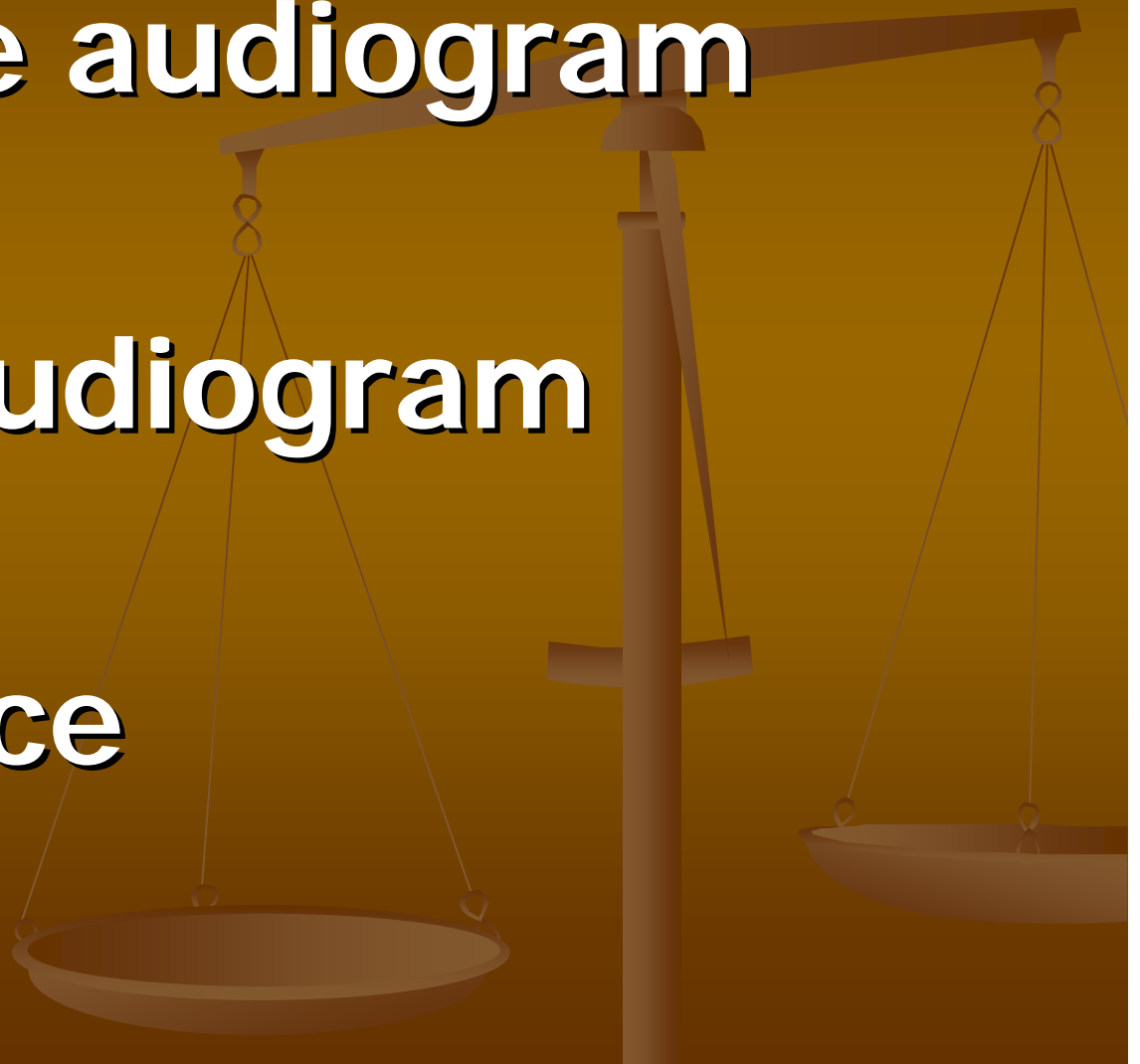
Purpose of Audiogram

- **Degree of hearing loss**
- **Configuration**
- **Site of lesion** (Conductive, Sensory, Neural or mixed)
- **Need for further test or Rx**
- **Help non-surgical** (Hearing aid, sign language,...)



Audiogram Battery

- **Pure tone audiogram**
- **Speech audiogram**
- **Impedance**



Pure tone audiogram

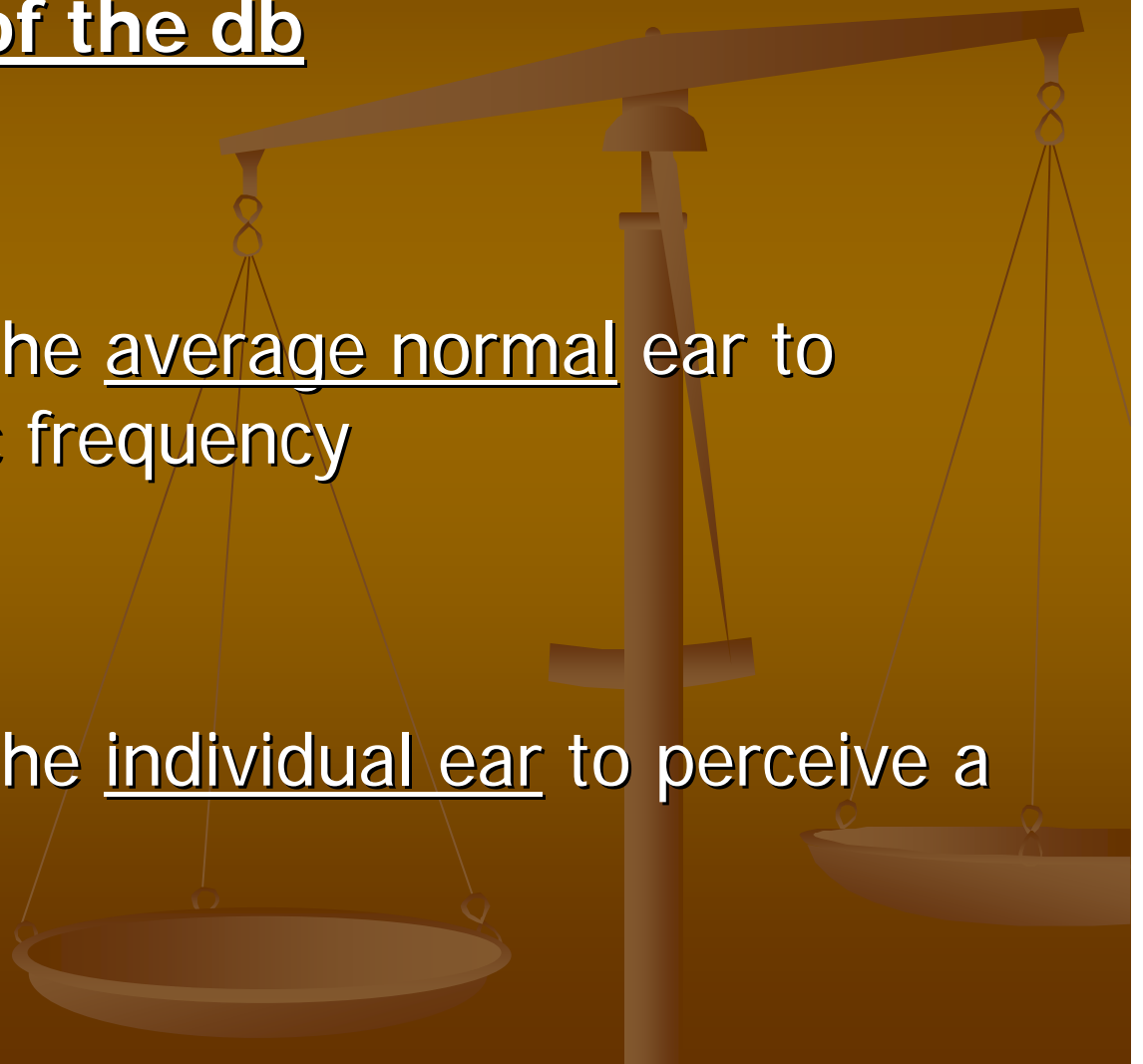
Reference levels of the db

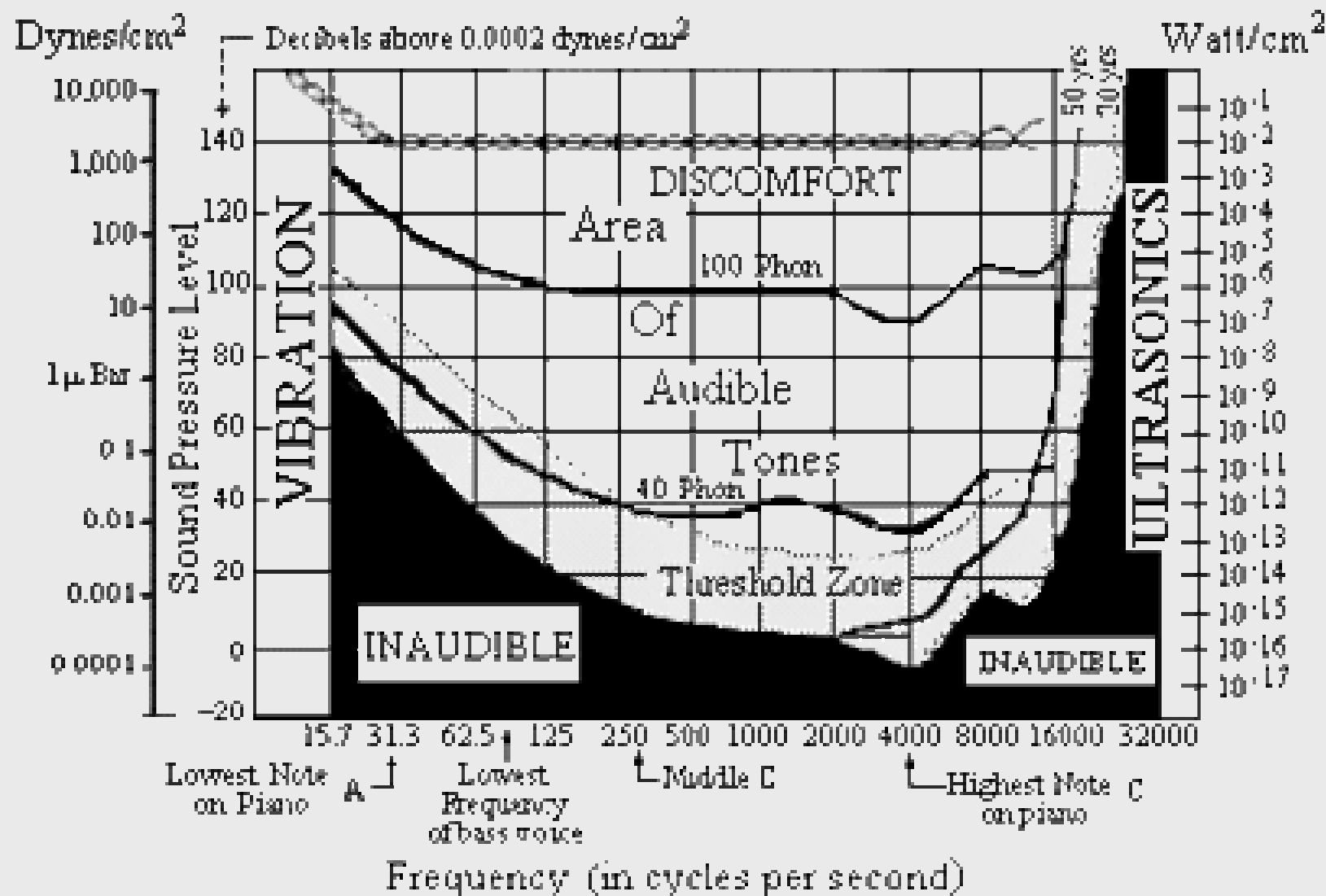
- **Hearing level**

Sound intensity for the average normal ear to perceive a specific frequency

- **Sensory level**

Sound intensity for the individual ear to perceive a specific frequency





Pure tone audiogram

■ **Air conduction**

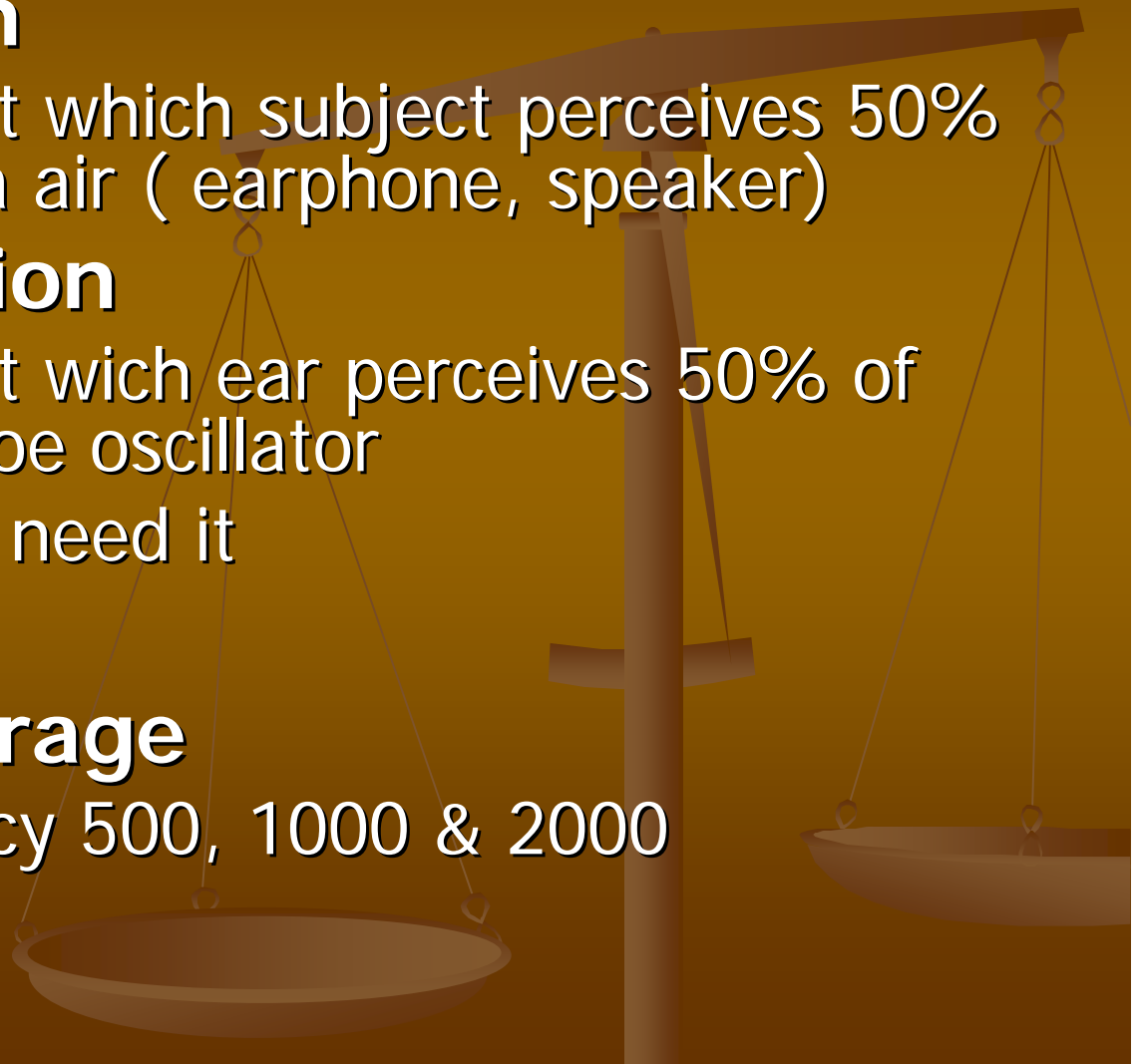
- Lowest **dbHL** at which subject perceives 50% of pure tone via air (earphone, speaker)

■ **Bone conduction**

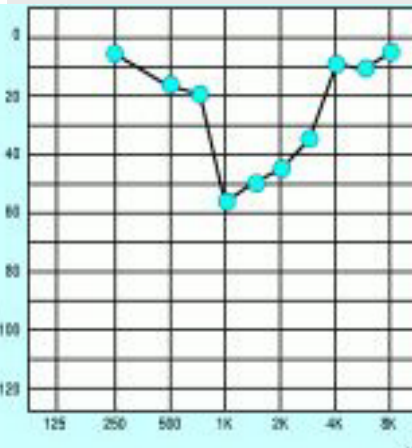
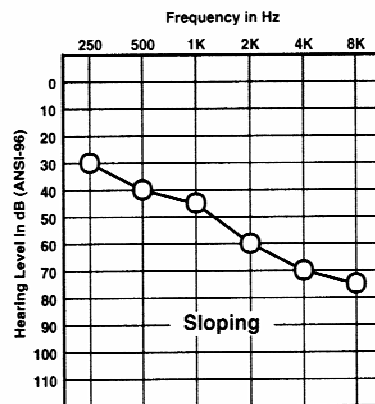
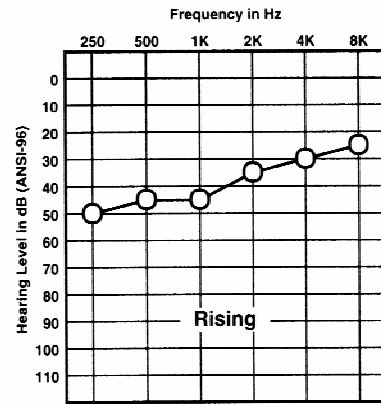
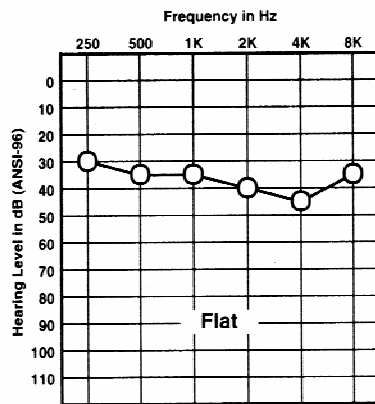
- Lowest **dbHL** at which ear perceives 50% of pure tone via bone oscillator
- Do it when you need it

