Objectives

Learners will be able to:

• Discuss the principles of masking, including interaural attenuation and crossover
• Demonstrate the application of appropriate masking techniques
• Accurately determine and document masked AC thresholds for each ear
• Accurately determine and document masked BC thresholds for each ear
• Apply the acoustical attributes of complex sound to speech sounds
• Relate the acoustics of speech sounds to audibility and intelligibility
• Demonstrate accurate measurement and documentation of threshold and supra-threshold speech audiometric results for each ear
• Apply speech audiometry to patient/client management
MASKING 101

What is this Masking you speak of?

Masking:
1. Use of noise to eliminate the participation of one ear while testing another;
2. Amount or process by which the threshold for one sound is raised by the presence of another sound;
3. Noise that interferes with the audibility of another sound.

(Stach, 2003, p. 162.)
Masking Example

When you are watching TV and another person comes into the same room and creates an additional noise that makes it difficult for you to hear the TV.

The additional noise (the masker) masks out the TV (the signal).

Some Masking Terms...

Test Ear (TE) – the ear that pure tones or speech is presented to. (The Signal)

Non Test Ear (NTE) – the ear that is not being tested, and when masking is occurring the ear that the masking noise is presented to. (The Masker)
Lesson 17

MASKING FOR AIR CONDUCTION

Interaural Attenuation & Crossover

Interaural Attenuation (IA):
• “Between Ears”
• Attenuation – decrease in signal intensity
• Transducer Values for Masking:
  – Supra-aural & Circumaural Headphones = 40 dB
  – Insert Earphones = 70 dB for PT, 60 dB for Speech
  – BC Oscillator = 0 dB

Crossover:
• The process in which sound presented to one ear through an earphone crosses the head via bone conduction and is perceived by the other ear. (Stach, 2003, p. 72)
Monaural Stimulation

When a signal is presented to one ear and the patient/client perceives it to be heard in that ear only.

If the signal has a great intensity it is possible that the other cochlea may respond, but due to the reduced signal the listener typically cannot detect that both cochleas are being stimulated (symmetrical hearing). Their perception remains monaural as a result of the difference in intensity of the signal.

Masking Noise

Narrowband Noise:
- Used for PT testing

Speech Noise
- Used for speech testing
The Rule for Masking for Air Conduction

Supra-aural & Circumaural Earphones:
• Deliver narrowband noise masking to the NTE when there is a 40 dB difference between the measured AC threshold of the TE and the measured BC threshold of the NTE.

Insert Earphones:
• Deliver narrowband noise masking to the NTE when there is a 70 dB difference between the measured AC threshold of the TE and the measured BC threshold of the NTE.

*Apply this rule to every frequency tested.*

Modified Rule for Masking Air Conduction

Deliver narrowband noise masking to the NTE when AC thresholds are 40 dB (supra-aural and circumaural earphones) or 70 dB (insert earphones) different between the ears at any frequency.
Masking Procedure (Plateau Method)

1. Determine the need for AC masking by applying the Rule of Masking at each frequency.
2. Calculate the initial amount of narrowband masking needed in the NTE.
   1. Add 10 dB to the unmasked AC threshold in the NTE.
3. Re-instruct the member using the audiometer’s talk over system.
4. Set the audiometer as follows:
   1. AC to earphones
   2. PT to TE
   3. Narrowband Masking Noise to NTE
5. Deliver the initial masking level to the NTE

6. Present the tone to the TE at the previously established threshold level.
7. Increase masking noise by 5 dB in the NTE and re-establish threshold in the TE. Repeat this process until masking has been increased three times (consecutively) and the threshold in the TE has not changed.
Masking Procedure (Plateau Method)

8. Record the masked AC threshold on the audiogram using the appropriate symbol and document the final or effective masking level used.
9. Repeat this procedure to measure the AC threshold for each ear at every frequency where masking is required.

Review of Symbols
More Masking Terms...

Plateau – the range of masking intensities over which the masked threshold does not shift.

Effective Masking – the range of masking intensities required to establish the threshold plateau.

Under masking – occurs when the masking noise presented to the NTE is not intense enough to eliminate crossover.

Over masking – occurs when the masking noise presented to the NTE is so intense that it crosses over to the TE, causing a threshold elevation that does not represent the true threshold at that frequency.

