Speech Reception Threshold Testing in Iraqi-Speaking Adults

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Abstract

Objective: to contribute in the development of speech audiometry (speech reception threshold test) in Iraqi Arabic-speaking adults.

Methods: The study population included seventy normal persons aged 40-65 years (40 males and 30 females), they randomly recruited from the department of otolaryngology/ENT-clinic in Al-Sader Medical City in Al-Najaf Al-Ashraf government through a period which extends from December 2019 to May 2020 that divided into two equal groups. In both groups calculate pure tone average (PTA) and determine speech reception thresholds SRT monaurally by using bisyllable Ratcliff's words in first group and Arabic spondee words used in Zagazig University Hospitals in Egypt for second group through monitored live voice (MLV) speech test.

Results: revealed that there is a strong correlation between PTA and SRT in both groups within acceptable level (±12 dB), also there are no significant differences between SRT_1 of first group with SRT_2 of second group.

Conclusion: this study suggests that these two spondee word lists can be used in Iraqi Arabic- speaking adults to determine SRT.

Keywords: *Iraqi Arabic speech audiometry, SRT, PTA*

Introduction

Pure-tone testing is not enough to evaluate hearing of patients because we does not communicate through simple tones, but through complex speech which can be tested by speech audiometry to evaluate an person's ability to distinguish speech [1]. The use of speech test is necessary for many factors: speech stimulation are regarded as the basis of the hearing stimulus that happen in life daily, the perception of talk is necessary for combination into community and the words used in the examination are commonly simple and well-known, for that reasons speech audiometry has a great level of validity [2]. Speech reception threshold (SRT) is an essential component of speech audiometry. In 1988, the American Speech-Language Hearing Association (ASHA) named SRT as "the minimum hearing level for speech at which an individual can recognize 50% of the speech material"(3). Measurement of the SRT is used to determine speech threshold and to validate the outcome of PTA testing. It also gives as a reference level for further test of speech as word recognition score [4,5]. Also, because SRT is not time expenditure so it is helpful clinically and useful to evaluate the sensitivity for conversational messages [5, 6]. The SRT is an assessment of the degree at which the person can rerun after disyllable words (e.g., eardrum and woodwork) 50% of the time; it is mostly written in dB HL.

Spondee, or spondaic words (disyllable words), are words that have two-syllable identical in stress. These words are uniform, simple, common and familiar [3]. Uniformity of test words with regard to intelligibility is urgent due to it rises the certainty of the formation of

the speech threshold. It also admits the employment of lesser items of test, which reduce period of the test and hearer tiredness [7]. Familiarity of examination words is necessary due to it support that the test is valid [8].The words should be as common, easy and well-known as probable to confirm the speech test evaluate SRT instead the information of vocabulary. The words should have phonetic dissimilarity, which does not admit for alike or poetry words, provides the removal of hearing discrimination [2]. The patient is educated to repeat the words (spondee) they hear, even if the words are very faint. The words are then presented to the person at a comfortably loud level in order to familiarize the listener with approximately 8 to 10 test word items that will be used for the test.

Determination of SRT

There are different procedures by using to measure SRT.

1) ***ASHA method***: a descending threshold search (3):

a- Initial beginning level: Introduce one disyllable word at 30 to 40 dB HL over the expected speech threshold. If an exact answer is accepted, decrease the intensity by

10-dB steps till an inaccurate answer happen. Once an inaccurate answer is confirmed, introduce a second disyllable word at the same level of intensity. If the second word is said again accurately, decline by 10-dB steps till two words are lost at the same intensity . Once you arrive at the level where two disyllable words are lost, raise the intensity by 10 dB.

b- Threshold evaluation: by using 2-dB or 5-dB steps size.

2-dB step size: introduce two disyllable words at the beginning level. Decline the level by 2 dB and introduce two disyllable words. A person should obtain the first five out of six words accurate or otherwise level want to be elevated near 4-10 dB. If at least five of the first six words are accurate, persist decreasing the intensity by 2 dB till the person loss five of six presentations.

5-dB step size: introduce five disyllable words at the beginning level of intensity. The person should receive the first five disyllable words accurate at the beginning. Decline the intensity by 5 dB and introduce five disyllable words. Persist decreasing

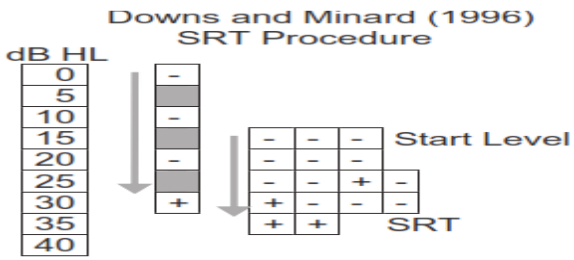
by 5 dB down to the person loss complete five disyllable words at the same intensity.

Evaluation of speech threshold is located on the Spearman–Kärber equation. An SRT is determined by subtracting the number of words said again accurately from the beginning level of intensity and increase a correction factor of 1 dB or 2dB according to which step size used either the 2-dB or the 5-dB steps size respectively. For example of a 5-dB Step, with a beginning intensity at 35 dB, the person obtain all five disyllable words; at 30dB, two of the words were accurate; and at 25 dB, none were accurate. Seven of the 15 disyllable words were accurate. Therefore, the evaluation of SRT would be 35 − 7= 28,+ 2 for the correction factor, equivalent to 30 dB HL [9].