■ **Pure tone average**

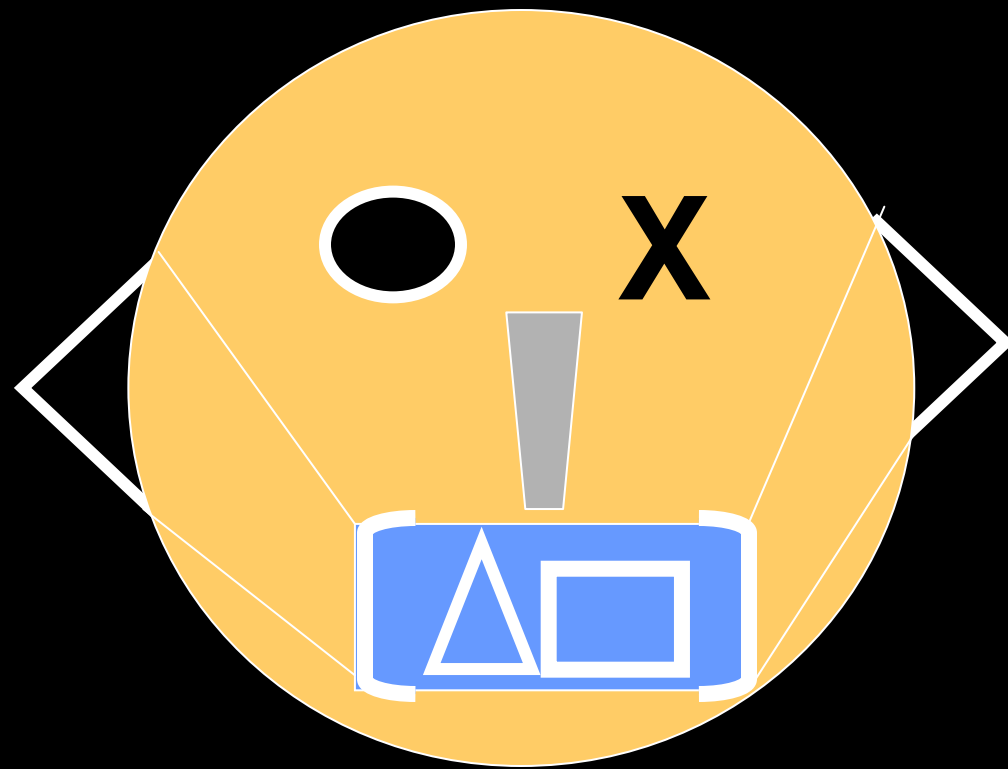
- Speak frequency 500, 1000 & 2000



Configuration HL

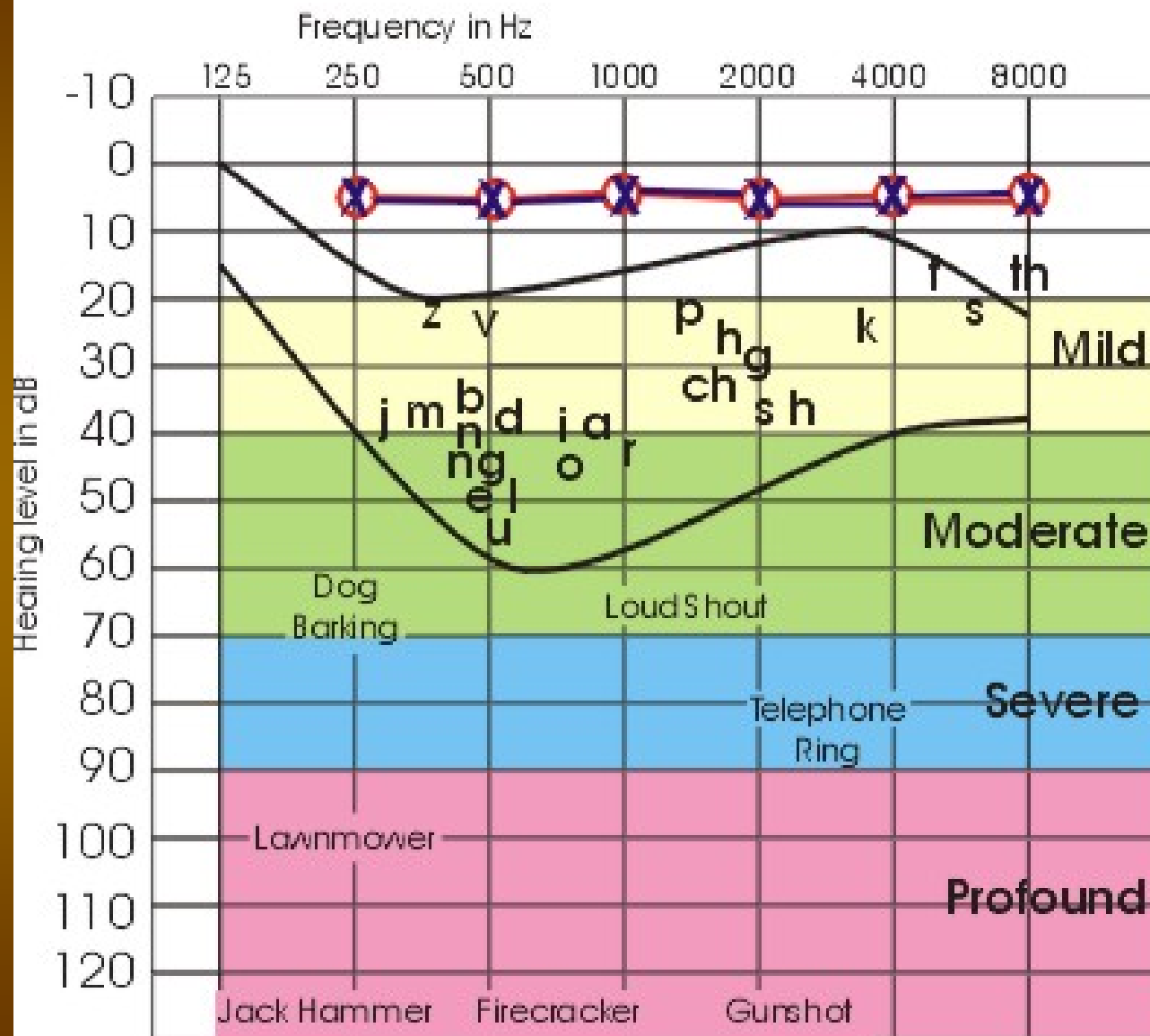


- ✓ Flat
- ✓ Rising
- ✓ Sloping
- ✓ Cookie bite



Legend	Right	Left
Air Conduction	O	X
•with masking	Δ	□
Bone Conduction	<	>
•with masking	⌊	⌋
No Response	↙	↘

AUDIOGRAM



Masking

- **Interaural attenuation**

Reduction in sound energy travelling through the skull

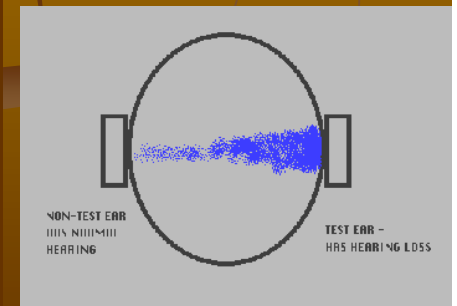
- **50 db AC & 0 db BC**

- **Noise introduced to prevent crossover**

- **Bilateral HL+ ABG > 50 db →**

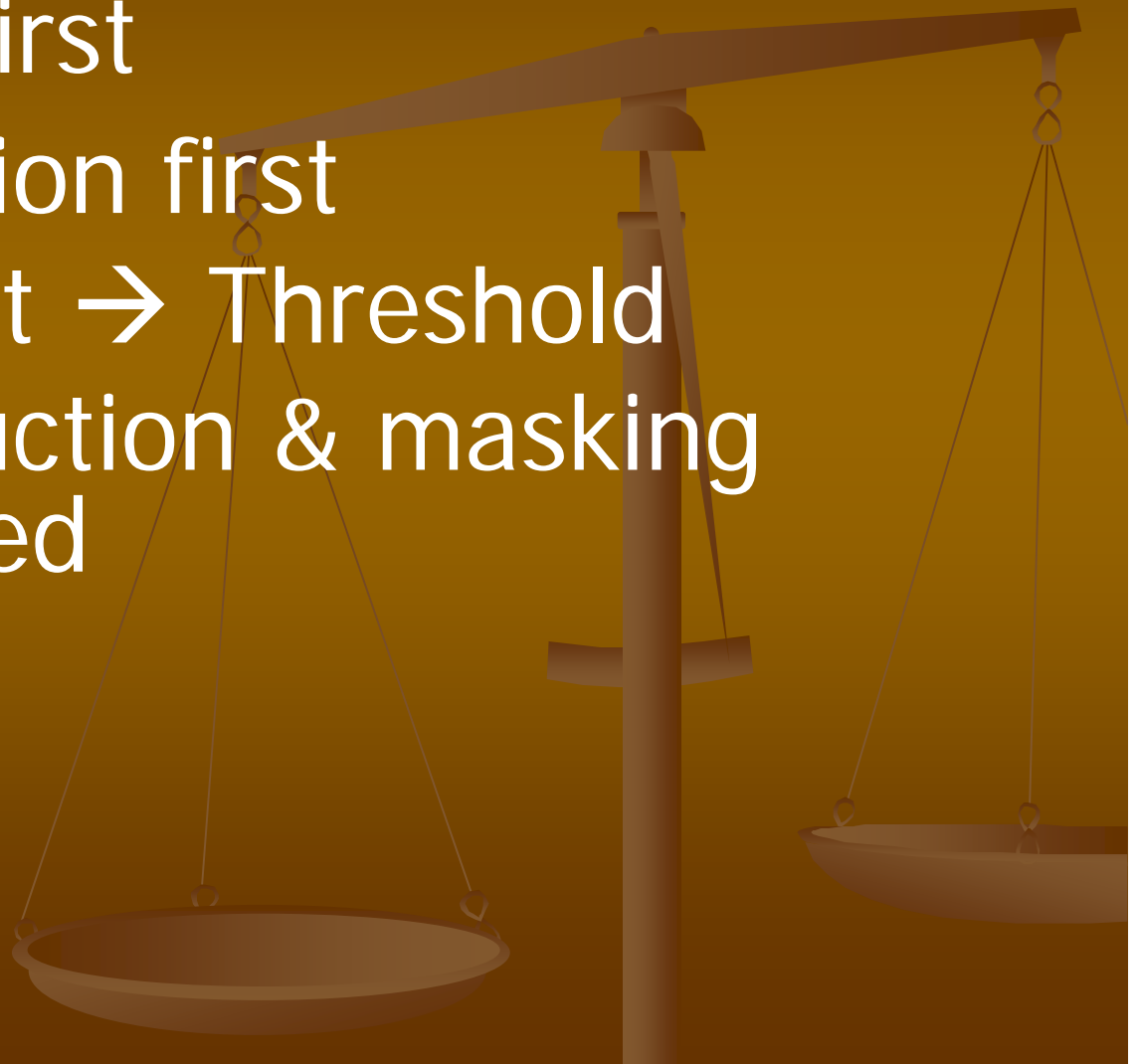
masking dilemma

- **Do it when you need it**



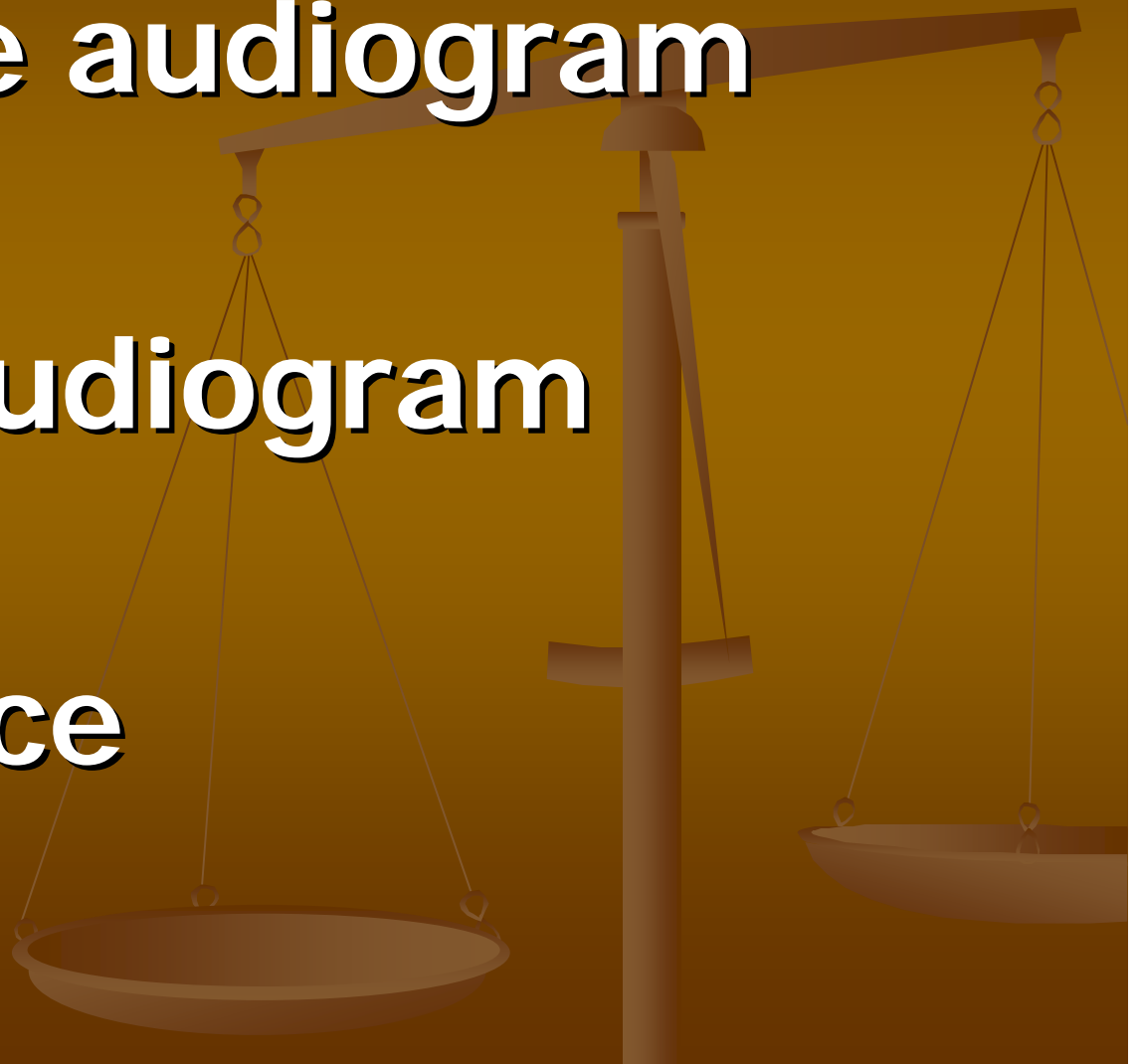
Pure Tone Audiogram

- o Better ear first
- o Air conduction first
- o 50% correct → Threshold
- o Bone conduction & masking when needed



Audiogram Battery

- **Pure tone audiogram**
- **Speech audiogram**
- **Impedance**



Speech audiogram

Speech reception threshold SRT

- Lowest dbHL subject can repeat a spondee (2 Syllable words with balance accent) 50%
- Ex: sidewalk, eardrum

Speech discrimination score

- Percentage monosyllabic words repeated correctly at 40 dbSL above SRT
- Normal > 90 %