Masking Example
Understanding the Picture:

- **Under masking**: is overcome because the masking procedure dictates that NBN be increased until effective masking is established and the threshold plateau is identified.

- **Effective masking**: happens between the minimum and maximum masking levels. When the TE responds at the same threshold with three increases of masking noise in the NTE (a 15 to 20 dB plateau)

- **Over masking**: if the masking intensity continues to be raised and the measured TE threshold increases by the same amount.
• Reminder…
  – IA varies with transducer
  – IA for BC is 0 dB
    • May make masking for BC a more common procedure than for AC threshold testing.

• Unmasked BC results are not side or ear specific, regardless of where the result is recorded on the audiogram.
  – All the symbol denotes is which side of the head the BC oscillator was placed on.
  – Only by using masking can we identify which ear is responding.
The Rule for Masking Bone Conduction

Deliver narrowband noise masking to the NTE when there is a 15 dB or greater difference between the measured AC and BC thresholds of the TE.

(Mask the NTE when there is an Air-Bone gap at any frequency.)

Apply this rule to the unmasked thresholds measured at every frequency.

Occlusion Effect (OE)

• **MUST** be applied in BC testing when masking is needed.
• The enhancement in the loudness of bone-conducted signals due to the occlusion of the external ear canal by the earphone which delivers the masking stimulus.
  – Primarily a low frequency phenomenon.
### Occlusion Effect (OE)

**Initial Masking** = $AC_{NTE} + 10\ dB + OE$ (For Frequency being Tested)

**Example**

$AC_{NTE} = 30\ dB\ HL\ @\ 500\ Hz$

$30\ dB + 10\ dB + OE\ of\ 15\ dB = 55\ dB\ Initial\ Masking\ Level$

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
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<tbody>
<tr>
<td>Occlusion Effect (dB)</td>
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</tbody>
</table>

### Occlusion Effect (OE)

**Occlusion Effect in dB – Cheat Sheet**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occlusion Effect (dB) + 10 dB</td>
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<td>20</td>
<td>10</td>
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</tbody>
</table>
Masking Procedure for BC (Plateau Method)

1. Determine the need for BC masking by applying the Rule for Masking at each frequency.

2. Arrange the transducers:
   1. Have member remove eyeglasses
   2. Place BC oscillator on the mastoid of the TE
      1. MUST not touch the Pinna
   3. NTE Earphone Placement
      1. Insert: Properly place the insert into the NTE
      2. Headphone: Place one earphone on/over the NTE, and the other earphone above the TE or on the member’s cheekbone – adjust the headband as necessary.
      3. **DO NOT OCCLUDE or cover up the TE**
         1. Covering/Occluding both ears leads to **inaccurate** thresholds

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Masking Procedure for BC

3. Calculate the initial amount of narrowband masking noise needed in the NTE.
   1. Confirm that the member hears the masking noise in the NTE.

4. Re-instruct the member using the audiometers talk-over system.

5. Set the audiometer as follows:
   1. TE: PT to BC oscillator
   2. NTE: Narrowband noise via AC
### Masking Procedure for BC

6. Deliver the initial masking level to the NTE.

7. Present the BC tone to the TE at the previously established threshold.

8. Increase the masking noise in 5 dB steps in the NTE and re-establish threshold in the TE. Repeat until masking has been increased three times (consecutively) and the threshold in the TE has not changed.

9. Record the masked BC threshold on the audiogram using the appropriate symbol and document the final or effective masking level used.

10. Repeat this procedure to measure the masked BC threshold for each ear at every frequency where masking is required.
Masking Example #1

Note that the left ear unmasked BC threshold at 500 Hz is 0 dB HL and the masked AC threshold is 65 dB HL. An air-bone gap has been identified, so masking is needed in the right ear for left bone conduction threshold determination.

BC Masking Rule:
*Deliver NBN masking to the NTE when there is a 15 dB or greater difference between the measured AC and BC thresholds of the TE.*
### Masking Worksheet (500 Hz)

<table>
<thead>
<tr>
<th>Presentation Level</th>
<th>Masked Ear (NTE)</th>
<th>Test Ear (Left)</th>
<th>Presentation Level</th>
<th>Masked Ear (NTE)</th>
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<tbody>
<tr>
<td>20 dB</td>
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R = response  
NR = no response
Now we begin bracketing to determine the threshold to begin masking determination at.

