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Development of Dichotic Word Test in Tamil Speaking Children

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Abstract

Objective

The present study was aimed to developing dichotic word test in Tamil speaking children and also to generate the normative data. The word list consists of two different sets of lists, each list containing 25 pairs of monosyllabic words. These word pairs have equal duration and aligned in such a way that both words were presented simultaneously in both ears.

Method

The Data were administered from 100 children between the age ranges of 7-12 years. Each group consists of 20 participants with 10 males and 10 females.

Analysis

Responses were scored in terms of single correct scores (right correct score and left correct score) and double correct scores.

Results

The results revealed that there was an improvement in the single and double correct scores for both Lists I and List II with an increase in age. The mean scores for right correct score and left correct score for both the lists, right ear scores were greater, compared to left ear scores and double correct scores. This indicates the Right Ear Advantage (REA). However, there was no significant difference between list and gender.

Conclusion

The developed dichotic word test in Tamil can be used clinically as diagnostic tool to assess the auditory processing disorder in Tamil speaking children between 7years to 12.11 years of age.

Keywords: Dichotic Word Test in Tamil Speaking Children, Dichotic, Right Ear Advantage, Double correct score, auditory processing.

Introduction

Central auditory processing is described as "what we do with what we hear" (Katz, Steeler & Henderson, 1992). Auditory processing disorders (APDs) refer to problems in the perceptual processing of auditory information at the level of central auditory nervous system as demonstrated by difficulties some aspects such as sound localization, lateralization, auditory discrimination, temporal aspects of audition, auditory pattern recognition, auditory performance in competing acoustic signal, and auditory performance in degraded acoustic signal (American Speech - Language -Hearing Association [ASHA] 2005).

CAPD is also frequently a component of the aging process (American Academy of Audiology [AAA] 2010). About two to three percent of children, with a 2:1 ratio between boys and girls (Chermak & Musiek, 1997). It is also estimated that CAPD occurs in 10 to 20% of adults (Cooper & Gates, 1991). Patients with APD frequently experience unusual difficulty hearing or understanding speech in various adverse acoustic and listening situations, such as listening to distorted or rapid speech, or hearing in noisy or reverberant environments, even though normal-hearing thresholds. One very common complaint of APD is difficulty hearing in the presence of noise (AAA, 2010).

Assessment of auditory processing was initially discovered by Kimura (1961), to evaluate the function of the central auditory nervous system includes hemispheric asymmetry and unilateral lesion effects using dichotic listening. The term "Dichotic Listening" refers to a condition in which different sounds to the right and the left ear simultaneously. Dichotic listening tests is one of the powerful behavioral test battery for assessment of hemispheric function, inter-hemispheric transfer of information, maturation of central auditory nervous system and identification of lesions of the central auditory nervous system (Keith & Anderson, 2007).

To measure dichotic listening, many speech stimuli such as digits, words, consonant-vowels and sentences are available among which digits are most exploited due to limited contextual cues and are quiet easier to administer. However, digits are easy to recognize for both normal hearing and hearing-impaired listeners because, they are a closed-set task that may incline to overestimate dichotic speech recognition ability and highly familiar (Strouse & Wilson, 1999).

Developing Dichotic Word Test (DWT) is most crucial because the auditory system is undergoing maturation, thus age-specific data are required to help in making decisions about whether a child's auditory system is developing normally or otherwise and the availability of age specific normative data also facilitates clinicians to monitor a child's performance over time during maturation time (Keith, 2000) .To incorporate as part of the central auditory nervous system evaluation battery, since dichotic measures have demonstrated good sensitivity in identifying and differentiating cerebral level lesion (Roup, Wiley, & Wilson, 2006).

The test interpretation needs to consider three parameters: the right-ear score, the left-ear score, and the ear advantage, which is defined as the overall difference in performance between the two ears. In the typically developing child, Dichotic Listening Test that use linguistically loaded stimuli generally yield right ear scores that are significantly higher than left-ear scores, reflecting the left hemisphere dominance for language processing (Hynd, Obrzut, Weed & Hynd, 1979). This phenomenon is referred to as the right-ear advantage (REA) (Speaks & Niccum, 1977) but, not every individual demonstrates a REA.

It is ideal to have speech tests in all languages as the individual perception of speech is influenced by their first language/mother tongue (Singh & Black, 1966).In dichotic word test there is not specific material in Tamil language for assessing the auditory processing ability. The need of the study is to develop dichotic word test and identify the auditory processing disorder in children since it is not available. Developing Dichotic Word Test (DWT) is used to investigate the maturation of auditory nervous system and neurological basis of learning disability in children, age specific data is warranted to find development of the child's auditory system. To include the DWT as part of the CANS evaluation battery, since dichotic measures have been found to be good sensitivity in identifying and differentiating cerebral level lesion (Berlin, & McNeil 1976). Normative data from a representative population is mandatory to confirm if it is a valid and reliable measure of auditory processing ability would be a prerequisite (Musiek, Gollegly, & Ross, 1985).