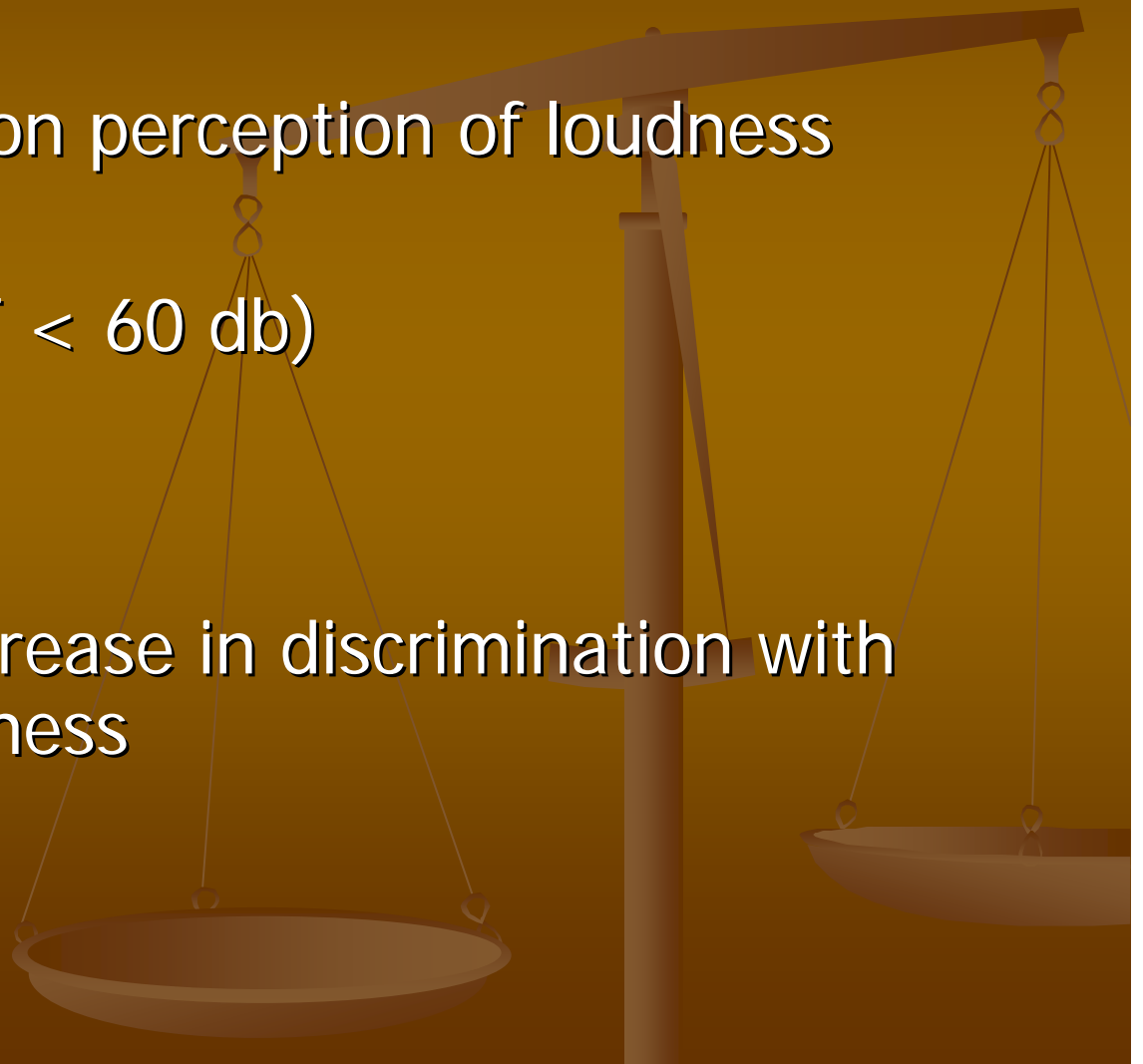
Recruitment & Rollover

■ Recruitment

- Out-of-proportion perception of loudness
- Cochlear loss
- Metz ($AR - SRT < 60 \text{ db}$)

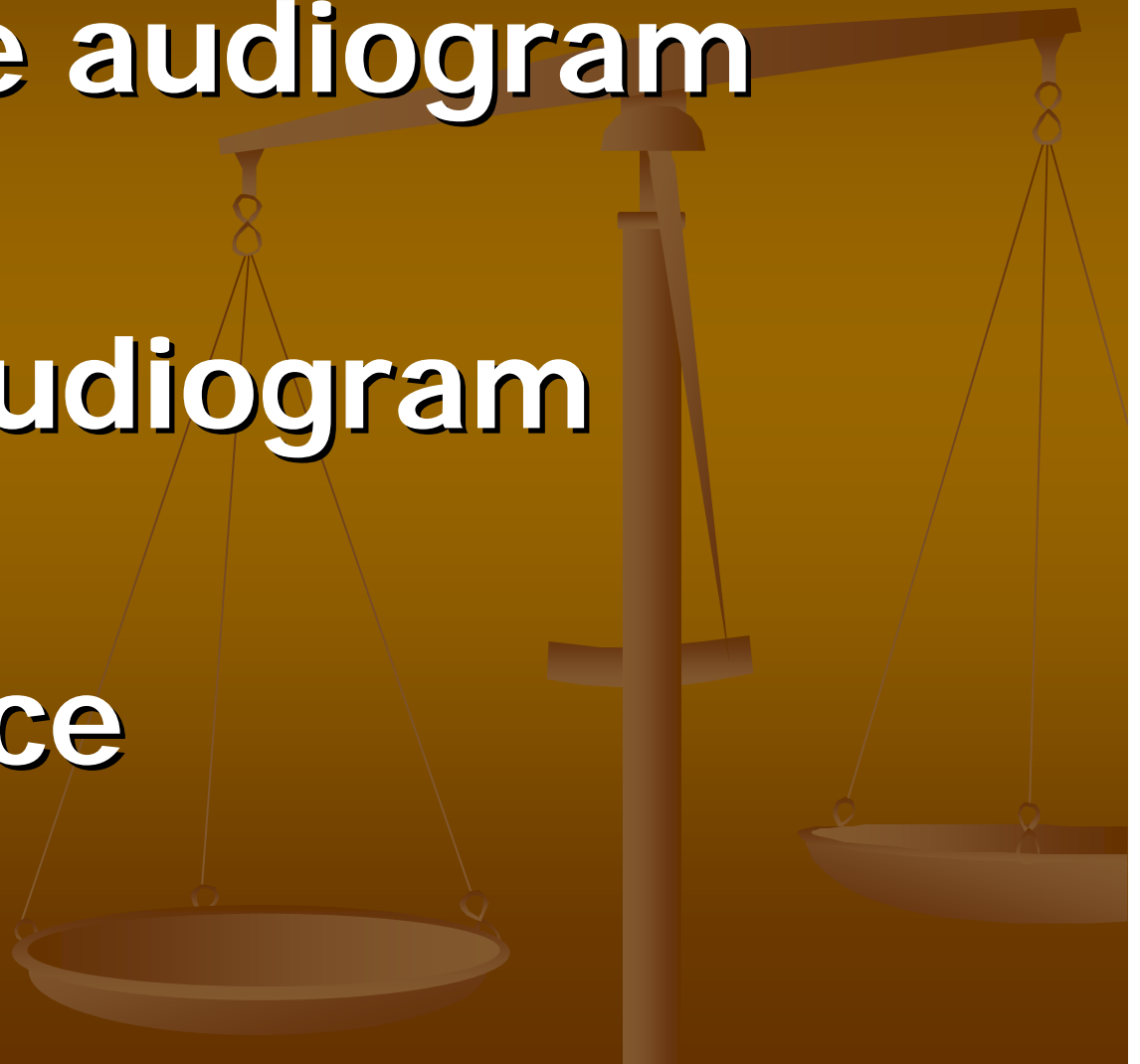
■ Rollover

- Paradoxical decrease in discrimination with increasing loudness
- Retro-Cochlear



Audiogram Battery

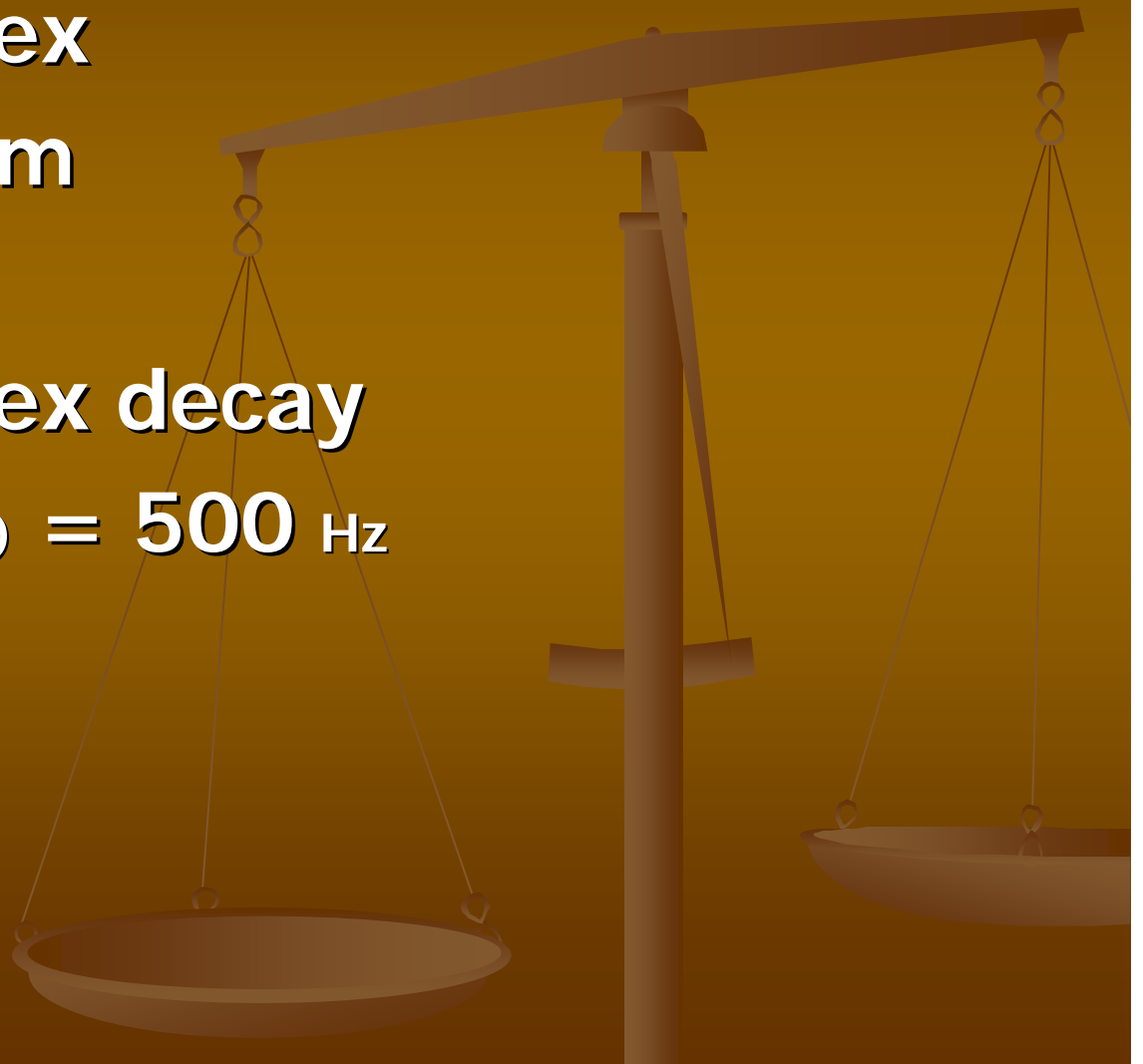
- **Pure tone audiogram**
- **Speech audiogram**
- **Impedance**

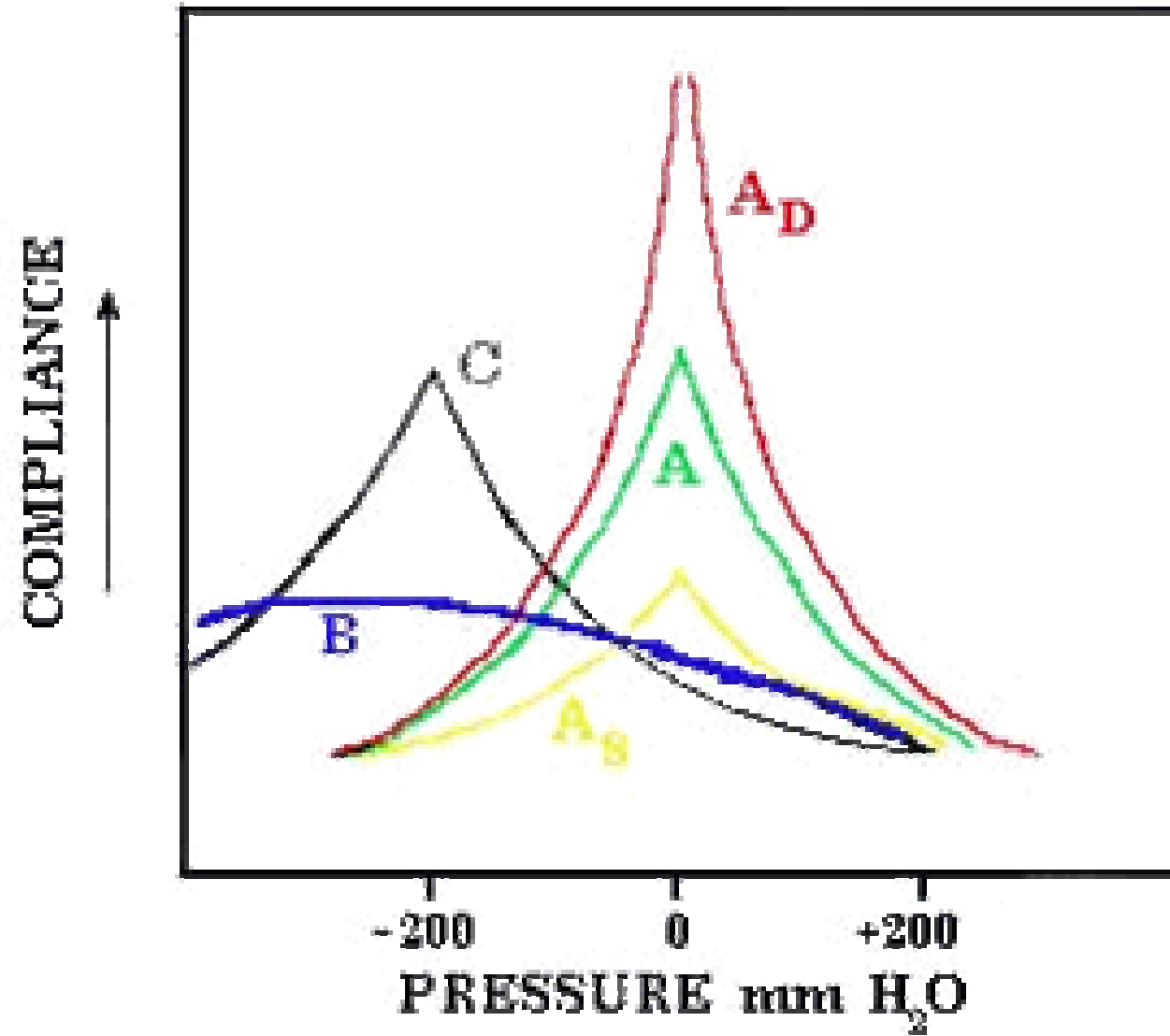


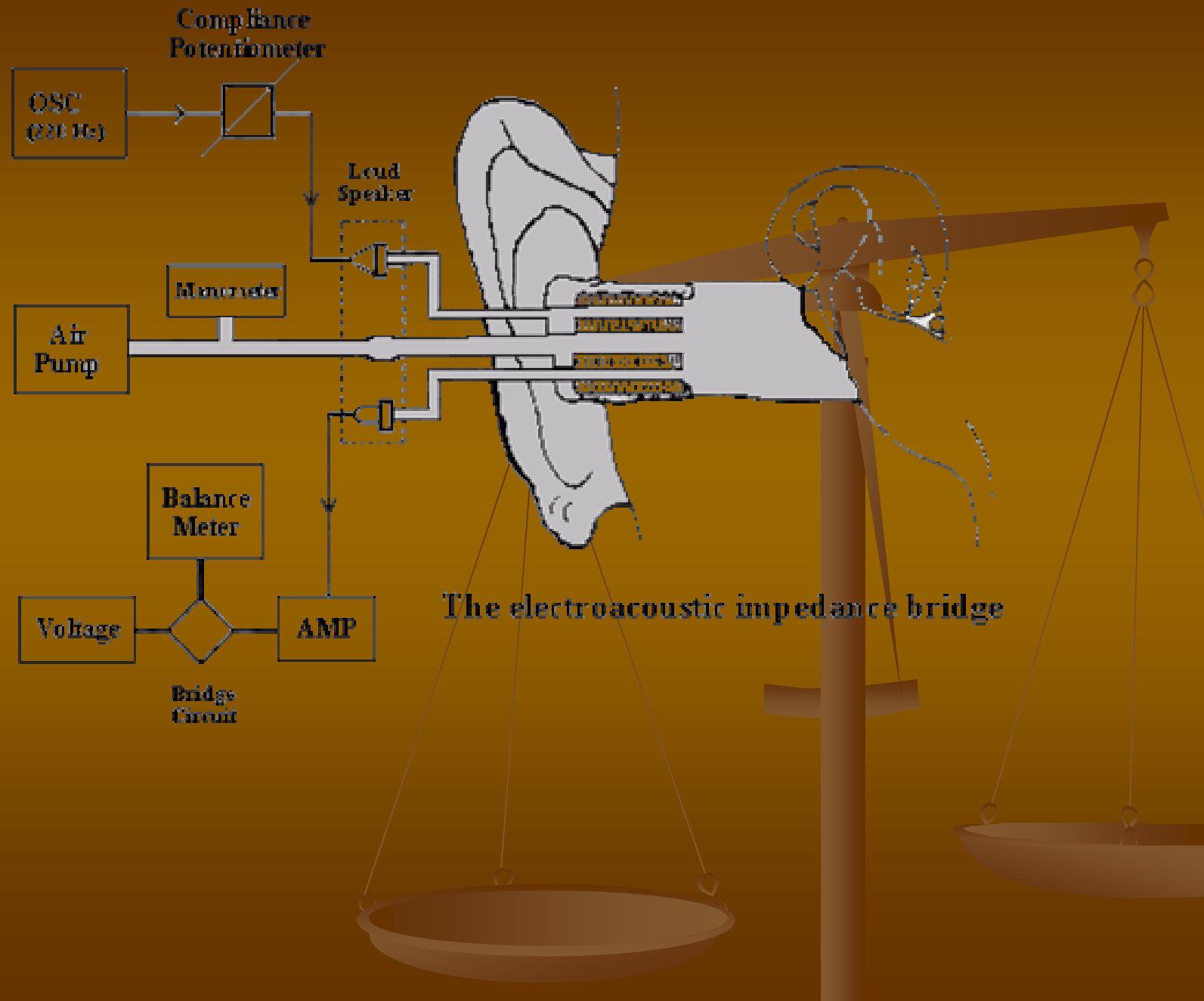
Impedance

1. **Acoustic reflex**
2. **Tympanogram**
3. **Volume**
4. **Acoustic reflex decay**