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R = response  
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</table>

R = response  
NR = no response
Second Bracket
This is the TE level at which we will begin our masking determination

1st Increase in Masking Noise
### Masking Worksheet (500 Hz)

#### Masking for Air Conduction

<table>
<thead>
<tr>
<th>Presentation Level</th>
<th>Masked Ear (NTE) (Right)</th>
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#### Masking for Bone Conduction

<table>
<thead>
<tr>
<th>Presentation Level</th>
<th>Masked Ear (NTE) (Right)</th>
<th>Test Ear (Left)</th>
<th>Masked Ear (NTE) (Right)</th>
<th>Test Ear (Left)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 dB</td>
<td>NR</td>
<td>60 dB</td>
<td>NR</td>
<td>35 dB</td>
</tr>
<tr>
<td>20 dB</td>
<td>R</td>
<td>60 dB</td>
<td>NR</td>
<td>40 dB</td>
</tr>
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<td>R</td>
<td>70 dB</td>
<td>NR</td>
<td>60 dB</td>
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<tr>
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<td>30 dB</td>
<td>R</td>
<td>65 dB</td>
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<td>55 dB</td>
</tr>
<tr>
<td>35 dB</td>
<td>R</td>
<td>65 dB</td>
<td>R</td>
<td>55 dB</td>
</tr>
</tbody>
</table>

R = response
NR = no response

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### 2nd Increase in Masking Noise

- Mark TE threshold at 55 dB and record NTE masking level at 50 dB.

### 3rd Increase in Masking Noise

- Mark TE threshold at 55 dB and record NTE masking level at 50 dB.
LI BC threshold improves by 5 dB... Why?

Stays at 60 dB
Masking Example #3

Record the final PL with the appropriate masked symbol.

Record the final or effective masking level.
Initial Masking Level
20 dB + 10 dB = 30 dB

Re-establish Threshold

Member Responds
Masking Dilemma

- Masking Dilemma - occurs when the initial amount of masking is so great that it crosses over to the test ear
  - More common in bilateral moderate to severe conductive hearing losses
- Document on the audiogram that the “masking dilemma” was encountered when masking was attempted.
- Using Insert earphones can help to overcome this phenomenon.

Record the final or effective masking level
Lesson 19

SPEECH ACOUSTICS

Complex Sounds

Everyday sounds are complex, not acoustically simple like the pure tones used to measure thresholds. They are made up of more than one frequency with varying amplitudes occurring all at the same time.

To hear the difference between a pure tone and a complex sound play a 1000 Hz Pure Tone and compare it to 1000 Hz narrowband masking noise.

Fourier (“FOUR-ee-ay”) Analysis or Transform

• The decontraction of a complex wave into the simple pure tones that comprises it. (Mathematical Reduction)
Graphic Displays of Complex Sound

Two ways to display or graph complex sounds:
1. Waveforms - how amplitude changes over time
2. Spectrum - the amplitude of each frequency that contributes to one cycle of the sound.
   1. Represents the sound in the frequency domain without consideration of time.
   2. The results of the Fourier analysis

Periodic vs. Aperiodic Sounds

Periodic Sounds have a pattern of vibration that has a specific duration, and the pattern repeats over time.
• The fundamental frequency and harmonics remain the same as the complex sound repeats.
• Vowels are an example of periodic complex sounds.

Aperiodic sounds do not repeat themselves and do not have harmonics that are integer multiples of the fundamental frequency.
• Noise is a common example of an aperiodic complex sound.
• White noise is a special type of noise that is characterized by equal sound energy at all frequencies.
• The spectrum of an aperiodic complex sound displays amplitude as a straight line.
Speech Sounds

Phonemes - the discrete sounds of speech
• Can be periodic or aperiodic
• Can have voicing or be continuous noises like some consonants
• A vowel is a periodic complex sound which has a fundamental frequency and the corresponding harmonics
  – Vowels are produced by vocal cord vibration that delivers a raw sound frequency shaped by the length, width, and configuration of the vocal tract.
  – Each vowel has a similar acoustical pattern that is characterized by frequency regions with relatively higher intensity than other regions. These are called Formants.
    • Each vowel has a specific Formant pattern no matter who is speaking.
  – Vowels are voiced, have relatively high intensity, and have a spectrum concentrated in the low frequencies.