Method

The present study was carried out with the aim of developing the dichotic word test and also to generate the normative data. The test was developed in Tamil language.

Phase I: Procedure for Developing Test Material

The test stimuli were prepared using monosyllable words. The words were selected from school books and were familiarized for the children within the age range of 7 years to 12 years.

Evaluation of Familiarity of Test Item

The list of 200 words were given to 15 professionals at Madras ENT Research Foundation-Institute of Speech and Hearing and the rating was done using Likert 5-point scale, with following rates: 0 – Very unfamiliar, 1- Unfamiliar, 2- Quite familiar, 3- Familiar, 4-Very familiar, and from this 100 words were extracted and constructed into two lists such as List I and List II.

Recording of Test Stimulus

The list of words was recorded using PRAAT 4.5.16 version software with a sampling rate of 44,100Hz in an acoustically treated environment. The speaker was instructed to produce each word three times clearly and naturally using a constant vocal effort without tension. Two Tamil speaking individuals had evaluated the clarity and naturalness of intonation. The digitalized word signals were edited using Pro Tools HD 12 software and the recorded stimuli were equalized to ensure that the intensity of all sounds was at the same level. The recorded stimuli were presented to 20 Tamil Speaking normal hearing individuals includes children and adults to ensure the good quality of the stimulus. The results obtained were greater than 90%. The word list consists of two different sets lists, each containing 25 pairs of monosyllabic words.

Construction of Stimulus

Dichotic word list duration was calculated for each words using PRAAT 4.5.16 version software and words with equal duration were paired together such that the onset and the offset times of the words were overlapped. The maximum difference in the duration of each word in a pair was not greater than 2ms. Two word lists each with 25 monosyllabic words were paired in the above the manner. It was ensured that each word occurred only once in the presentation of 100 words.

The words starting with the same phonemes were excluded as per the guidelines given by Roup, Wiley and Wilson (2006). The five pairs of words from list I and list II were taken as trial words or practice words and followed by twenty pair words of target taken for scoring. Inter-stimulus interval of 10 seconds is added between word pairs to function as the response time. A 30-second, 1000 Hz calibration tone was recorded at the beginning of the compact disc at a level equal to the average intensity of the words. Stimuli were played through the two different channels right and left and the stimuli were routed for the same stereo track such that one word of the pair was routed to one ear and the other word of the pair was routed to the other ear.

Phase –II Establishing Preliminary Data for Dichotic Word Test

Participants

Data were collected from 100 Tamil speaking children between the age ranges of 7-12 years. The Participants were divided into five age groups (7-7.11; 8-8.11; 9-9.11; 10-10.11; 11-11.11 years). Each group consists of 20 participants with 10 males and 10 females. The subjects were randomly selected from the school registers based on their date of birth and gender, to make sure that each age group was represented by an equal number of males and females. Parental consent was obtained according to the guidelines of bio behavioral research and the written consent was taken for all he participants.

Inclusion Criteria

All participants must have passed the Screening Checklist for Auditory Processing (SCAP) developed by Yathiraj & Mascarenhas (2003) to rule out any auditory processing deficit. The participants with normal hearing thresholds were included for this study. Bilateral normal-hearing thresholds (0-15 dB HL) at frequencies from 250 Hz to 8000 Hz for air conduction thresholds and 250Hz to 4000 Hz for bone conduction threshold**.** Speech recognition threshold should be ±12 dB (re: PTA of 0.5,1 and 2 kHz). In addition, Speech identification score of > 90% at 40 dB SL (re: SRT) in both ears**.** Bilateral type-A tympanograms and normal acoustic reflexes (ipsi and contra) in both ears, and Right-Handedness were included**.** Participants with other associated problems were excluded from the study.

Test Environment

The testing was carried out in a well-lit air-conditioned sound treated double room and noise levels maintained within permissible limits as per ANSI S3.1 - 1991.

Instruments

A calibrated two channel Cello Inventis diagnostic audiometer with TDH-39P headphones and B71 bone vibrator was used to estimate the Pure Tone Threshold, Speech Recognition Threshold (SRT), Speech Identification Score (SIS), and Uncomfortable level for speech (UCL). Calibrated Clarinet Inventis was used to rule out the middle ear pathology. The word lists were played through the audacity software, connected to the computer using audiometer.