$$50 \% \times 10 \text{ sec (db)} = 500 \text{ Hz}$$

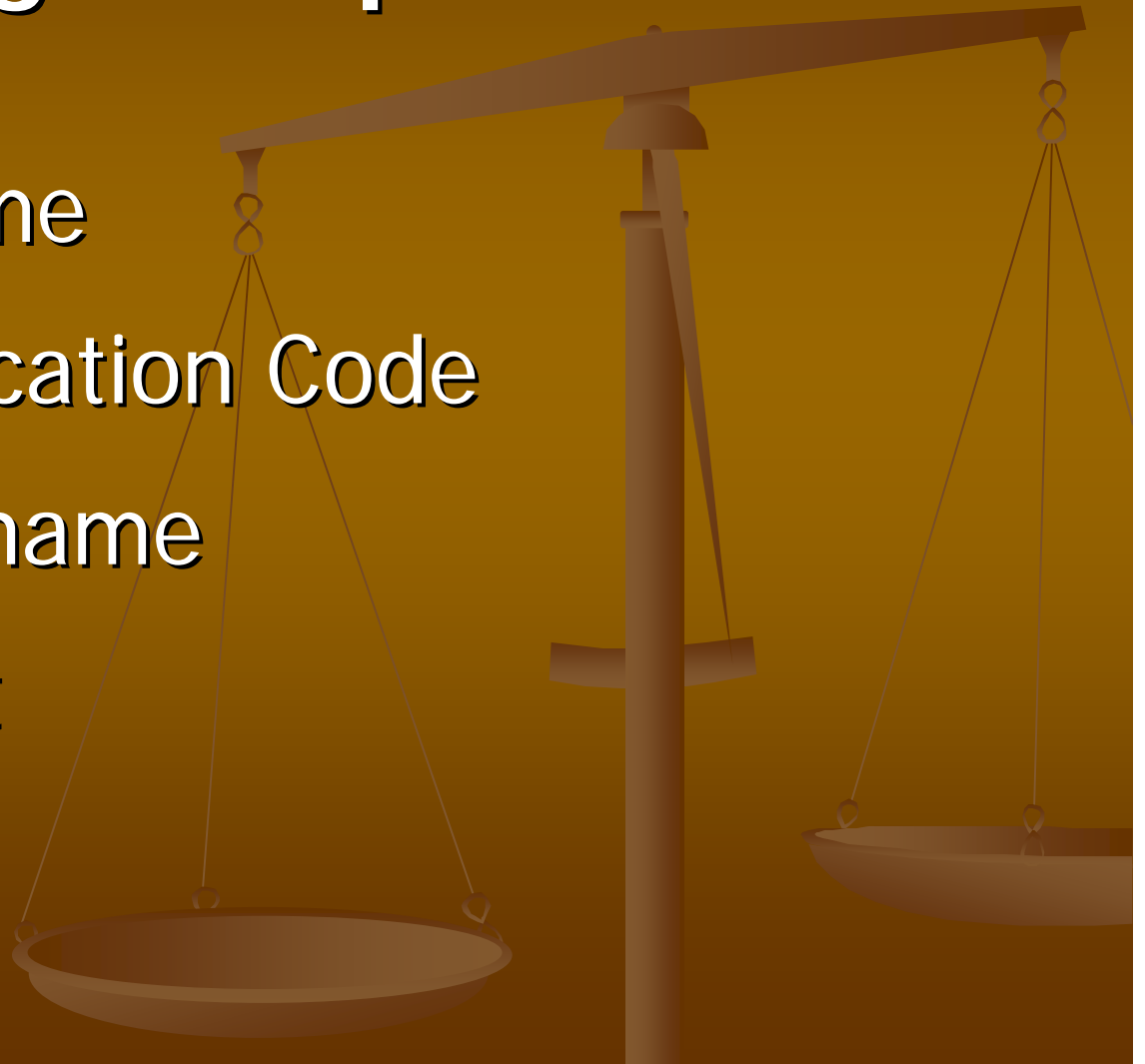






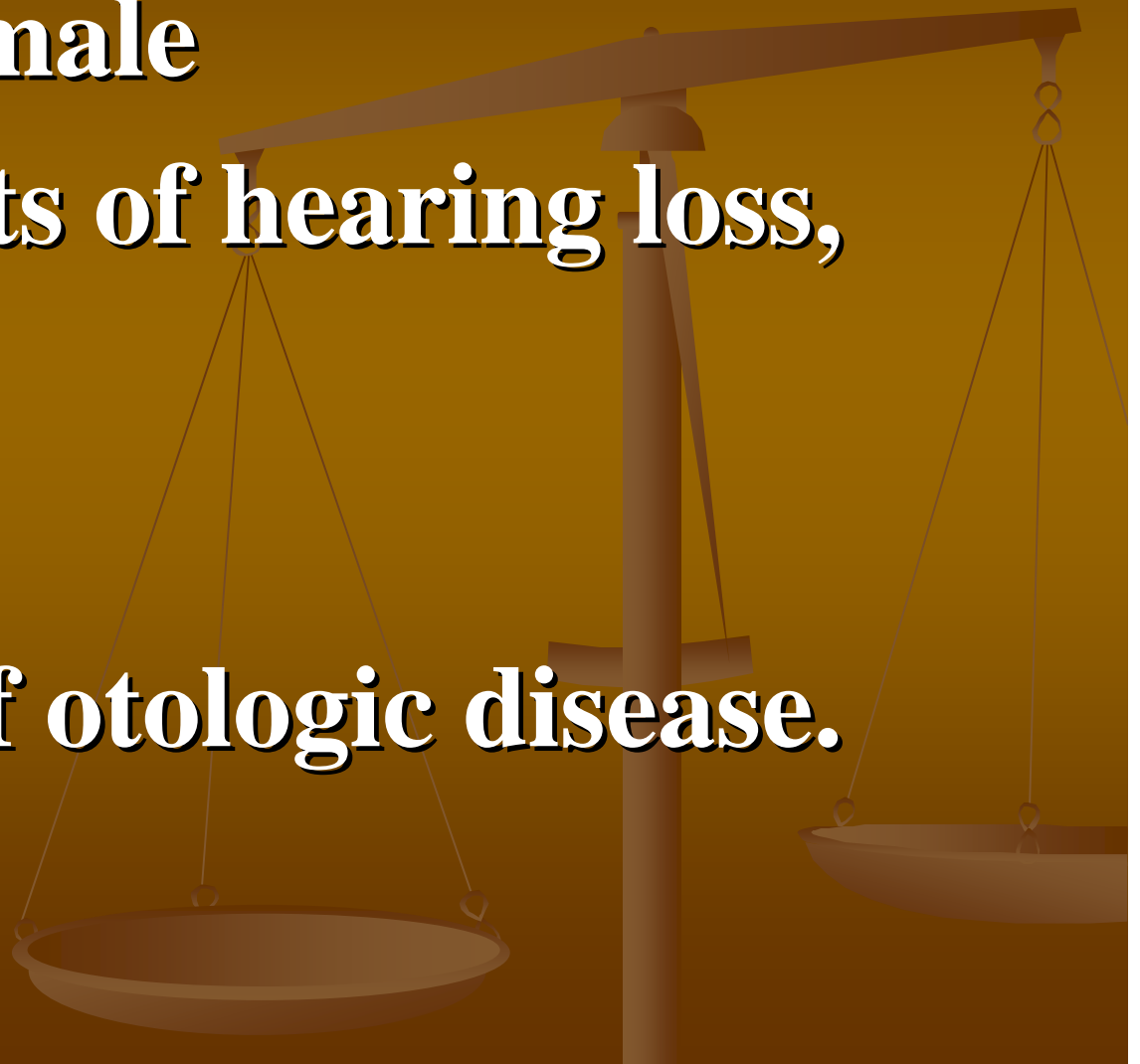
Medical Legal Requirements

- Patient's name
- Unit Identification Code
- Examiner's name
- Date of Test
- Reliability

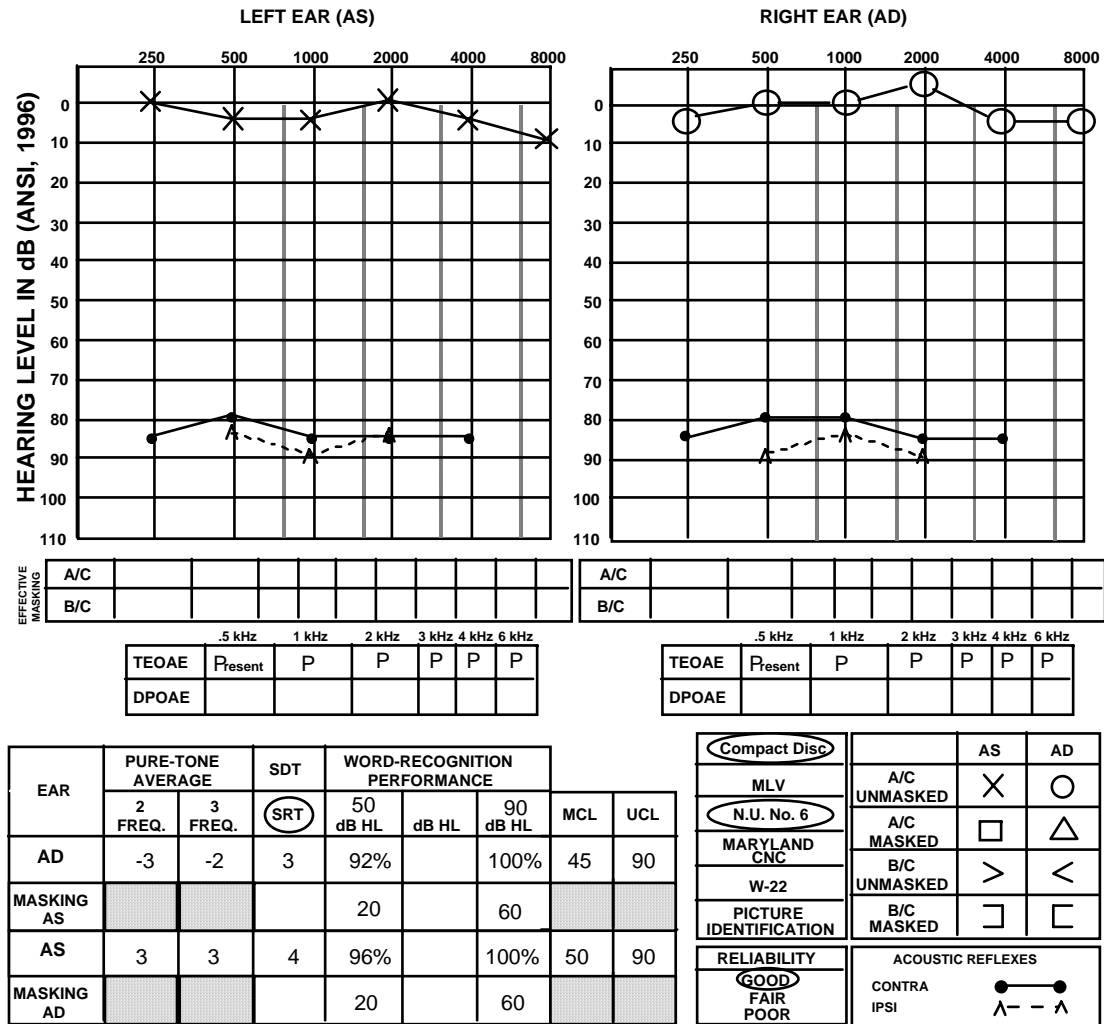


Case #1

- 23-year old male
- no complaints of hearing loss,
- No dizziness
- No tinnitus
- No history of otologic disease.



AUDIOLOGICAL CONSULTATION

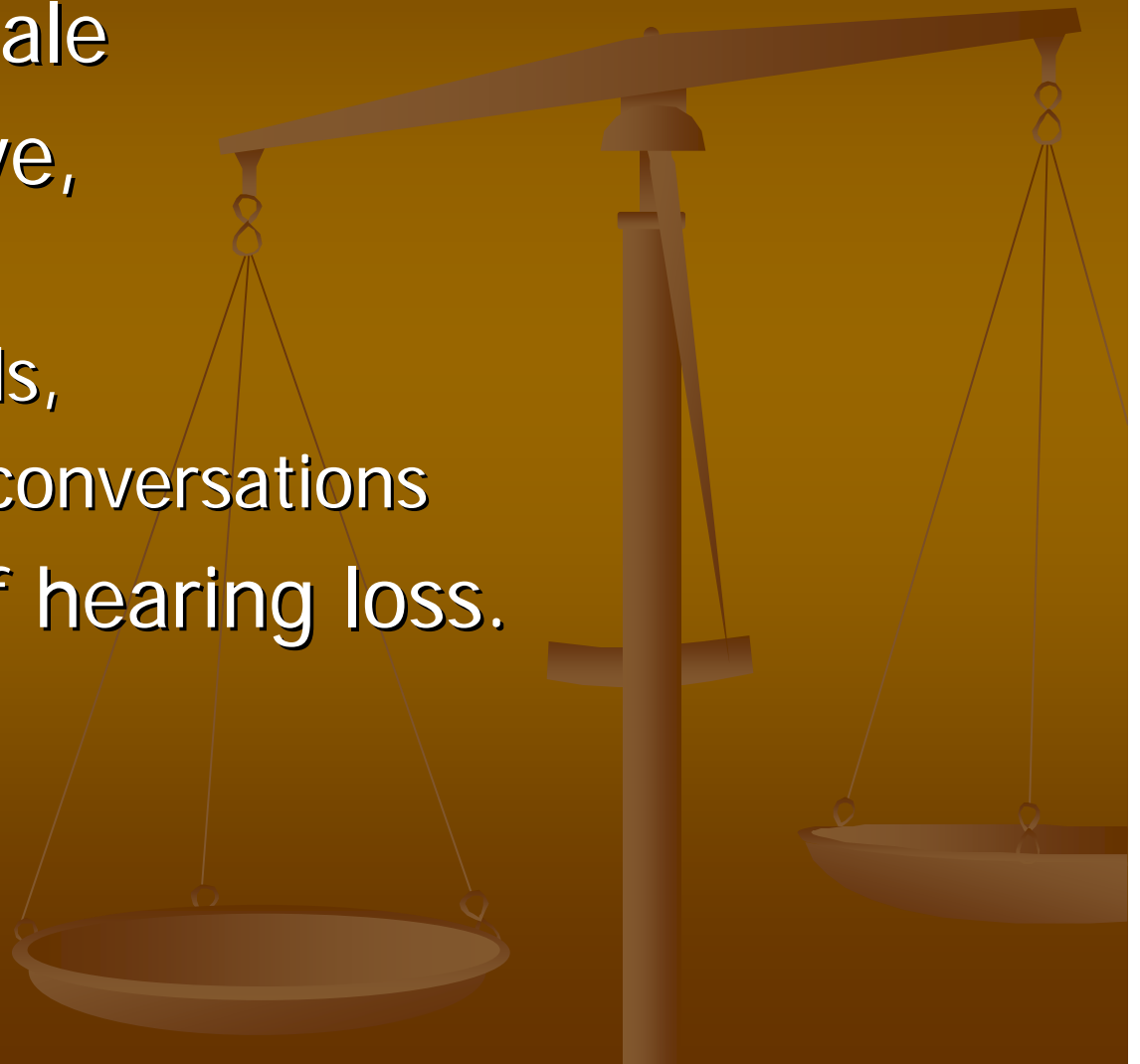


REMARKS: Tympanograms normal AU

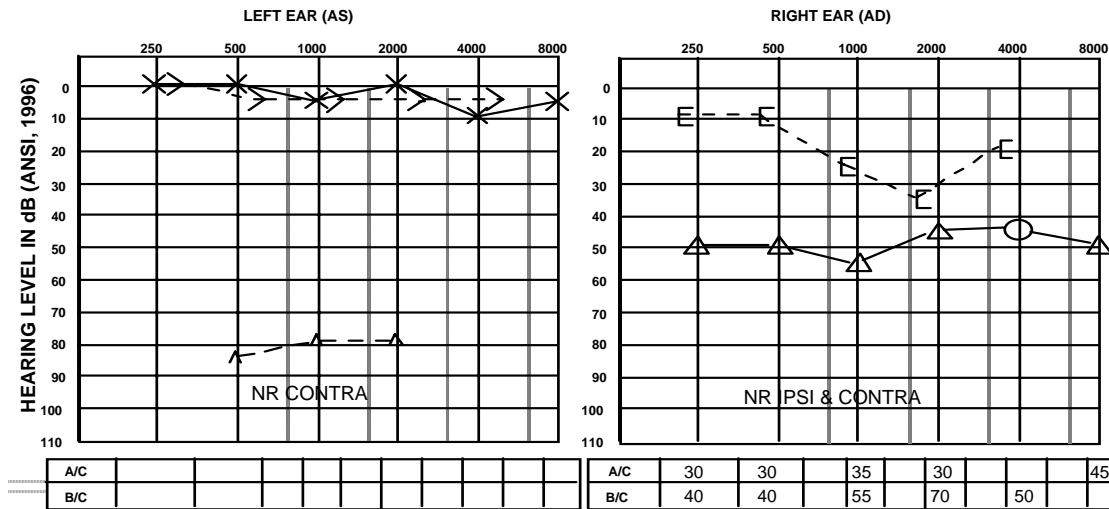
LAST, FIRST, MI	Case #1	DATE
SS#		AGE 23
SIGNATURE OF EXAMINING AUDIOLOGIST		

Case #2

- 45-year old female
- Right progressive,
 - hearing loss.
 - localizing sounds,
 - understanding conversations
- family history of hearing loss.



