Speech Audiometry (1)
Introduction

- Using Pure tone audiometry in assessment of hearing loss is just giving a general view and not showing the real impact of hearing loss in person’s communication

- As difficulties regarding hear and understand speech are the main complains of hearing impaired people, speech stimuli need to be used to test hearing function
What is speech audiometry?

- It is the procedure that uses speech stimuli to assess auditory function

- **Plomps (1978)** - framework for hearing loss:
  - Audibility component (loss of sensitivity)
  - Quantified by assessment of speech thresholds
Distortion component (loss of clarity),

- speech understanding is reduced in background noise regardless of presentation level

- Quantified by parentage of correct recognition at supra-threshold level (speech recognition scores)
How test would be performed?

- **In the past**, separate speech audiometers were used.

- **Nowadays**, Diagnostic audiometers used with both speech and pure tone circuits incorporated.
Diagnostic audiometers

- It’s either accompanied by or have supplementary input to test with microphone, CDs or other video films

- A volume units (VU) meter to monitor the intensity reaching the patient

- It also contains circuit for introducing masking noise to the non-tested ear or mixing it in the same ear
• Test could be administered **monaurally** or **binaurally**

• Speech stimuli can also be directed to one or more loudspeakers for sound field testing

• Hearing level controls have a range of 120 dB HL ( -10 to 110 dB HL)

• A talk back system is available for communication
Test environment

- Patient should be isolated from the examiner in Monitored live voice (MLV) testing, either in one room or two rooms setting, to make sure that the patient receiving the stimulus via the audiometer and not the room air.

- If pre-recorded material is used, one room set up is quiet possible.
• Using pre-recorded material has an advantage over the monitored live voice

  ➢ Provide consistency of presentation

• Most audiologists prefer MLV

  ➢ It offers more flexibility
  ➢ It can be performed faster
Response strategy

• Testing words should be fairly understood to the tested patient

• Responses obtained by:

✓ Oral replay
✓ Written replay
✓ Picture or object identification
Oral replay (spoken responses)

• **Advantages:**

- Fast scoring of the responses
- Empathy maintained between the patient and examiner
• **Disadvantages:**

- Possible misunderstanding of patient responses, as some with speech and/or language problems

- Discrepancies among responses scoring, as it is subjective scoring

- For unclear reasons, talkback system in many audiometers are usually of poor quality, make the response interpretation inaccurate
Written replay (responses)

- **Advantages**
  
  ✓ Eliminates the complexities in response scoring due to patient speech difficulty
  ✓ Provides permanent record of type of errors made by patient
• Disadvantages

- Scoring done upon test completion so it requires patient writing, this might slow down the test and waste needed time
- Spelling mistakes might add a problem
Picture or object pointing

- Used with small children
- Used with adults with special needs
False responses

- **False positive responses**
  - Theoretically impossible to happen
  - It might happen if the examiner
    a) Careless
    b) Allows some visual cues which permit lip reading

- **False negative responses**
  - Usually occur
Clinician's role

• The audiologist should clearly convey to the patient what they should do during the test time

• A combination of written and verbal instructions is successful for adults and older children
• Hearing aids or other amplification tools should be in their place during the instruction time

• Observing examiner face by the patient should be prohibited during the test time, especially if MLV is used
The desirable test room setting for speech audiometry
Purposes for doing speech audiometry

- Measurement of speech thresholds (Awareness/Detection, Reception/Recognition)
- Correlation with pure tone audiometry
- To contribute towards differential diagnosis
• To quantify supra-threshold speech recognition ability

• Estimate communicative function

• Hearing aid fitting

• To determine need for aural rehabilitation and progress in management process
Speech threshold testing

- Speech thresholds are of 2 types:
  1) Speech Detection Threshold (SDT)
  2) Speech Recognition Threshold (SRT)
Speech detection threshold

- **Definition**
The lowest intensity level, in decibels, at which subject can barely detect the presence of speech and identify it as a speech.

- It’s also known as speech awareness threshold (SAT).

- It doesn’t indicate that the speech comprehended, it implies that the present of speech is just detected.
Procedure

- Presenting continuous discourse via any of transducers
- The speech level raised and lowered
- The patient should indicate whenever s/he barely detect the speech and recognize it as a speech
- Sentences are preferable on words or phrases
• The speech stimulus should be presented rapidly and monotonously

• The testing materials should not be interested (cold running speech)

• Starting with left or right ear is a subjective decision
• SDT can be tested binaurally (earphone), through sound fields speakers (with or without hearing aids)

• Patients could respond verbally, hand or finger signals or pressing button
Speech Recognition Threshold

✓ Previously it is known as Speech reception threshold

✓ As the person usually recognize and not receive, the term speech recognition threshold is preferable and recommended on speech reception threshold
Test materials

- SRT tests are obtained using spondaic words (often known as spondees)

- **Spondee** is a two-syllables word pronounced with equal stress on each syllable

- **Examples**: baseball, hotdog, toothbrush.. Etc
• No matter by which mode they are presented (MLV through mic, CD, imbedded audio film within the audimeter’s software), both syllables of each word should be peaked at zero VU.