Procedure: The test was done in two stages

Stage I – Procedure for Participants Selection

Screening Checklist for Auditory Processing developed by Yathiraj and Mascarenhas (2003) was administered to the children by the class teacher. This checklist has 12 questions related to Auditory Processing (Auditory perceptual processing, Auditory Memory). The class teacher was asked to score on a two-point rating scale (Yes/No). Participants who scored less than 50% (<6/12) were considered for the study (passed SCAP). Pure tone thresholds were obtained at octave intervals between 250 Hz to 8000 Hz for air conduction and between 250 Hz to 4000 Hz for bone conduction using modified version of Hughson and Westlake procedure (Carhart & Jerger, 1959). The Participants hearing threshold was calculated and the average was taken for 500, 1000 and 2000 Hz. Speech recognition threshold was obtained using the spondee word list in Tamil developed by Dayalan (1976). The intensity at which spondees presented was 20 dB SL (re: PTA) and the children were asked to repeat the spondees. The minimum intensity at which the children were able to repeat two out of three spondees correctly was considered as speech recognition threshold of children. Speech identification score was carried out at 40dBSL (re: SRT) using the monosyllabic words in Tamil developed by Swarnalatha (1972). The children's tasks were to correctly repeat the words presented in the live mode. Each correct response was given a score of 5%. The total correct response was calculated and termed as speech identification score. Tympanometry was carried out at 226 Hz and then acoustic reflex was done at 500, 1000, 2000 and 4000 Hz ipsilaterally and contralaterally. Tympanometry and reflexometry were carried out to rule out the middle ear pathology.

Stage II – Administration of Dichotic Word Test

The dichotic word test material was played through computer connected to the audiometer through auxiliary input. The recorded stimuli were presented at the 40 dB SL; the participants were instructed to repeat the words heard from both ears simultaneously. You may repeat words from any ear first, 'Pay attention, this won't take long'. Before the real test practice items were given to understand the test procedure. Verbal responses were taken from all the participants in the study. Tester noted down the response on the data sheet.

Calculation of Scores for Dichotic Word Tests

The participant's responses were calculated in-terms of correct responses for each ear. The right-ear score (RES), left-ear score (LES) and double correct score (DCS) were calculated for both the lists. A score of one was given to each correct pair and each correct word.

Analysis

The collected data were tabulated and statistically analyzed, using statistical package for social science (SPSS) version 16 to investigate the effect of age, ear, gender and list. Descriptive statistics includes Mean, Standard Deviation and Range for Right Correct Score (RCS), Left Correct Score (LCS) and Double Correct Score (DCS) and inferential statistics, i.e. paired sample 't' test and independent 't' test were done to extract significant difference.

Results & Discussion

The aim of the current study was to develop the dichotic word test in Tamil speaking children and also to investigate the effect of ear, list, gender and age. In the present study, data were collected from 100 Tamil speaking children between the age ranges from 7 to 12 years. Each group had twenty participants with equal number of males and females.

Ear Effect

The descriptive statistics: mean, standard deviation (SD) and range for right and left ear across the age groups for both the lists are depicted in Table 1.

Table 1 *Descriptive Statistics of Single and Double Correct Scores for Both Ears.*

Age group		Right correct score		Left correct score		Double correct Score	
		List I	List II	List I	List II	List I	List II
7-7.11 years	Mean	16.10	15.70	12.70	13.30	10.60	10.15
	SD	1.68	2.49	4.44	3.06	4.05	3.31
	Range	12-19	10-19	4-20	9-19	4-19	5-16
8-8.11 years	Mean	16.60	17.00	13.85	13.40	11.25	10.85
	SD	1.73	1.95	3.86	3.23	3.67	3.60
	Range	13-19	13-20	4-19	5-18	4-17	3-17
9-9.11 years	Mean	16.70	16.50	14.80	15.10	12.35	12.45
	SD	2.58	1.85	2.82	2.51	3.25	3.27
	Range	9-20	13-19	8-19	8-19	6-18	5-17
10-10.11 years	Mean	17.80	17.75	16.70	16.70	14.85	14.90
	SD	1.64	1.41	2.64	2.36	2.98	3.21
	Range	15-20	14-20	10-20	11-20	6-20	7-18
11-11.11 years	Mean	18.35	18.75	17.40	16.90	15.85	15.70
	SD	1.09	0.91	2.01	1.71	1.69	1.81
	Range	17-20	17-20	12-20	13-19	12-18	12-19

It is inferred from table 1 that the mean scores of right ear is greater than the left ear scores in list I and list II irrespective of the age groups. The mean scores of right and left ear differences were decreased as age increases.