AUDIOLOGICAL CONSULTATION



TEOAE							
DPOAE							

TEOAE							
DPOAE							

EAR	PURE-TONE AVERAGE		SDT (SRT)	WORD-RECOGNITION PERFORMANCE			MCL	UCL
	2 FREQ.	3 FREQ.		60 dB HL	70 dB HL	90 dB HL		
AD	47	50	48	36%	84%	100%	85	100+
MASKING AS			30	20	30	50		
AS	0	2	0	100%		100%	50	90
MASKING AD				60		90		

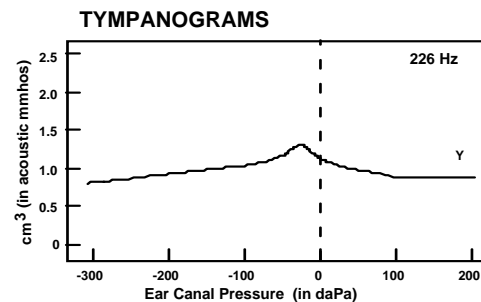
RELIABILITY							

A/C	AS	AD
	×	○
A/C	□	△
B/C	>	<
B/C	⌊	⌋

RELIABILITY							

REMARKS: Weber lateralized right ; Bing was negative in the right ear and positive in the left ear.

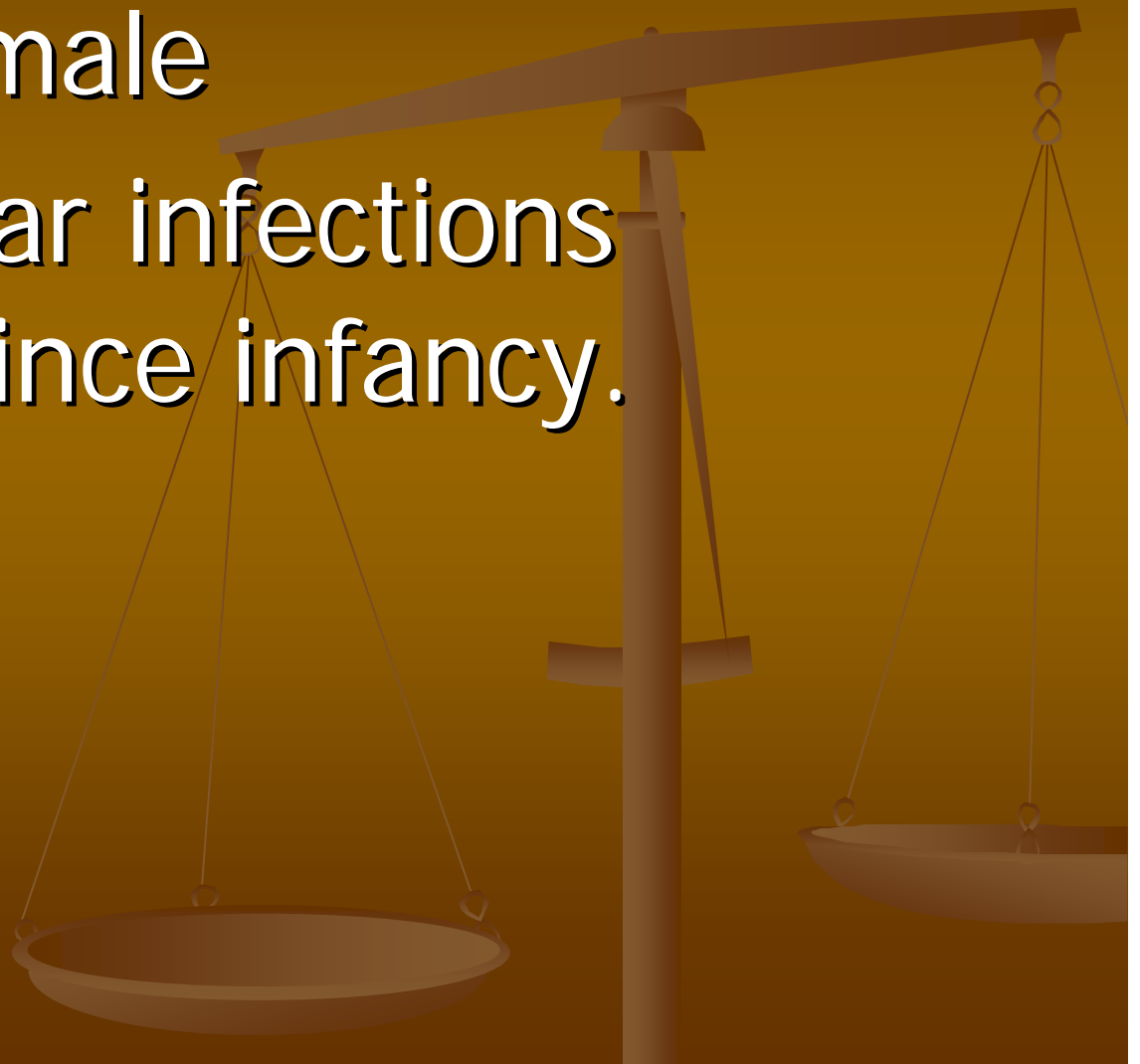
LAST, FIRST, MI	Case #2	DATE
SS#		AGE 45
SIGNATURE OF EXAMINING AUDIOLOGIST		



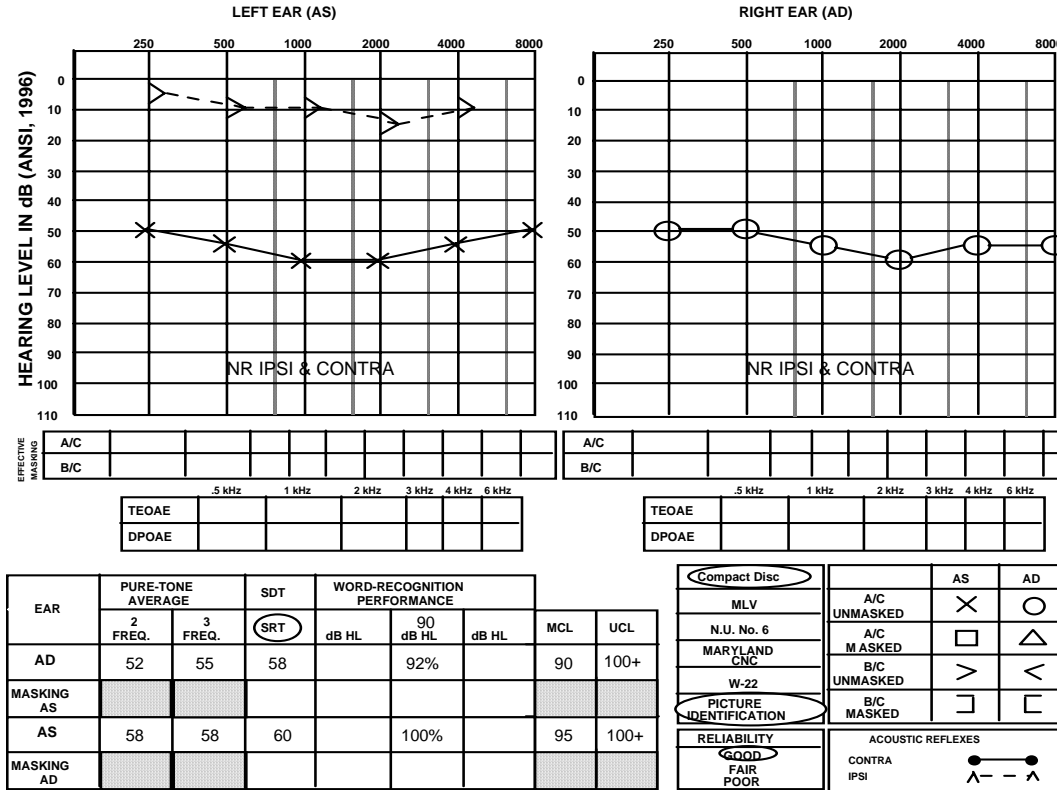
surgical findings confirmed otosclerosis in the right ear.

Case #3

- 4-year old male
- history of ear infections bilaterally since infancy.



AUDIOLOGICAL CONSULTATION

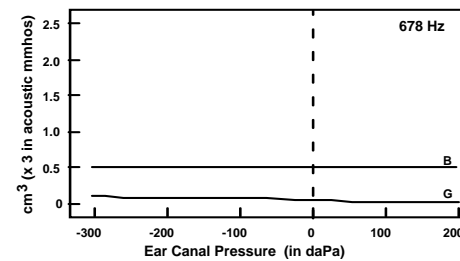
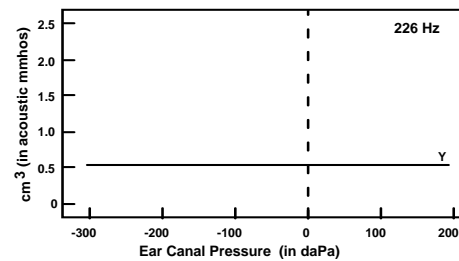


REMARKS:

Weber was midline and Bing was negative AU at 250 & 500 Hz

LAST, FIRST, MI	DATE
SS#	AGE 4
SIGNATURE OF EXAMINING AUDIOLOGIST	

TYMPANOGRAMS

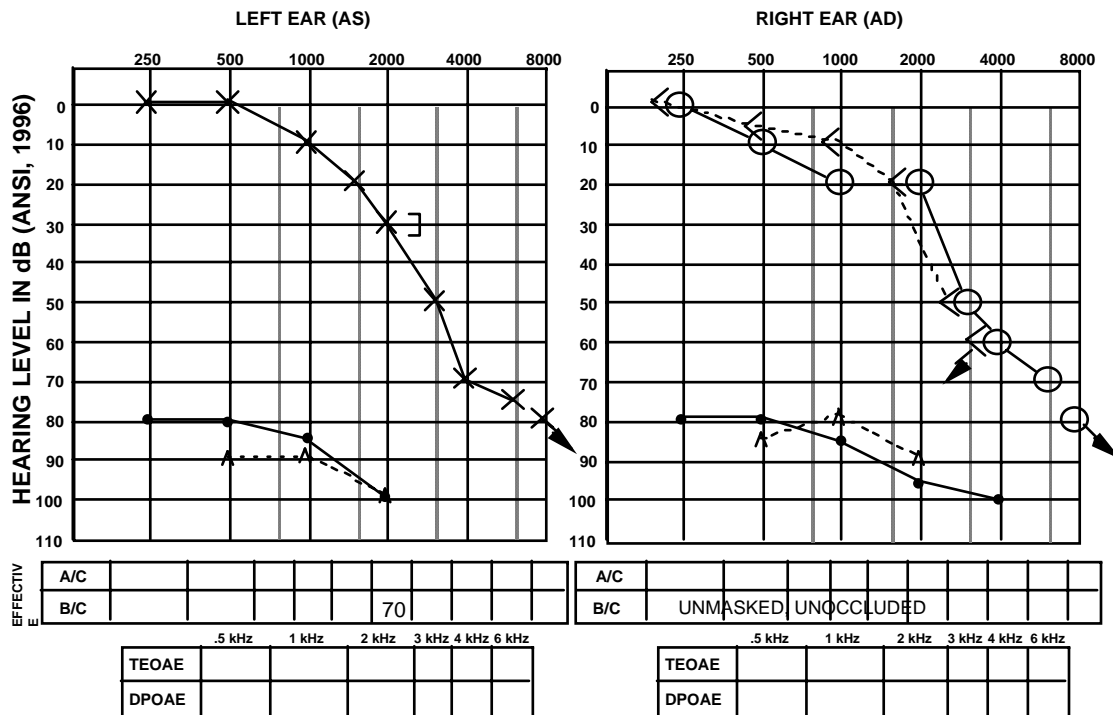



Case #4


- 58-year old diabetes male
- bilateral tinnitus,
- Lt > Rt
- difficulty understanding conversation
- Noise for over 30 y



AUDIOLOGICAL CONSULTATION



EAR	PURE-TONE AVERAGE		SDT	WORD-RECOGNITION PERFORMANCE			MCL	UCL
	2 FREQ.	3 FREQ.		50 dB HL	dB HL	90 dB HL		
AD	15	17	20	84%		90%	65	100
MASKING AS				20		60		
AS	5	13	10	76%		90%	60	90
MASKING AD				20		60		

Compact Disc		AS	AD
MLV	A/C UNMASKED	×	○
N.U. No. 6	A/C MASKED	□	△
MARYLAND CNC	B/C UNMASKED	>	<
W-22	B/C MASKED	⌋	⌋
PICTURE IDENTIFICATION			
RELIABILITY	ACOUSTIC REFLEXES CONTRA IPSI	 $\Lambda - - \Lambda$	
GOOD			
FAIR			
POOR			

REMARKS:

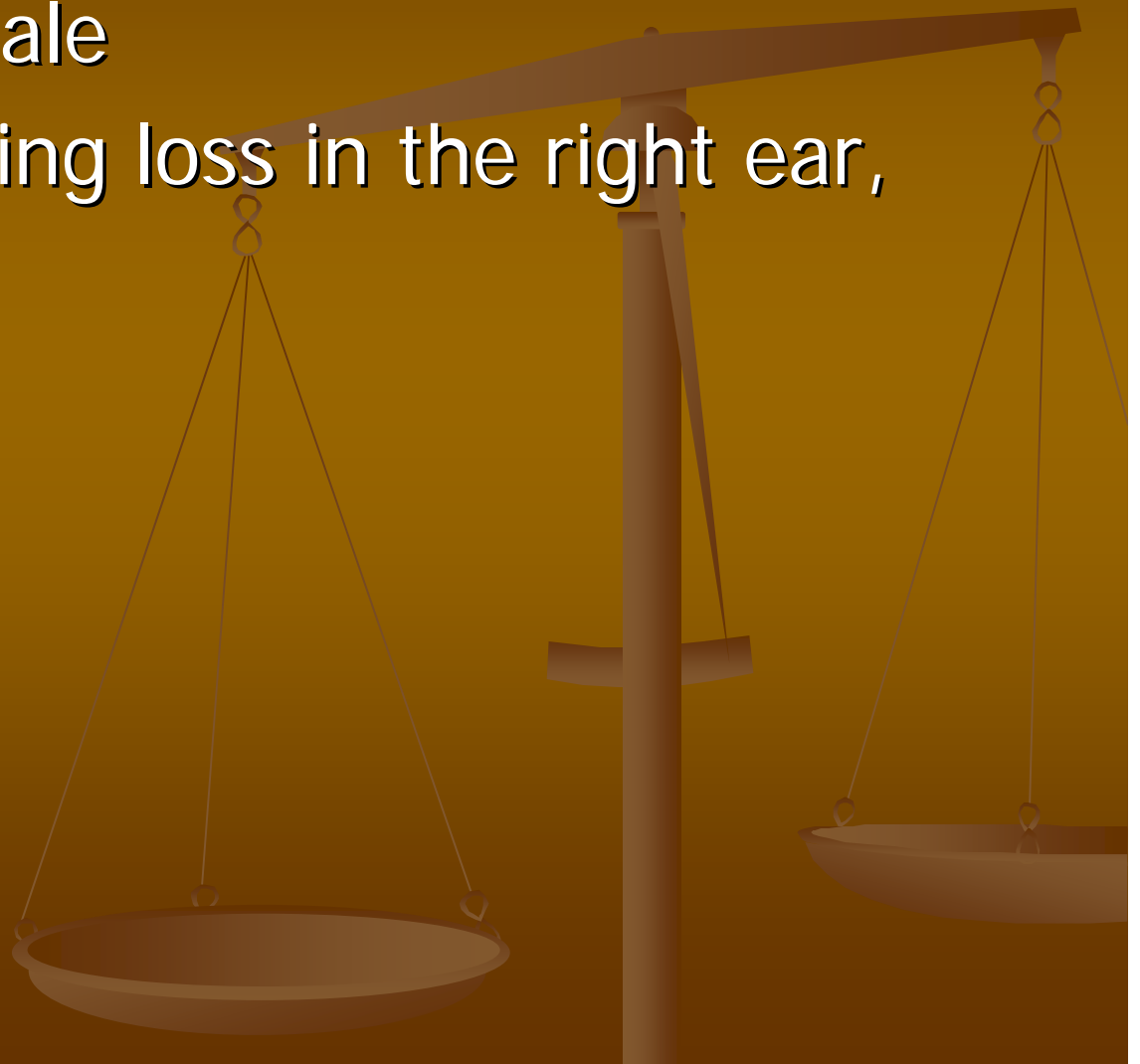
Tympanograms normal AU; Weber lateralized AD; Bing positive AU

