

# Speech Audiometry

## Dynamics of speech

- Intensity
  - whisper - 20 dB HL
  - Normal conversational speech - 50 to 60 dB
  - Loud speech - 70 dB
  - Shouting - 90 dB

## Purpose of Speech Audiometry

- To verify pure-tone thresholds.
- To determine the extent of speech recognition difficulty.
- To aid in diagnosis of retro-cochlear problems.
- Assists in the selection of amplification systems.
- Helps clinician educate patients about loss and make a prognosis about treatment outcomes.

## Contribution of speech evaluation to differential diagnosis

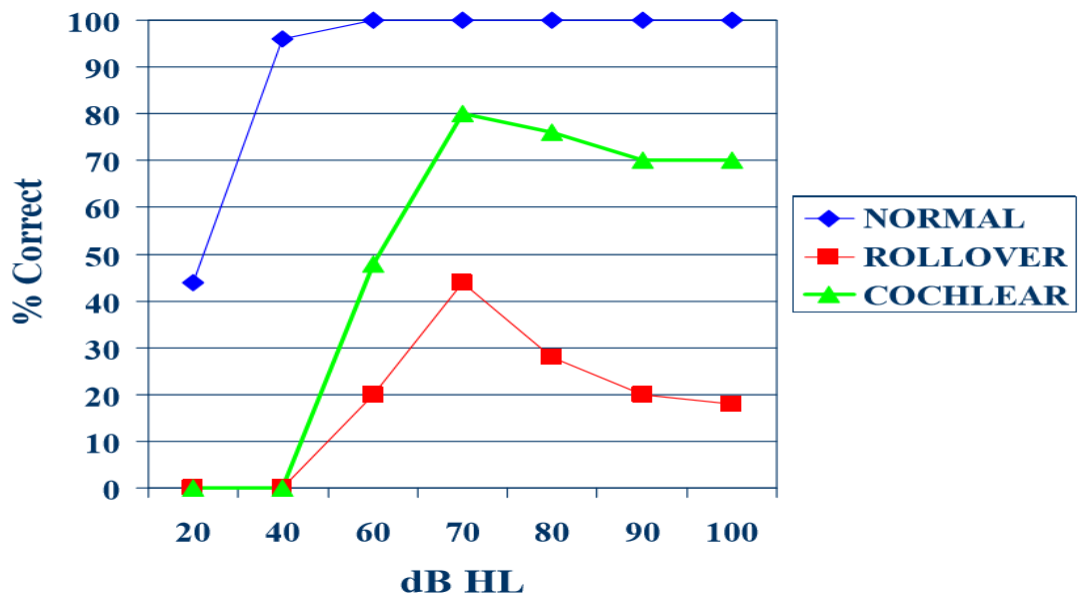
- Rollover effect: Reduction in speech recognition (more than 20% from maximum performance) with increases in intensity.
  - Occurs with retrocochlear pathological conditions

## Performance Intensity Functions

- Curve reaches a peak ( $P_{bmax}$ ), and then – Either remains high (normal), or – Drops at higher levels (Rollover)
- Rollover Index =  $(P_{bmax} - P_{bmin})/P_{bmax}$

## Rollover Indices for the preceding examples

- Normal:  $(100 - 100) / 100 = 0.0$
- Rollover:  $(44 - 20) / 44 = 0.54$
- Cochlear:  $(80 - 70)/80 = 0.125$
- Rollover Indices of 0.45 or greater indicate a neural (VIIIth nerve) problem.



## Presentation of Speech Tests

- Monaural (one ear at a time, usual method).
- Binaural (both ears simultaneously).
- Can be presented with earphones.
- Can be presented via bone conduction. ☐ Can be presented in the sound field using speakers
- Monitored live-voice (MLV) you say the list of words
- Pre-recorded lists on CD or cassette.
- Lists of words that patient repeats.
- Standardized picture tests that require the patient to point to a picture that matches the spoken word
- Standardized speech-in-noise tests.

## Test environment

- Normally sound treated booth - mandatory for MLV.
  - Pt should not see the examiner's face to avoid lip reading cues.
- Recommend CDs whenever possible.

## Live Voice Testing

- Controlled Vocal Effort.
- Adjust microphone sensitivity – To have the speech balanced at 0 dB on VU meter.



## Patient's and clinician's role

- Patient must understand type of speech stimuli (Open set or closed set).
- Clinician must make sure that stimuli is presented properly

## Level of auditory ability assessed

- **Awareness**: tests that require the patients to simply indicate that a sounds was detected.
- **Discrimination**: tests that require the patient to detect a change in the acoustic stimulus.
- **Identification/recognition**: tests that require the patient to attach a label to the stimulus either by pointing to a corresponding picture or object or repeating the stimulus orally:
  - Speech recognition threshold (SRT)
  - Word recognition scores or sentence recognition scores.

## Most Frequent Speech Data Obtained

- **Speech Recognition Thresholds (SRT)**

- Uses spondee words: toothbrush, hotdog etc.
- Level of presentation is gradually decreased until patient is guessing words presented.