2) ***The Downs and Minard (1996) method*** ,ascending threshold, for obtaining an SRT is a relatively fast and easy to perform with same results. (Figure 1)

a- Initial beginning or starting level begin by presenting one spondee at the lowest audiometer setting or at least 30 dB below the estimated or known PTA; continue presenting one spondee in 10 dB ascending steps until the patient repeats one spondee correctly. Decrease the level by 15 dB (starting level) .

b- Threshold evaluation: at the starting level and at each 5 dB HL ascending step, present blocks of either two, three, or four spondees as needed until patient repeats two spondees. This level is the patient's SRT [10].



Figure(1): Illustration of how speech recognition

estimated [10].

Subjects and methods:

This study was carried out at Al-Sader Medical City in Al-Najaf Al-Ashraf government through a period which extends from December 2019 to May 2020.

It included seventy normal persons aged 40-65 years (40 males and 30 females) divided into two equal groups. After determining hearing thresholds in quiet room through calculating pure tone average (PTA) from air conduction thresholds at 0.5, 1 and 2 KHz by pure-tone audiometer, determine speech thresholds SRT monaurally through speech audiometer (Path medical GmbH Germany) by using bisyllable Ratcliff's words in first group and Arabic spondee words used in Zagazig University Hospitals in Egypt for second group through monitored live voice (MLV) with the microphone at a distance of about 15cm distance from the tester's lips which are covered by paper or mask to avoid lip-reading. The typical VU meter has a range that goes from –20 dB to +10 dB relative to the calibration point at 0 dB. The Downs and Minard (1996) method used to determine SRT. Ratcliff (2006) develop a familiar and uniform subset of 23 disyllabic Arabic words which are used to evaluate the speech threshold of persons whose home language is Arabic (Palestinian/Jordanian dialect) [11].

Results

1- Correlation between PTA and SRT:

There is a strong correlation between conventional three frequency average (0.5,1 and 2 KHz) PTA and SRT in right and left ears for both groups.

2- Correlation between SRT1 and SRT2:

there are no significant differences between SRT1 of first group with SRT2 of second group. Table (1,2)

Table (1) T-test: Paired Samples Correlations between, PTA/SRT and SRT1/SRT2 in right and left ears of two groups

		N	Correlation	Sig.
Pair 1	PTA1Rt & SRT1Rt	35	.932	.000
Pair 2	PTA1Lt & SRT1Lt	35	.940	.000
Pair 3	PTA2Rt & SRT2Rt	35	.950	.000
Pair 4	PTA2Lt & SRT2Lt	35	.970	.000
Pair 5	SRT1Rt & SRT2Rt	35	-.243	.159
Pair 6	SRT1Lt & SRT2Lt	35	-.221	.201

Table (2) Paired Samples T- test: paired differences between, PTA/SRT and SRT1/SRT2 in both ears for two groups

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% CI of the Difference				
					Lower	Upper			
Pair 1	PTA1Rt - SRT1Rt	-8.68571	1.98185	.33499	-9.36650	-8.00492	-25.928	34	.000
Pair 2	PTA1Lt - SRT1Lt	-8.45714	1.89958	.32109	-9.10967	-7.80461	-26.339	34	.000
Pair 3	PTA2Rt - SRT2Rt	-8.82857	2.06491	.34903	-9.53789	-8.11925	-25.294	34	.000
Pair 4	PTA2Lt - SRT2Lt	-8.00000	1.68034	.28403	-8.57722	-7.42278	-28.166	34	.000
Pair 5	SRT1Rt - SRT2Rt	.14286	8.95132	1.51305	-2.93203	3.21774	.094	34	.925
Pair 6	SRT1Lt - SRT2Lt	.00000	8.91133	1.50629	-3.06115	3.06115	.000	34	1.000

Discussion

The purpose of this study is to contribute in development of SRT test in Iraqi-Arabic dialect for adults by measuring the correlation between PTA and SRT and by comparing the SRTs of two groups that are measured by two different bisyllabic words lists i.e. the first group use Ratcliff's words while second group use Zagazig words.

Arabic is the native language for about 300 million speakers while the total number of Arabic speaking more than 450 million. Hearing impairment is more prevalent in developing countries is twice as much as in developed countries [12] while services and technology are still very limited [13].

The Arabic language is diglossia i.e. two levels of the dialects are the spoken dialects (Colloquial Arabic) and the formal dialects (Literary or Standard Arabic). The former one, home Arabic, that is used by peoples in their life communication with each other [14]. This form of the language differ according to country and even from region to region inside any country [15]. The difference in dialects between Arab countries is one of the factors that limit the distribution of speech materials [16].

There is a strong correlation between conventional three frequency average (0.5,1 and 2 KHz) PTA and SRT .This results agree with Jeong Min Kim et al 2016 which conclude the best-matched pairs was found between 3FA (0.5,1 and 2 KHz) and weighted 3FA doubling 1 kHz threshold PTA and SRT [17]. In addition to that the speech threshold is found within 10 dB HL of the PTA which agree with acceptable levels of PTA/SRT values (9,10,18). The difference between the SRT and PTA is considered good if within ±6 dB, fair if between ±7-12 dB (19,20). While there are no significant differences between SRT1 of the first group that used Ratcliff's spondee words list and SRT2 of second group that used Zagazig spondee words list.

This study conclude that these two spondee word lists can be used in Iraqi Arabic- speaking adults to determine SRT.

Recommendations: 1-In Iraq, SRT test must be used in audiological examination in addition to PTA test.

2- Test the SRT in noise.

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Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the Faculty of Medicine and all experiments were carried out in accordance with approved guidelines.

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