↘ = no response at limits of equipment

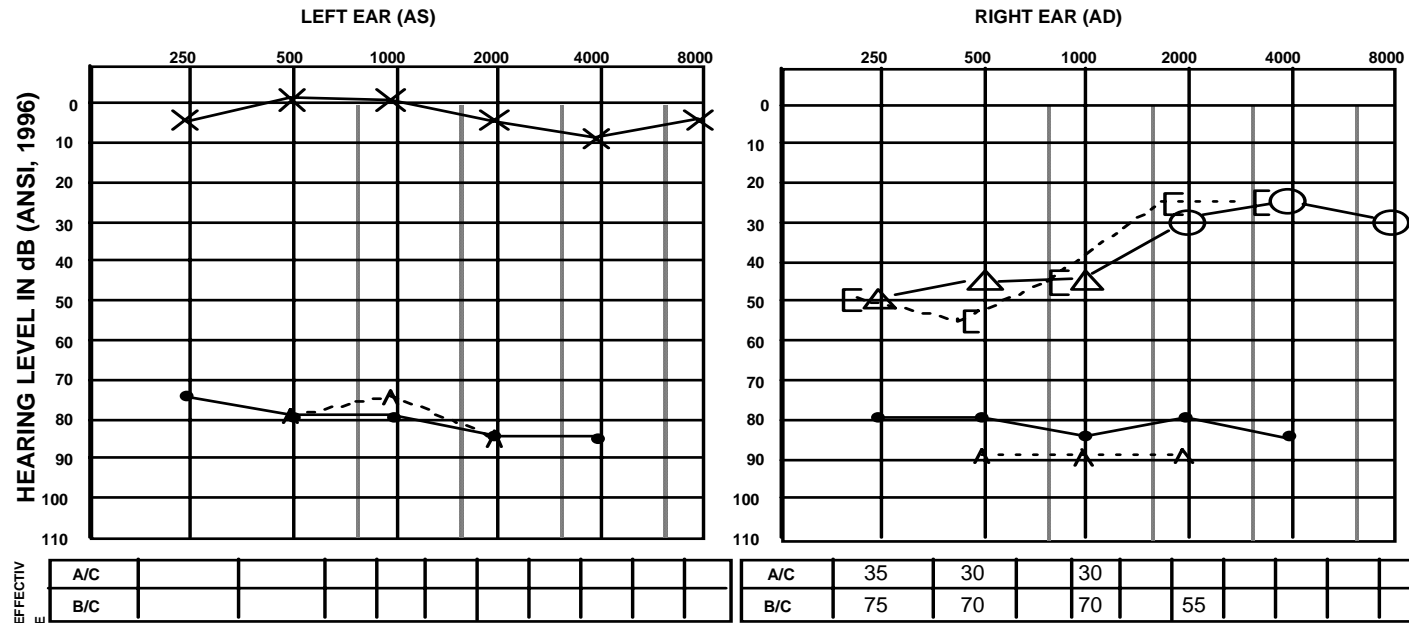
LAST, FIRST, MI	Case #4	DATE
SS#		AGE 58
SIGNATURE OF EXAMINING AUDIOLOGIST		

Case #5

- 33-year old female
- fluctuating hearing loss in the right ear,
- Vertigo
- tinnitus
- fullness



AUDIOLOGICAL CONSULTATION



	.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz
TEOAE	P _{resent}	P	P	P	P	P
DPOAE						

	.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz
TEOAE	A _{bsent}	A	A	P	P	P
DPOAE						

EAR	PURE-TONE AVERAGE		SDT	WORD-RECOGNITION PERFORMANCE			MCL	UCL
	2 FREQ.	3 FREQ.	SRT	50 dB HL	70 dB HL	90 dB HL		
AD	38	40	38		52%	60%	65	95
MASKING AS					40	60		
AS	0	3	0	96%		100%	45	100+
MASKING AD						60		

Compact Disc		AS	AD
MLV			
N.U. No. 6			
MARYLAND CNC			
W-22			
PICTURE IDENTIFICATION			
RELIABILITY			
GOOD			
FAIR			
POOR			

A/C UNMASKED	×	○
A/C MASKED	□	△
B/C UNMASKED	>	<
B/C MASKED	⌈	⌋

ACOUSTIC REFLEXES	
CONTRA	●
IPSI	●

REMARKS: Stenger negative @ 1000 Hz; tympanograms normal AU; Weber lateralized left; Bing was positive AU

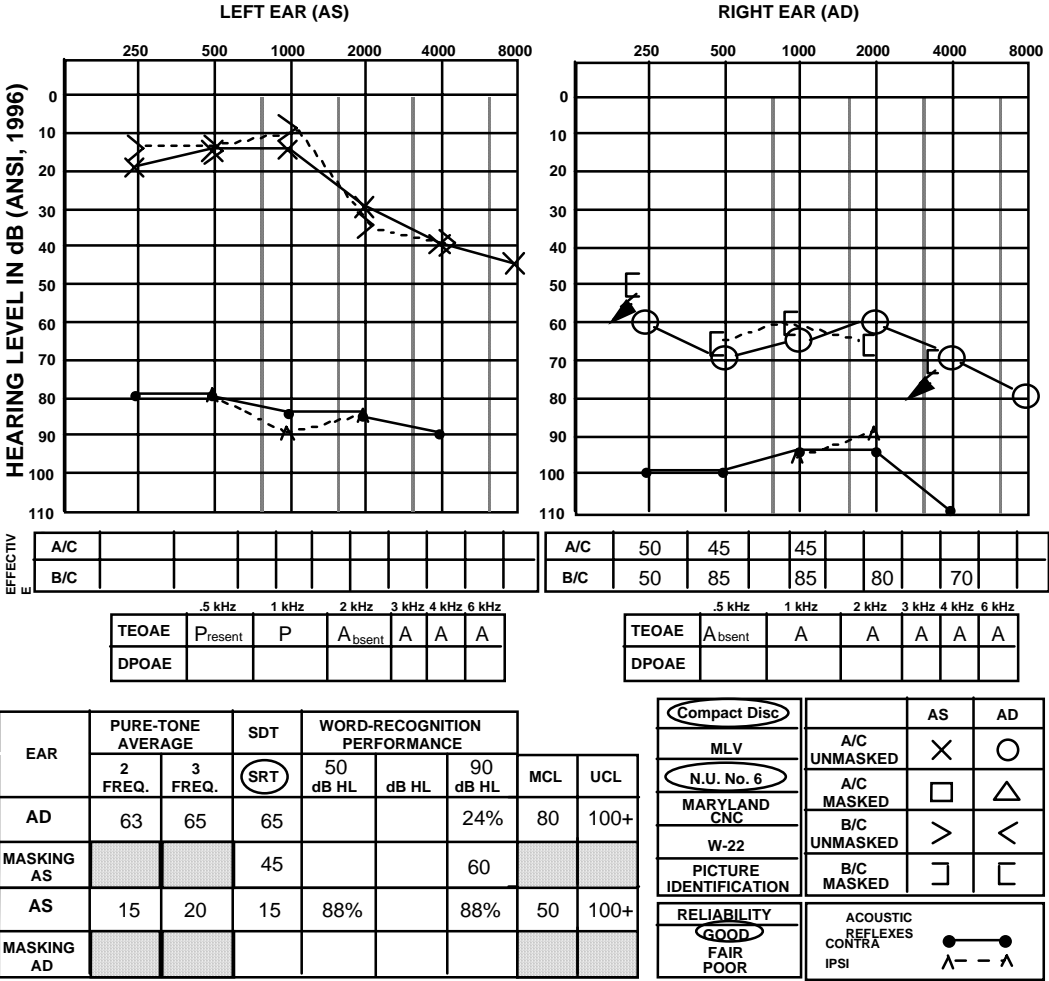
LAST, FIRST, MI	Case #5	DATE
SS#		AGE 33
SIGNATURE OF EXAMINING AUDIOLOGIST		

Case #6

- 47-year old male
- nausea, disequilibrium,
- right ear
 - hearing loss
 - tinnitus
 - fullness
- -ve PMH.



AUDIOLOGICAL CONSULTATION

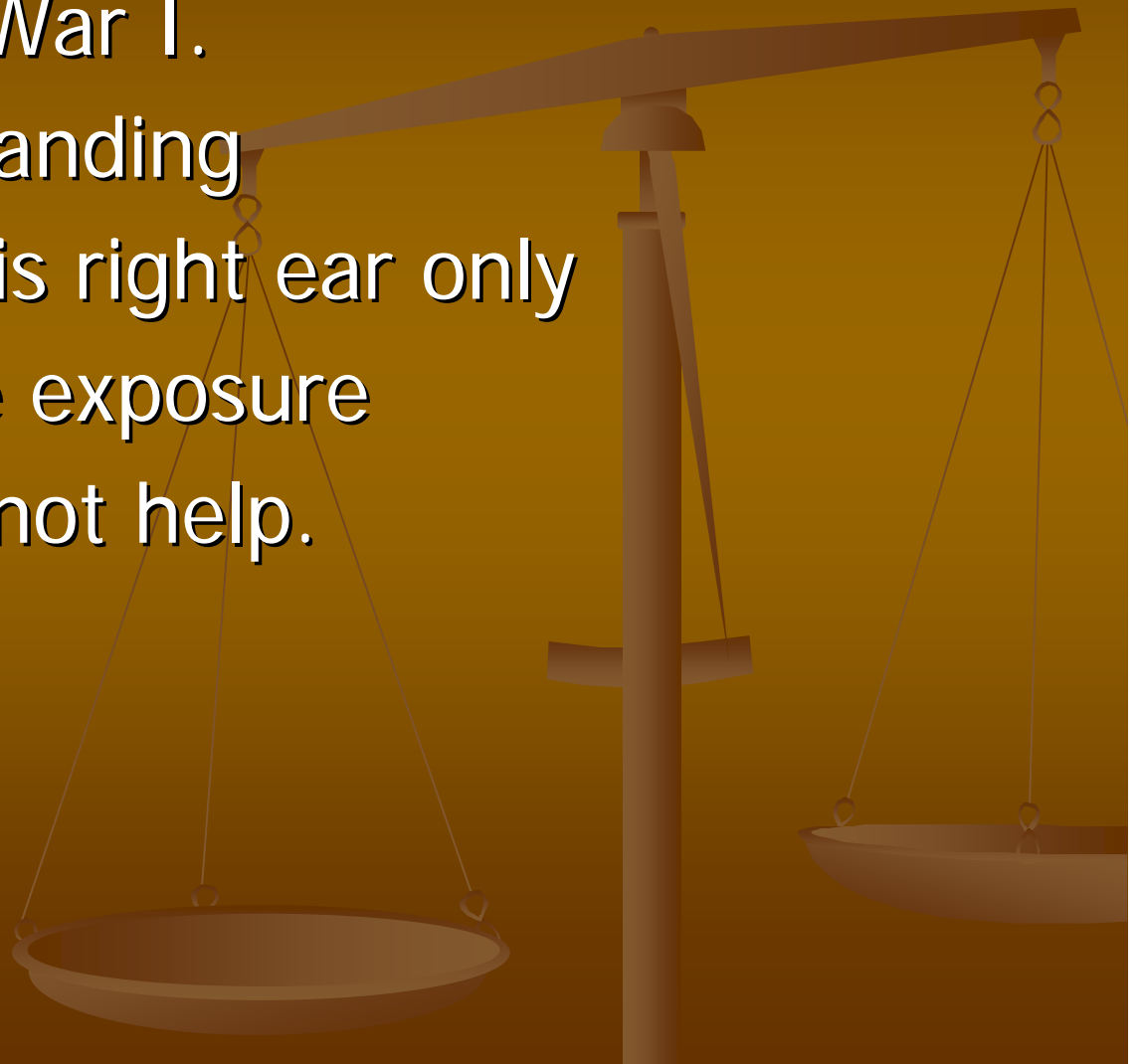


REMARKS: Stenger negative @ 1000 Hz; tympanograms normal AU;
Weber lateralized AS; Bing was positive AU
↘ = no response at limits of equipment

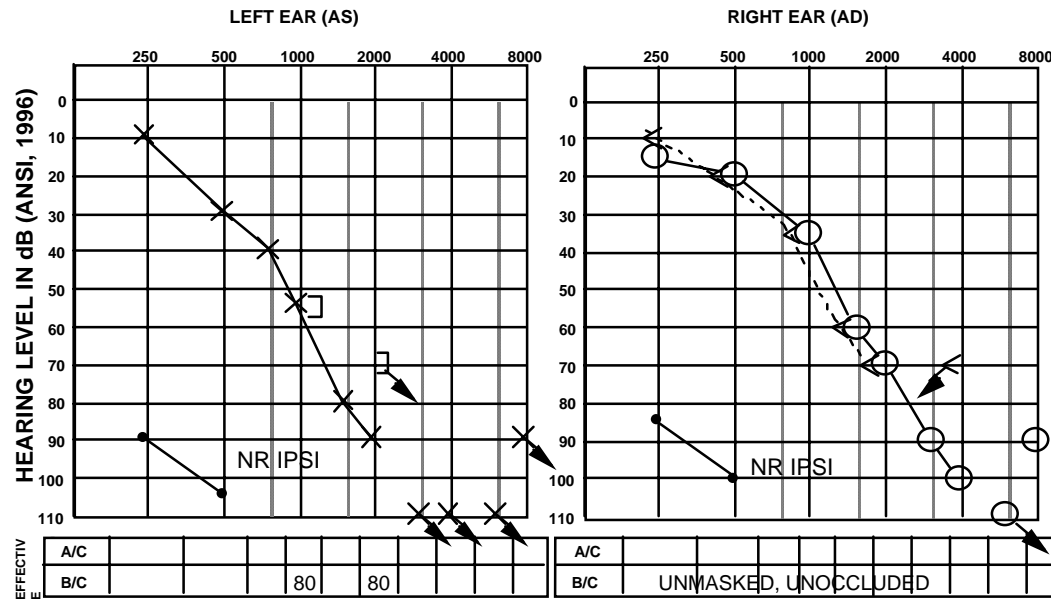
LAST, FIRST, MI	Case #6	DATE
SS#		AGE 47
SIGNATURE OF EXAMINING AUDIOLOGIST		

Case #7

- 107-year old man
- served in World War I.
- difficulty understanding
- telephone with his right ear only
- 40 years of noise exposure
- hearing aids did not help.



AUDIOLOGICAL CONSULTATION



	.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz
TEOAE						
DPOAE						

	.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz
TEOAE						
DPOAE						

EAR	PURE-TONE AVERAGE		SDT	WORD-RECOGNITION PERFORMANCE			MCL	UCL
	2 FREQ.	3 FREQ.		70 dB HL	dB HL	90 dB HL		
AD	28	42	35	24%		16%	75	90
MASKING AS				40		60		
AS	43	58	55	20%		20%	80	95
MASKING AD				40		60		

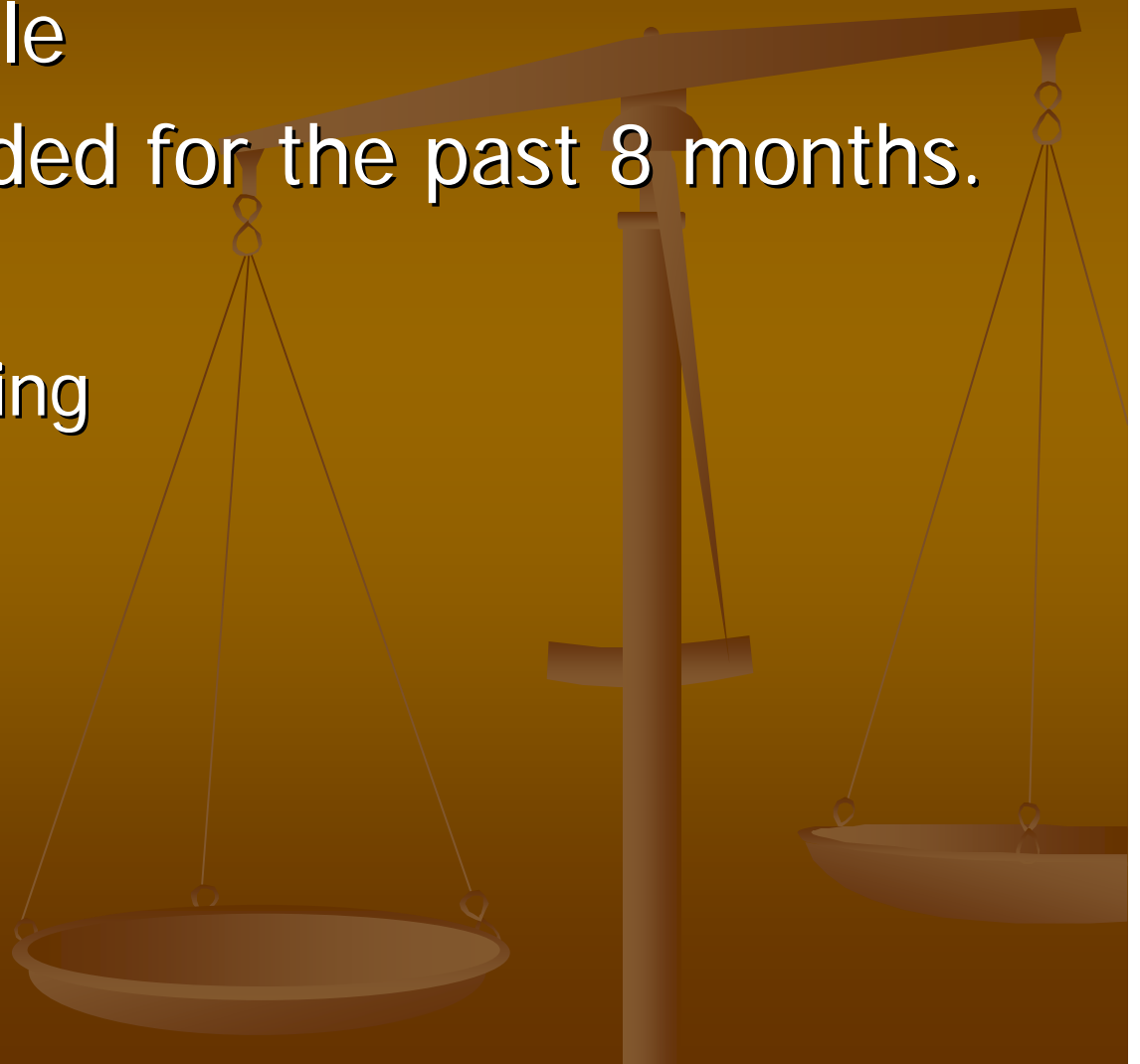
Compact Disc		AS	AD
MLV	A/C UNMASKED	X	O
N.U. No. 6	A/C MASKED	□	△
MARYLAND CNC	B/C UNMASKED	>	<
W-22	B/C MASKED	⌈	⌋
PICTURE IDENTIFICATION			
RELIABILITY	ACOUSTIC REFLEXES		
GOOD	CONTRA		
FAIR	IPSI		
POOR	Λ - - Λ		