Speech Sounds

• Voiced consonants are phonemes that are periodic complex sounds with an additional element of noise, like the phoneme /v/.
  – The spectrum of voiced consonants is more in the mid to high frequency range.
• Unvoiced consonants are aperiodic complex sounds, like the phoneme /sh/.
• Consonants are critical to speech understanding, also called speech intelligibility, and their frequency signatures are concentrated in the high frequencies.

Speech Banana - the frequency-intensity locations relevant to each sound, called the speech banana because the shape of the speech sounds resembles that of a banana.

Vowels = loudness or audibility
Consonants = intelligibility or clarity
### Speech Sounds

#### Upward Spread of Masking

- The masking of high-frequency sound by low-frequency sound, e.g., weaker high-frequency consonant sounds being masked by stronger low-frequency vowel sounds.

- Ambient background noise has most of its energy in the low frequencies, so it readily masks the weaker high frequency phonemes and decreases speech intelligibility.

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### Speech Intensity and Speech Intelligibility

**Goal of Amplification = to improve speech audibility and intelligibility**

Making sounds louder may not achieve the improved intelligibility goal for all members with sensory/neural hearing loss.

- Hearing loss that is caused in part or totally by damage to the auditory neurons (retrocochlear hearing loss) can result in progressively worse speech intelligibility with increased speech presentation levels.
  - Rollover - the decrease in performance at higher intensity levels
PB-maximum (PB-max) – the highest percentage correct score obtained on monosyllabic word recognition measures presented at several intensity levels.

Rollover - paradoxical decrease in speech recognition ability with increasing level at high intensity levels, consistent with retro cochlear disorder.

Speech Intensity and Speech Intelligibility

The average level of conversational speech is 65 dB SPL ± 12dB.

- This value converts to 45 dB HL

One way of looking at the relationship between loudness and clarity is a comparison of power and intelligibility within each freq. Range.

- Vowels are louder than consonants and contain more low frequency
- Excess low frequency power is not generally advantageous for the understanding of speech due to the upward spread of masking.
Speech Intensity and Speech Intelligibility

This figure shows the relationship between speech energy (power) and speech intelligibility.

- By eliminating all of the energy below 500 Hz, 60% of the energy but only 5% of the speech intelligibility is lost.
- By eliminating all of the energy above 1000 Hz, 5% of the energy but 60% of the speech intelligibility are lost.
- Note the high percentage of speech intelligibility around 2000 Hz.

This figure shows the relationship in another way.

- There is a greater concentration of energy in the lows, with a tapering off through the higher frequencies.
- The higher frequencies provide clarity but have very little energy.

Speech Intensity and Speech Intelligibility

Just as we cannot appreciate a full range of colors in our visual system without enough light, we cannot appreciate speech without sufficient intensity to make it audible.

**Without audibility there can be no intelligibility!**

Fitting Verification coming soon to a class near you!

The proper balance between power and intelligibility is crucial.
Speech Intensity and Speech Intelligibility

**Speech Intelligibility Index (SII)** - a measure of the contribution by frequency to intelligibility.

- 250 Hz - 8%
- 500 Hz - 14%
- 1000 Hz - 22%
- 2000 Hz - 33%
- 4000 Hz - 23%

Languages Other Than English

- Speech acoustic in this lesson are specific for spoken English
- Vowel sounds have similarity across the world’s languages
  - This is expected due to the human vocal tract possessing similar structure.
  - The consideration of speech audibility when fitting hearing instruments is fairly constant whether the patient/client speaks English or another language.
- It is important to recognize that consonants provide speech intelligibility
  - These vary significantly among the world’s languages
  - Linguistically relevant acoustic information in languages other than English may be clustered around different frequency bands
- The SII was developed for English and may not be applied in a meaningful way to other languages
- Some manufacturers are beginning to address this issue with language specific targets
- Probe microphone measurements (PMM or REM) will remain an integral component of the fitting process.
- The patient’s/client’s preferences for the quality and intelligibility of their native language will hold paramount importance to the success of the fitting.
Considerations for Speech Audiometry

- Standard word lists have been developed for speech audiometry
- The use of recorded lists represents the *Best Practice* approach
  - Monitored live voice is an alternative only if it is not possible to use recorded materials
- Performed with headphones on/in
- Speech signal must be calibrated prior to performing speech audiometry.
  - The VU meter is set to “0 dB” while a calibration tone is presented.
  - This ensures that you are presenting your speech at the level you intend.
    - If your attenuator is set to 65dB, but the calibration tone is at +7 dB, the presentation level of the recorded speech is actually 72 dB
- If the patient/client requires more time than is available on recorded word lists, simply pause the recording after each word to allow them more time to respond.
Speech Recognition Threshold (SRT)