• Pre-recorded test material is recommended rather than using MLV when the examiner has different accent from patients being tested

➢ Calibration first should be done carefully for pre-recorded materials
• Some audiologists recommended to use carrier phrase before the test material like (say the word....)

- Yet, no true advantage from using carrier phrase has been proved
SRT using cold running discourse

- **Instructions**
  
  - Patient instructed to indicate whenever the presented speech is so soft and they can barely follow 50% of what has been said

- **Responding methods**
  
  - Verbal or hand signal
- **Procedure**

  - Speech level should be raised and lowered usually in 5 dB steps
SRT using spondaic words

• **Definition**
  - SRT is usually defined as the lowest intensity at which person can perceive 50% of a list of spondaic words correctly

• **Why spondees have been selected for SRT testing?**
  1) Relatively easy to discriminate
  2) Usually guessed with high level of accuracy
Martine and Dowdy have recommended a procedure for SRT testing that enhance the use of SRT as independent measurement of hearing and check the reliability of pure tone thresholds.

The method should be accomplished without knowing the pure tone thresholds with which it compared.
Recommended procedure

- Start at 30 dB HL, present 1 spondee. If the patient respond correctly, this is above his/her SRT

- If no response elicited from the patient, jump to 50 dB HL directly and present 1 spondee. If still no response, increase the level in 10 dB steps with 1 spondee at each level. Stop the test either when correct response is obtained or the maximum limit of the machine reached
• At the level correct response elicited, lower the intensity in 10 dB steps and present one spondee at each level.

• When incorrect response obtained, increase the level in 5 dB steps and present one spondee each time until the correct response reappear.

• Decrease the level at 10 dB steps with one spondee until incorrect responding seen, increase the intensity in 5 dB steps ..
• From this point, at which the level decrease in 10 dB and increase in 5 dB with one spondee at each level, find the level at which 3 words have been repeated correctly and this considered as SRT

• Threshold defined as the lowest level at which at least 50% of the responses are correct, with a minimum of at least 3 correct responses at that intensity
Some tips

• ASHA (1988) has recommended the patient familiarity with the test material before the testing time

  They stated that the words should be presented to the patient in advance and vague words should be eliminated

  However, ASHA recommended procedure has never had full acceptance due to some limitations
To ensure the patient familiarity with the test words, it is advisable to give the patient the list of testing words prior to the testing session together with the complete test instruction in a printed form.
Instructions (example)

✓ The purpose of this test is to find out the faintest level at which you can hear and repeat some words.
✓ Each word with two syllables like baseball or hot dog.. Etc. Each time you hear the word, repeat it
✓ Repeat the words even if they are very soft
✓ You might guess the word if needed.
✓ Any questions?
Recording SRT results

• After SRTs for each ear has been accomplished, test results should be recorded within the appropriate space on the audiometric worksheet
Samples for audiograms with speech tests results
Relationship between SRT and SDT

- SRT is always higher than SDT. I.e. it requires greater intensity to be elicited

- The difference usually does not exceed 12 dB

- This may change with the audiogram shape
Relationship between SRT and PTA

• SRT could be predicted by finding the average of the lowest 2 thresholds at 500 Hz, 1000 Hz and 2000 Hz

• Carhart and Porter (1971) found that SRT can be predicted from averaging the pure tone thresholds at 500 and 1000 Hz and subtracting 2 dB
• **In some cases**, SRT may be lower (better) than PTA like when the audiogram falls perceptually at high frequencies.

• **In other cases**, SRT poorer than PTA in some elderly patients with Central auditory nervous system disorders.

• There is a significant disagreement between SRT and PTA in patients with functional hearing loss.
Usefulness of SRT testing

• How valuable the SRT is??, it’s questionable as a diagnostic tool

• Its true value appears in 2 areas;

1. Comparison of PTA and SRT results determine the accuracy of both tests
2. SRT used in patient’s counseling regarding the degree of hearing loss
Bone Conduction SRT

- On most recent clinical audiometers speech tests can be conducted via the bone vibrator.

- BC SRTs are useful

  - Especially in testing children who are tested play audiometry with words but not tone.
Comparison between child SRT for bone conduction and by air conduction provides useful information about conductive components child has due to the high correlation between PTA by BC at 500, 1000 and 2000 Hz and the BC SRT.

It also helps in separating auditory from tactile responses by bone conduction.
Drawbacks for Bone conducted SRT

• The bone conduction testing can’t provide ear specific information (common bone)

• Unless proper masking added to NTE

• Masking placement is not possible for some people

• This justify the uselessness of BC SRT