REMARKS: tympanograms normal AU
 ↘ = no response at limits of equipment

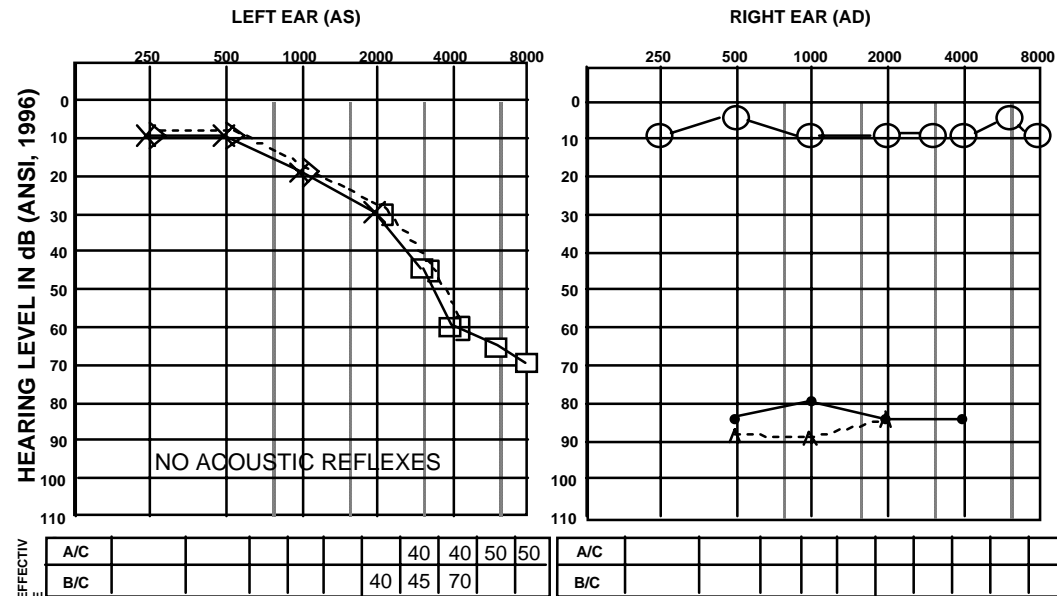
LAST, FIRST, MI	Case #7	DATE
SS#		AGE 107
SIGNATURE OF EXAMINING AUDIOLOGIST		

Case #8

- 35-year old female
- feeling lightheaded for the past 8 months.
- Left ear 5 m
 - decreased hearing
 - tinnitus



AUDIOLOGICAL CONSULTATION



		.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz	
TEOAE	P _{resent}	P	P	P		A _{bsent}		
DPOAE	P	P	P	P		A		

		.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz	
TEOAE	P	P	P	P	P	P		
DPOAE	P	P	P	P	P	P		

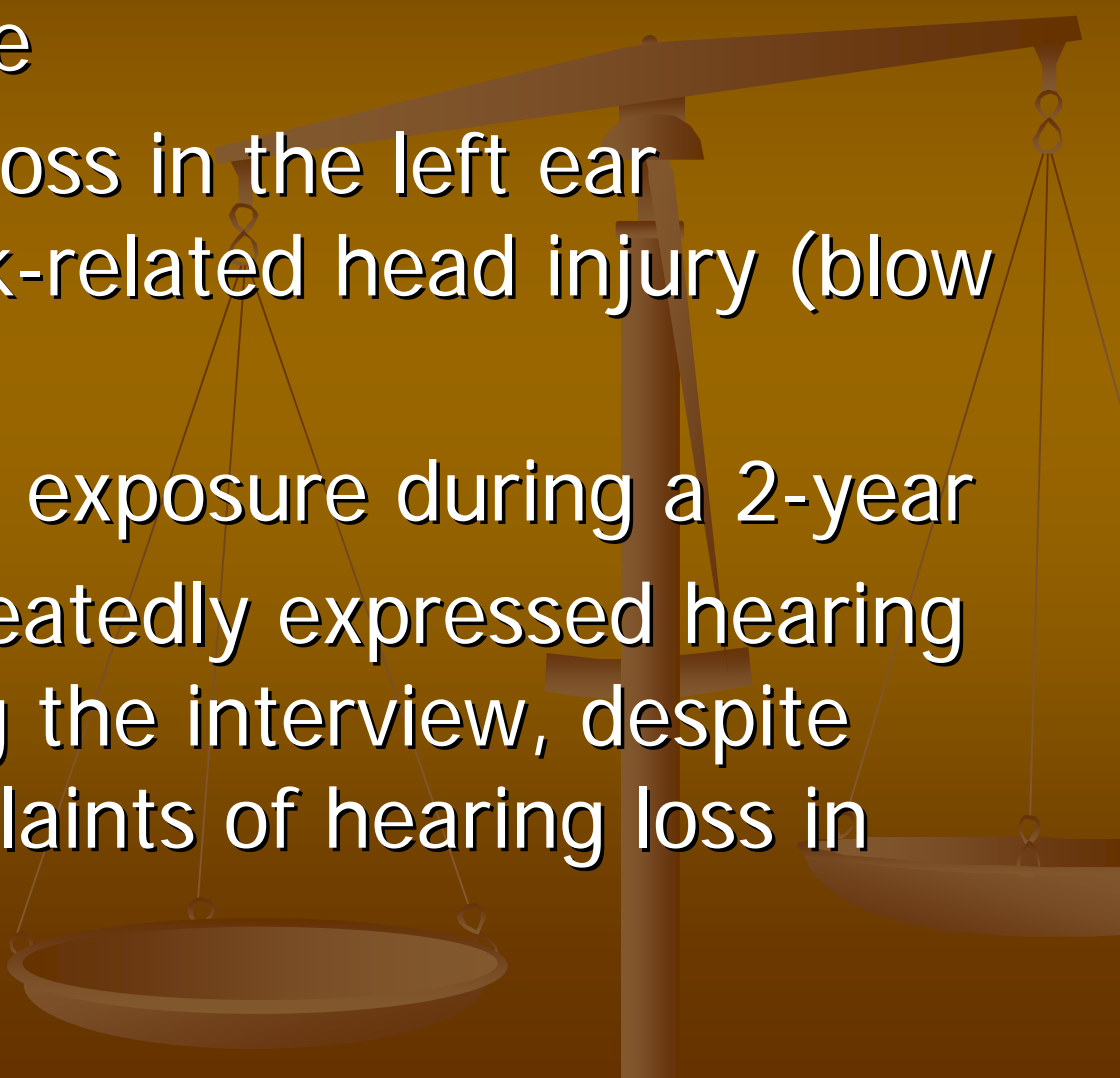
EAR	PURE-TONE AVERAGE		SDT (SRT)	WORD-RECOGNITION PERFORMANCE			MCL	UCL
	2 FREQ.	3 FREQ.		50 dB HL	80 dB HL	90 dB HL		
AD	8	8	5	96%		100%	48	100
MASKING AS				20		60		
AS	15	20	30	16%	26%	20%	70	100+
MASKING AD				20	50	60		

Compact Disc		AS	AD
MLV	A/C UNMASKED	×	○
N.U. No. 6	A/C MASKED	□	△
MARYLAND CNC	B/C UNMASKED	>	<
W-22	B/C MASKED	⌈	⌋
PICTURE IDENTIFICATION			
RELIABILITY	ACOUSTIC REFLEXES CONTRA ● — ● IPSI ⋯ — ⋯		
GOOD			
FAIR			
POOR			

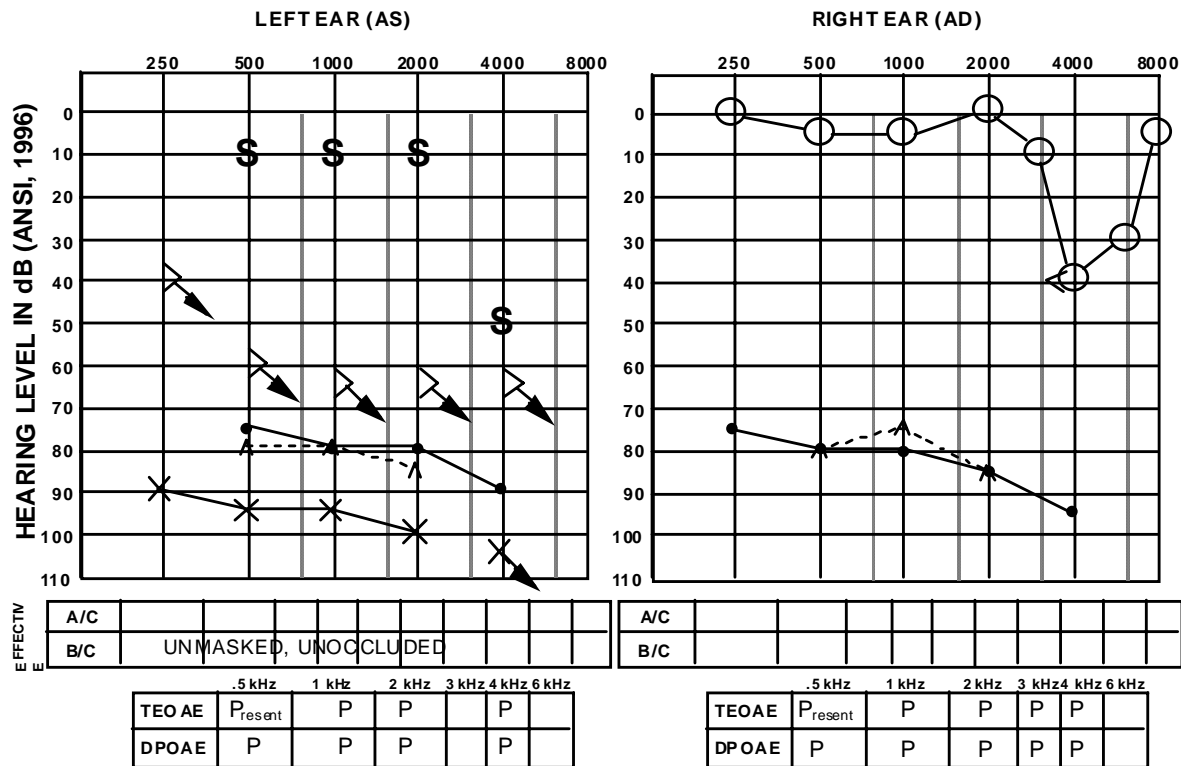
REMARKS: tympanograms normal AU

LAST, FIRST, MI	Case #8	DATE
SS#		AGE 35
SIGNATURE OF EXAMINING AUDIOLOGIST		

Case #9**

- 29-year old male
 - severe hearing loss in the left ear following a work-related head injury (blow to head).
 - significant noise exposure during a 2-year
 - The patient repeatedly expressed hearing problems during the interview, despite having no complaints of hearing loss in the right ear
- 

AUDIOLOGICAL CONSULTATION



EAR	PURE-TONE AVERAGE		SDT	WORD-RECOGNITION PERFORMANCE			MCL	UCL
	2 FREQ.	3 FREQ.		40 dB HL	dB HL	80 dB HL		
AD	3	3	2	100%		100%	45	
MASKING AS						60		
AS	95	98	70*			100%	70	
MASKING AD			60			60		

Compact Disc		AS	AD
MLV	A/C UNMASKED	×	○
N.U. No. 6	A/C MASKED	□	△
MARYLAND CNC	B/C UNMASKED	>	<
W-22	B/C MASKED	⌈	⌋
PICTURE IDENTIFICATION			
RELIABILITY	ACUSTIC REFLEXES CONTRA GOOD FAIR POOR IPSI		

REMARKS: **S** = Stenger Threshold Estimates
 *half-word responses
 ↘ = no response at limits of equipment

LAST, FIRST, MI <div style="text-align: center; font-weight: bold;">Case #9</div>	DATE
SS#	AGE <div style="text-align: center;">29</div>
SIGNATURE OF EXAMINING AUDIOLOGIST	

Pseudohypacusis

- PTA & SRT 10 db
- Retest > 5 db
- No cross-over
- AC > BC

- Objective test
 - Acoustic reflex
 - OAE
 - ABR



Pseudohypacusis

Special test

- **Stenger test**

5db above good ear & 5db below poorer ear
→ No response (+ve)

- **Lee test**

Stutter with delay played back subjects sound

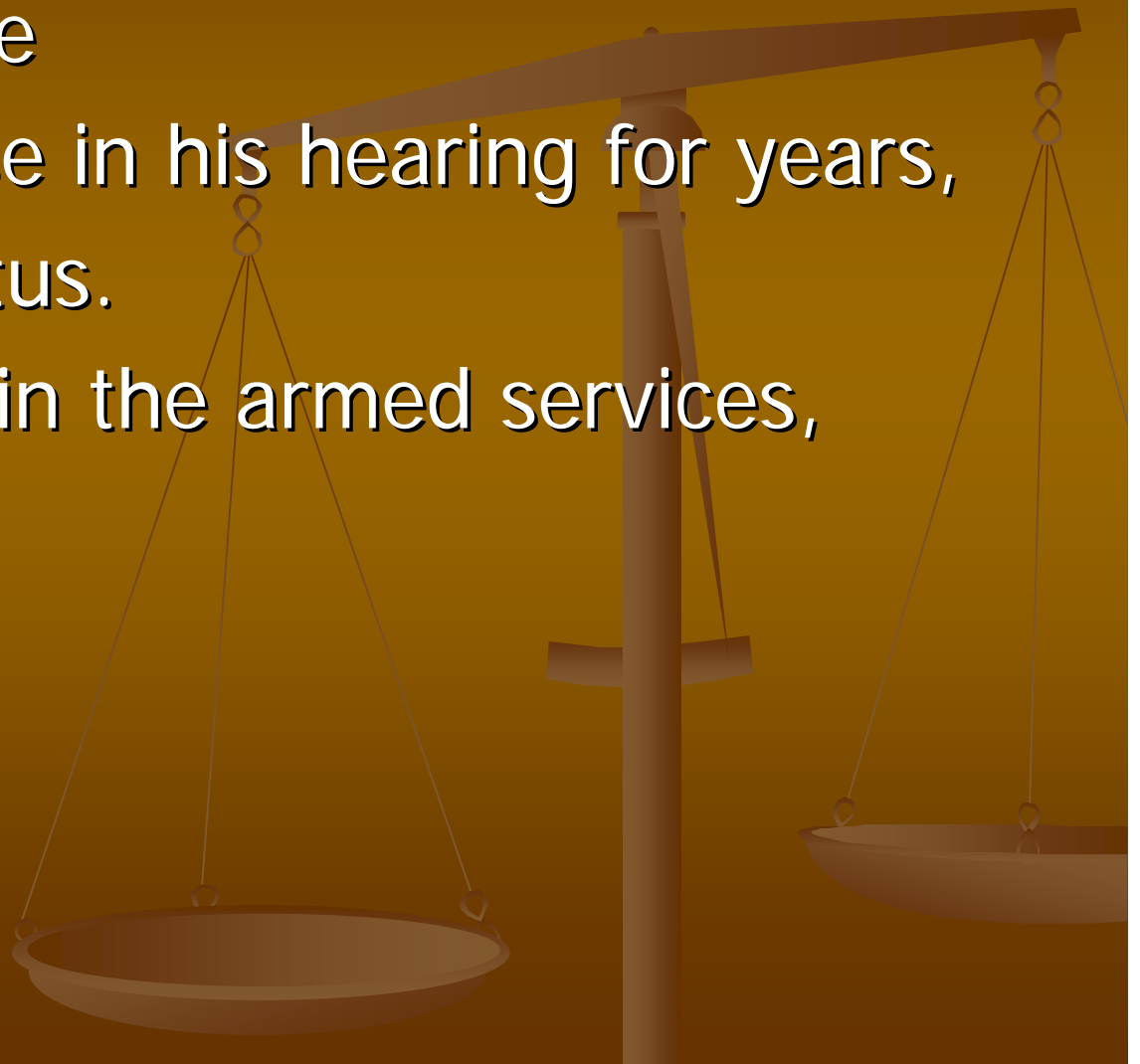
- **Lombard test**

Increase voice with increasing background noise



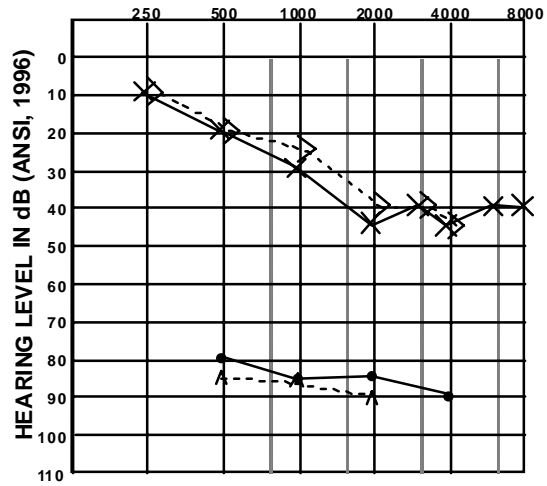
Case #10

- 68-year old male
- gradual decrease in his hearing for years,
- occasional tinnitus.
- noise exposure in the armed services,



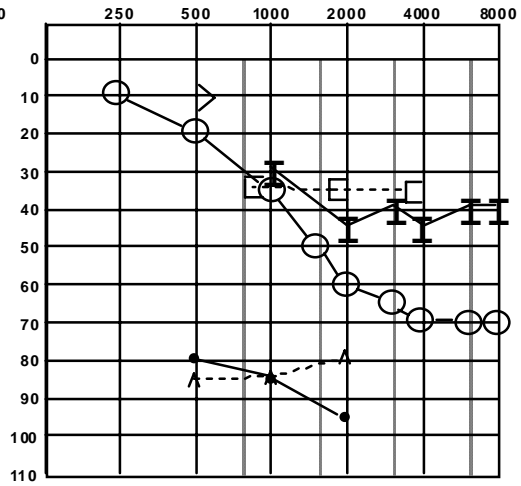
AUDIOLOGICAL CONSULTATION

LEFT EAR (AS)

[illegible]

	.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz
TEO AE	P _{present}	P	?		?	
DPOAE	P	P	?		?	