Two purposes for measuring SRT:

1. **The SRT validates the PTA (SRT/PTA Agreement)**
   a. The SRT should be within ± 5 dB of the PTA
   i. In the case of a precipitous high freq. Loss, the SRT should be within ± 5 dB of the average PT AC thresholds at 500 & 1000 Hz for that ear
   ii. For an audiometric configuration that has peaks and valleys, or when there is a substantial low frequency hearing loss, the SRT can be within ± 5 dB of the best PT AC threshold in that ear
   iii. The point is there must be a reasonable (± 5 dB) agreement between the SRT and another measure derived from the PT AC audiogram

2. **The SRT is relevant in its use for quantifying the degree of hearing loss for the speech signal**
   a. This application may be helpful for putting the audiometric results into the context of everyday listening

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**SRT** - the lowest intensity at which the patient/client can repeat 50% of the words presented.

**Spondee** - two syllable word spoken with equal emphasis on each syllable.

- Spondees are used for SRT testing

SRT’s are established separately for each ear.

**Spondee Examples:**

- Airplane - Armchair - Backbone - Baseball - Blackboard
SRT Procedure

1. Set the audiometer as follows:
   a. Select the appropriate test
   b. Select the appropriate transducer (Headphones/Insert earphones)
   c. Select the recorded source and calibrate the speech list using the VU meter and the recorded calibration tone.

2. Familiarize the patient/client with the list of spondee words
   a. Using the audiometers talk-over system at a comfortable listening level for the member, instruct them as follows: “I want you to be familiar with the words used for this test. Let’s practice. Please repeat each word I say.” Present a few spondees without changing intensity to familiarize them with the target words.
   b. Costco has a printed list of words available on the intranet that we would like you to show the member. Each booth in your location should have the lists printed and laminated.

3. Re-instruct the member “Now you will hear words in your right/left ear. Repeat each word you hear. The words will get softer and softer until they are very difficult to hear. If you are not certain of a word, take a guess. Do you have any questions?”

4. Establish the SRT as follows:
   a. Present one spondee at 40 dB HL. If there is no response, increase the presentation level in 20 dB steps until a spondee is repeated correctly.
   b. Decrease the presentation intensity in 10 dB steps until there is no response (descending technique)
   c. Increase spondee presentation intensity in 5 dB steps until there is a correct response (ascending technique)
   d. Continue the descending/ascending technique until 50% of the responses are correct at the same presentation intensity.
SRT Procedure

5. Document the SRT on the audiogram in dB HL

6. Repeat procedure on the other ear.

SRT Procedure

- 40 dB HL - hotdog (correct)
- 30 dB HL - airplane (correct)
- 20 dB HL - sailboat (incorrect)
- 25 dB HL - hothouse (correct)
- 15 dB HL - railroad (incorrect)
- 20 dB HL - bathtub (incorrect)
- 25 dB HL - birthday (correct)
- 15 dB HL - sunshine (incorrect)
- 20 dB HL - grandson (incorrect)
- 25 dB HL - greyhound (correct)
SRT Procedure – Alternative Method

- Presentation level begins 10-15 dB above the PTA of the test ear.
- Use spondee words
- Use the bracketing method
  - 6 words per series
  - Decrease stimuli in 5 dB increments
  - Record the lowest level that can be understood 50% of the time.

<table>
<thead>
<tr>
<th>PL</th>
<th>1st Word</th>
<th>2nd Word</th>
<th>3rd Word</th>
<th>4th Word</th>
<th>5th Word</th>
<th>6th Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 dB</td>
<td>baseball</td>
<td>hotdog</td>
<td>airplane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 dB</td>
<td>sailboat</td>
<td>hothouse</td>
<td>railroad</td>
<td>bathtub</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 dB</td>
<td>birthday</td>
<td>sunshine</td>
<td>grandson</td>
<td>greyhound</td>
<td>oatmeal</td>
<td></td>
</tr>
<tr>
<td>20 dB</td>
<td>stairway</td>
<td>padlock</td>
<td>headlight</td>
<td>doormat</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Because 50% of the words could not be obtained at 20 dB HL there is no reason to decrease to 15 dB HL. At 25 dB HL 50% of the words were repeated correctly. The lowest level that 50% of the words could be repeated correctly was 25 dB HL. The SRT is 25 dB HL.
SRT/PTA Agreement