- **Speech Recognition Scores (SRS)**

- Uses monosyllabic words, phonetically balanced.
- Presented at a fixed level above the SRT. 40 dB
- Score is recorded as percent correct out of 25-50 words presented
- Also known as word recognition score (WRS)

## Speech Threshold Testing

- **Speech-Detection Threshold (SDT) or Speech Awareness Threshold (SAT)**

- Lowest dB HL level that speech can be detected.
- Patient indicates when speech is audible.
- Used when patient cannot repeat words.
- SDT is lower than SRT

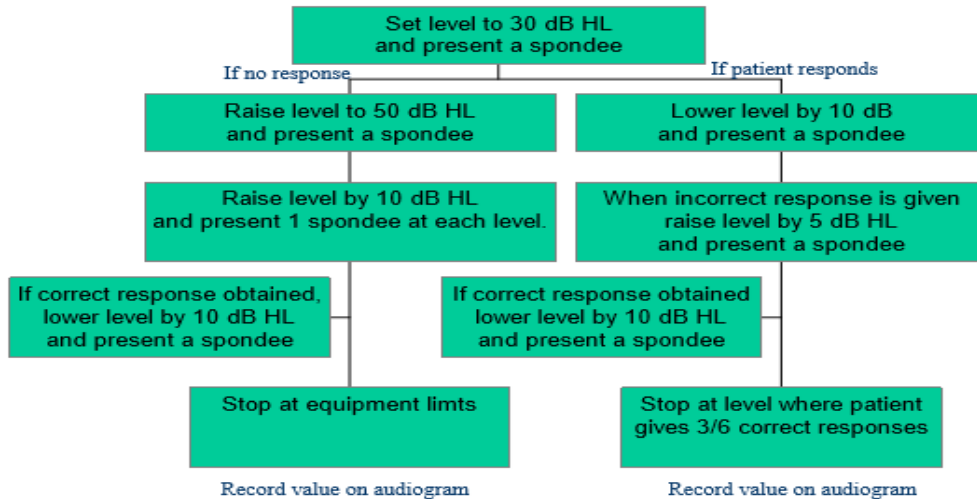
- **Speech Recognition Threshold (SRT)**

- Lowest dB HL level that speech is understood.
- Patient repeats words or points to pictures.



## Method for Obtaining SRTs

Martin and Dowdy Method for Obtaining SRT (1986)



## SRT relation to pure tone audiogram

- SRTs can be predicted by finding the average of 500, 1000, and 2000 Hz (Pure tone average, PTA).
  - In some cases, SRT may be higher (worse) than the three frequency PTA.
    - Age, or disorders of the CANS.
  - In other cases, the SRT may be much lower (better) than the PTA.
    - When the audiogram falls precipitously in the high frequencies.



## Exception for steeply-sloped high frequency losses

- SRT will be better than PTA
- In this case use Fletcher average:  $500 \text{ Hz} + 1000 \text{ Hz} / 2$ .

## Speech recognition scores testing

- Speech recognition scores (SRS) or word recognition scores (WRS).
  - Quantifies pt's ability to discriminate speech:
    - It determines the extent of speech-recognition difficulty.
    - It aids in diagnosis of the site of the disorder in the auditory system.
    - It assists in the determination of the need for and proper selection of amplification systems.
    - It helps the clinician to make a prognosis for the outcome of the treatment efforts.

## Word Recognition Testing

- Open set : pt can respond with any word he/she can think of.
- Closed set: response options are provided for the pt (multiple choice test).
- Free response-client is free to respond or not.
- Forced Response-client must say something.
  - [Forced choice = closed set forced response.]

## Method for Obtaining SRS

- Decide method of delivery (MLV, recorded).
- Choose materials to be used (word lists etc).
- Inform patient with regards to method of response.
- Select intensity.
- Decide if multiple levels should be tested.
- Decide if test will be presented with noise in the background.

## SRT and Hearing Aid Fitting

- Find most comfortable loudness level (MCL) and uncomfortable loudness level (UCL).
  - NHLs find speech most comfortable at 40-55 dB above threshold.
- Patient hears running speech and is asked to indicate where speech level is comfortable or uncomfortable.
- Pt is instructed to indicate when speech is perceived to be at comfortable level.
  - "I am going to continue talking to you as I make my voice louder and softer. I will keep asking you to tell me whether my voice is too soft, too loud or comfortably loud."
- $UCL - SRT = \text{dynamic range for speech}$ .

## Interpretation of SRT results

Compare between SRT and PTA if the results:

1. Different within  $\pm 6$  dB we say there was good agreement between the SRT and PTA results
2. Different between 7-12 dB we say there was fair agreement between the SRT and PTA results
3. Different 13 dB or more we say there was poor agreement between the SRT and PTA results

## Interpretation of WRS results

1. 86 % - 100 % Normal
2. 75 % - 85 % Slight difficulty in speech perception
3. 60 % - 74 % Moderate difficulty in speech perception
4. 50 % - 59 % Poor speech recognition
5. < 50 % very poor speech recognition