RIGHT EAR (AD)



A/C									
B/C			60		75		75		

	.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz
TEOAE	P	P	?		A _{bsent}	
DPOAE	P	P	?		A	

EAR	PURE-TONE AVERAGE		SDT	WORD-RECOGNITION PERFORMANCE				
	2 FREQ.	3 FREQ.	(SRT)	50 dB HL	dB HL	90 dB HL	MCL	UCL
AD	25	28	26	62%		90%	72	105
MASKING AS						60		
AS	25	32	26	58%		92%	68	100
MASKING AD						60		

Compact Disc		AS	AD
MLV	A/C UNMASKED	✕	○
N.U. No. 6	A/C MASKED	□	△
MARYLAND CNC	B/C UNMASKED	>	<
W-22	B/C MASKED	⌋	⌋
PICTURE IDENTIFICATION			
RELIABILITY	ACOUSTIC REFLEXES CONTRA IPSI		
GOOD			
FAIR			
POOR			

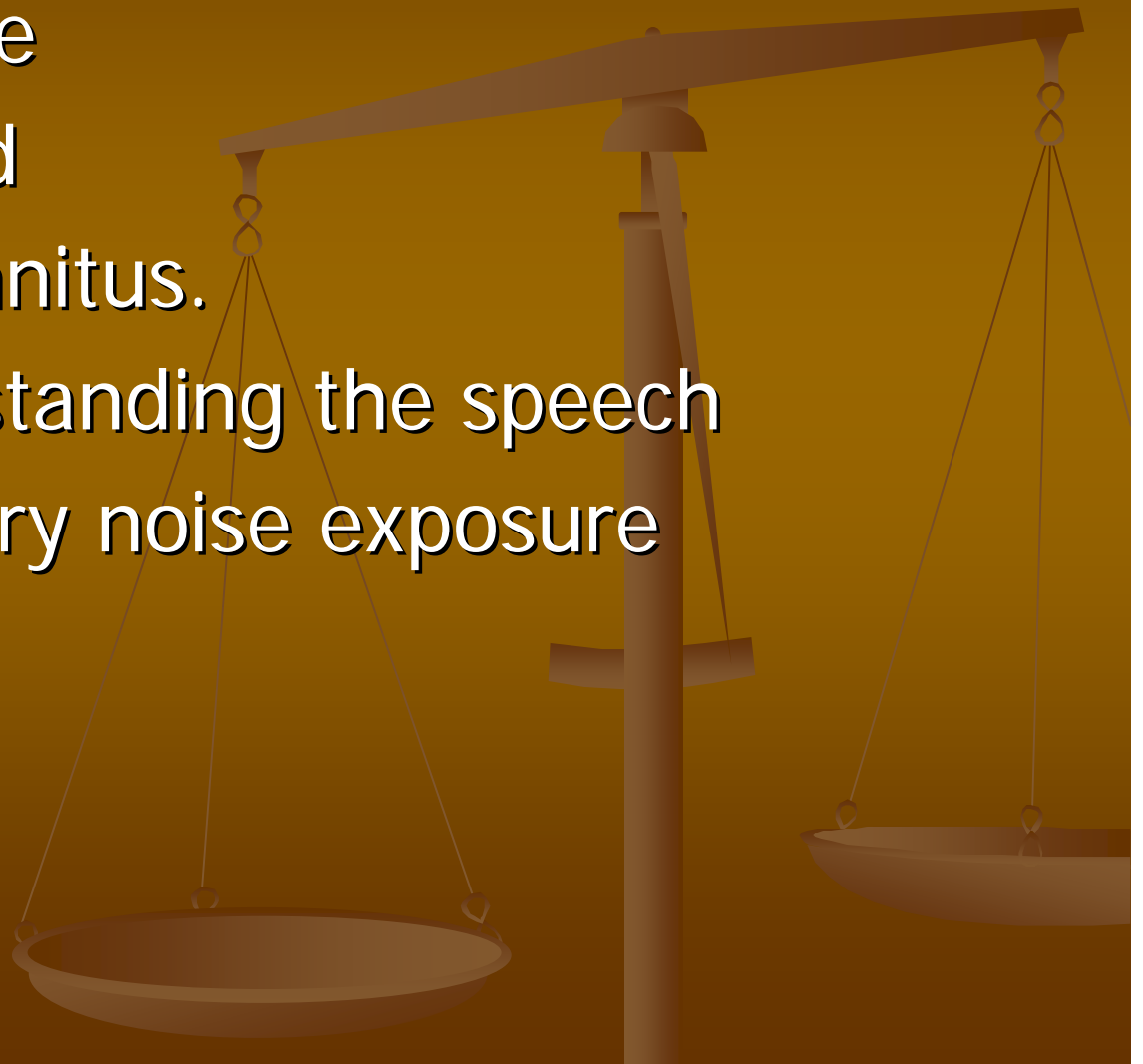
REMARKS: tympanograms normal AU

I = Insert Earphone Thresholds

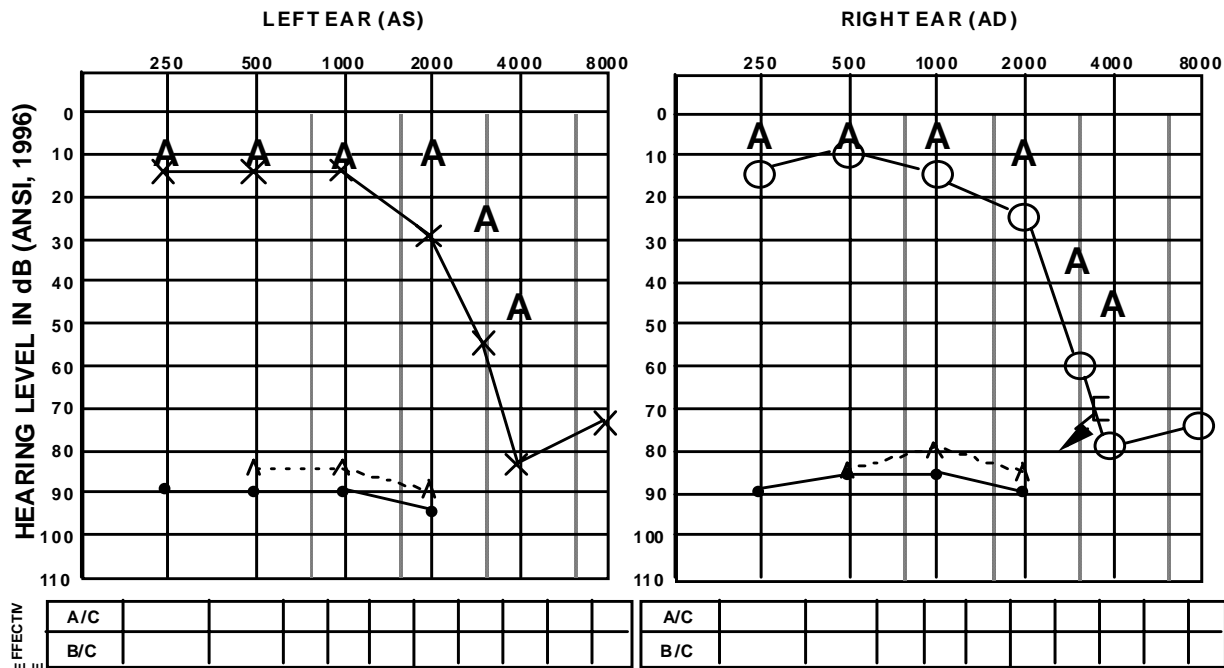
LAST, FIRST, MI	DATE
Case #10	
SS#	AGE 68
SIGNATURE OF EXAMINING AUDIOLOGIST	

Case #11

- 49-year old male
- hearing loss and
- mild periodic tinnitus.
- difficulty understanding the speech
- History of military noise exposure



AUDIOLOGICAL CONSULTATION



	.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz
TEO AE	Present	P	P		Absent	
DPOAE	P	P	P		A	

	.5 kHz	1 kHz	2 kHz	3 kHz	4 kHz	6 kHz
TEOAE	P	P	P		A	
DPOAE	P	P	P		A	

EAR	PURE-TONE AVERAGE		SDT	WORD-RECOGNITION PERFORMANCE			MCL	UCL
	2 FREQ.	3 FREQ.		50 dB HL	dB HL	80 dB HL		
AD	13	17	20	80%		100%	65	100
MASKING AS						60		
AS	15	20	20	84%		100%	65	100
MASKING AD						60		

Compact Disc		AS	AD
MLV	A/C UNMASKED	X	O
N.U. No. 6	A/C MASKED	□	△
MARYLAND CNC	B/C UNMASKED	>	<
W-22	B/C MASKED	⌈	⌋
PICTURE IDENTIFICATION			
RELIABILITY	ACUSTIC REFLEXES CONTRA IPSI		
GOOD	● — ●		
FAIR	Λ — Λ		
POOR			

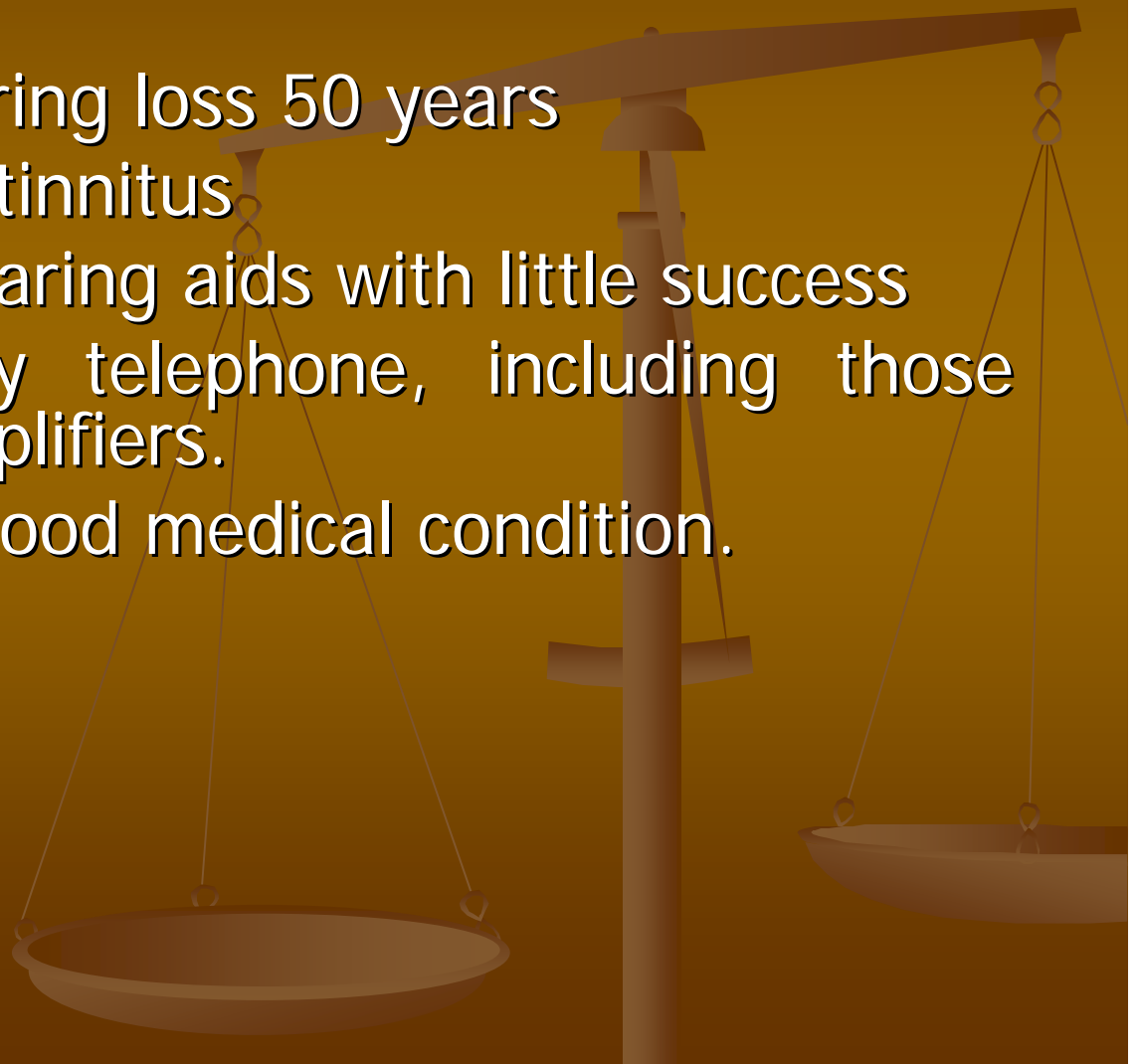
REMARKS: Tympanograms normal AU

A = thresholds through CIC hearing aid;
binaural word recognition through CIC was 96%

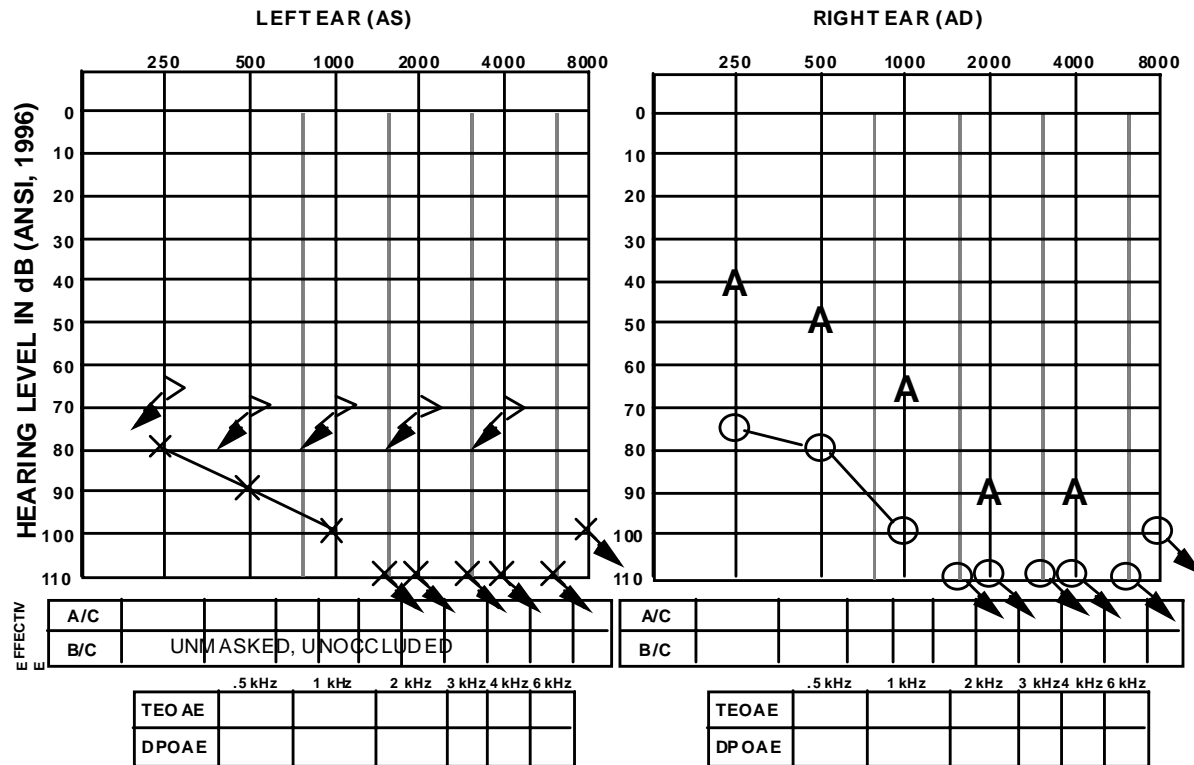
LAST, FIRST, MI	Case #11	DATE
SS#		AGE 49
SIGNATURE OF EXAMINING AUDIOLOGIST		

Case #12

- 76-year old male
- sensorineural hearing loss 50 years
- constant bilateral tinnitus
- behind-the-ear hearing aids with little success
- can not use any telephone, including those equipped with amplifiers.
- The patient is in good medical condition.



AUDIOLOGICAL CONSULTATION



EAR	PURE-TONE AVERAGE		SDT	WORD-RECOGNITION PERFORMANCE			MCL	UCL
	2 FREQ.	3 FREQ.		dB HL	dB HL	100 dB HL		
AD	90	--	85			4%	>100	
MASKING AS								
AS	95	--	90			0%	>100	
MASKING AD								

Compact Disc		AS	AD
MLV	A/C UNMASKED	×	○
N.U. No. 6	A/C MASKED	□	△
MARYLAND CNC	B/C UNMASKED	>	<
W-22	B/C MASKED	⌈	⌋
PICTURE IDENTIFICATION			
RELIABILITY	AC OUSTIC REFLEXES CONTRA IPSI		
GOOD	● — ●		
FAIR	Λ — Λ		
POOR			

REMARKS: Tympanograms normal AU; Word recognition with hearing aid was 12%.

A = thresholds with hearing aid

↘ = no response at limits of equipment

LAST, FIRST, MI	Case #12	DATE
SS#		AGE 76
SIGNATURE OF EXAMINING AUDIOLOGIST		

The End