- The SRT should agree with the pure tone average (PTA) ±5 dB
  - **Exception:** In steeply sloped high frequency losses, the SRT will be better than the PTA
  - In this case, add the thresholds at 500 Hz and 1000 Hz, then divide by 2
- If the SRT and PTA are not in agreement you should re-instruct the member on all testing that has already been obtained and retest.
  - It is more efficient to either begin with the SRT and then do pure tone AC testing or do pure tone AC testing first and then SRT.

Speech Awareness Threshold (SAT)

**SAT** - the lowest intensity level at which the patient/client can detect the presence of speech.

- Can be used as an alternative to the SRT when that measurement cannot be obtained due to limited language proficiency or barriers to the patient’s/client’s own speech being clearly understood.
- When recording SAT/SDT - it must be **clearly identified** as such on the audiogram.

Will agree with 250 & 500 Hz.

Live voice, nonsense syllables (recorded has a pattern of when the word will present)

- "Uh-oh"
- "Bop-bop-bop"
Most Comfortable Level or Loudness (MCL)

MCL - intensity level at which speech is perceived to be most comfortable

- Provides an intensity reference for preferred listening and is applied to word recognition testing.
- Is an important and consideration for the hearing aid fitting
- Each is is considered separately
- MCL is established using continuous speech - Stimulus = Cold Running Speech (Rainbow Passage)
  - An informative but non-emotional series of sentences recorded at a constant level.
- People with normal hearing typically have MCL’s of 20 to 40 dB above SRT

MCL Determination Procedure

1. Set the audiometer as follows:
   a. Select the appropriate test
   b. Select the transducer type
   c. Select the cold running speech and calibrate using the VU meter
   d. Ensure that the indicator on the VU meter fluctuates around 0 dB as close as possible
   e. Set the attenuator at SRT plus 20 dB and instruct the member as follows: “We are going to measure your most comfortable listening level. As I speak I’ll slowly increase the loudness of the voice, so that you can listen at different levels. Point your finger up if you want it louder and down when you want it softer. Please tell me when we reach the loudness level you prefer. Do you have any questions?

2. Record the MCL on the audiogram in dB HL
3. Repeat procedure on the other ear
Word Recognition Testing (WRS)

The score in each ear on WR testing has *predictive* value relative to the potential success that amplification may provide to a member.

- They’re expectation may be that hearing aids will make them hear perfectly again...
- The member’s WR score can be used to set reasonable expectations for benefit from hearing aids.

**WRS** - the percent correct score on a word repetition task where *the presentation intensity remains constant.*

- Standardized Lists - For example: NU-6 and W-22
- One Syllable phonetically balanced words - contain all of the phonemic elements of general American English
- Words are often referred to as "PB Words" **PB** - Phonetically Balanced
- A WRS is always established for each ear - and sometimes binaurally or dichotically

On recorded lists the PB word is always preceded by a carrier phrase that prepares the member for the target word.

- “Say the word,” “You will say”
- The VU meter is centered at zero for the carrier phrase, not the PB word.

**Sample PB words:**
- Carve
- Yard
- Ball
- Self
- Laud

*The member is not being tested on their vocabulary, only the ability to recognize and repeat back a PB word.*
WRS Test Procedure

1. Set the audiometer as follows:
   a. Select the appropriate test
   b. Select the transducer
   c. Select the recorded source and calibrate the speech list using the VU meter

2. Using the audiometers talk over system, instruct the member as follows:
   “You will hear the recording of a man’s voice. Repeat only the word he tells you to say, not the entire phrase. If you are not sure, please make your best guess. You will hear the words in your right/left ear. Do you have any questions?”

3. Set the attenuator at the member’s MCL + 10 dB.

4. Present 25(50) PB words. Tally the correct responses. Any response other than the word presented is an error and is marked wrong.

5. Calculate the WRS.
   - For a 25 word list each response is worth 4%.
   - For a 50 word list each response is worth 2%.

6. Document the WRS on the audiogram as a percentage.

7. Repeat on other ear and then both as needed.
Speech UCL

- Just like PT UCL
  - Ascending method
- Use cold running speech

References