Comparison between the Ears

The paired 't' test was done to evaluate the significant difference between the ears on RCS and LCS. The t- value, degrees of freedom and its significance between the two ears across all age groups is depicted in the table 2

Table 2 *The 'T' Value and Significance 'P' Value of Paired 'T' Test between the Ears*

Age group	Pairs	t-value	Df	Sig(2 tailed)
7-7.11 years	RCSI-LCSI	3.633	19	0.002**
	RCSII-LCSII	3.015	19	0.007**
8-8.11 years	RCSI-LCSI	2.858	19	0.010**
	RCSII-LCSII	4.766	19	0.000**
9-9.11 years	RCSI-LCSI	2.111	19	0.048**
	RCSII-LCSII	2.593	*19*	0.018**
10-10.11years	RCSI-LCSII	1.696	*19*	0.106
	RCSII-LCSII	2.622	*19*	0.017**
11-11.11 years	RCSI-LCSI	1.571	*19*	0.133
	RCSII-LCSII	4.069	*19*	0.001**

Note. RCSI – Right Correct Score for List I; RCSII - Right Correct Score for List II; LCSI – Left Correct Score for List I; LCSII - Left Correct Score for List II; Df- Degrees of freedom. ($p < 0.05$**)

From Table 2, it can be concluded that there is a significant difference between the right ear scores and the left ear scores ($p < 0.05$) for all the age groups except for 10-10.11 years and 11 -11.11 years for the list I. The rationale on the dichotic listening reported that when two different words are presented simultaneously to the right and left ear, normal listeners would accurately identify more words on the right ear than on the left ear (Broadbent, 1954). This study consensus with the findings of present study that the right ear scores are higher when compared to the left ear scores, across different age groups. However, as the age increases the pattern of right ear and left ear performance were observed to be similar.

The similar pattern on the scores observed in the present study is in good agreement with the literature reported by Kimura (1961). Kimura, stated that stronger crossed auditory pathways from the right ear ascends directly to the speech dominant left cerebral hemisphere, and also noted that the REA was enhanced by suppression of information ascending via the ipsilateral pathway from the left ear to the speech dominant left hemisphere.

The evidence of the dichotic listening, strongly suggests that the right ear advantage mechanism proposed by Kimura's structural model/anatomical model of dichotic speech recognition is based on several assumptions. According to this model, 1) Contralateral auditory pathways are stronger than ipsilateral pathways, 2) the stronger contralateral pathways occlude or inhibit the weaker ipsilateral pathways, 3) the left hemisphere is the dominant hemisphere for processing speech stimuli, and 4) information presented to the non-dominant ear must travel from the non-dominant hemisphere through the corpus callosum to the dominant hemisphere to be processed (Kimura, 1961a; 1961b; 1967). Hence, the structural and functional (Speech stimuli) aspects are very important to elicit the right ear advantage.

The magnitude of the REA has an effect of age as reported by Fennell, Satz and Morris in 1983. Generally, the developmental effects on dichotic listening tasks suggests an improvement in overall performance as the age increase but, there is not much improvement on the REA as observed with aging. It is due to the development and myelination of the corpus callosum which is responsible for these trends (Bellis, 2003). Another possible reason could be that the dominance for speech is achieved around four years of age or earlier (Kimura, 1963).

The results of the current investigation revealed that there was no shift in right ear's performances, which could be possibly due to the maturation of the CANS that improves after ten years of age falling within the normal range. However, auditory structures such as thalamocortical fibers, the primary auditory cortex and the corpus callosum, continues to mature up to 10 years of age and may play a role in speech perception in noise and in ear advantage.

List Effect

The mean, standard deviation and range for the List-I and List -II across the five age groups are obtained for single and double correct scores, which is depicted in table 3.

Table 3 *Descriptive Statistics for List I and List II (Single and Double Correct Scores)*

Age group		Right correct Score		Left correct Score		Double correct Score	
		List I	List II	List I	List II	List I	List II
7-7.11 years	Mean	16.10	15.70	12.70	13.30	10.60	10.15
	SD	1.68	2.49	4.44	3.06	4.05	3.31
	Range	12-19	10-19	4-20	9-19	4-19	5-16
8-8.11 years	Mean	16.60	17.00	13.85	13.40	11.25	10.85
	SD	1.73	1.95	3.86	3.23	3.67	3.60
	Range	13-19	13-20	4-19	5-18	4-17	3-17
9-9.11 years	Mean	16.70	16.50	14.80	15.10	12.35	12.45
	SD	2.58	1.85	2.82	2.51	3.25	3.27
	Range	9-20	13-19	8-19	8-19	6-18	5-17
10-10.11 years	Mean	17.80	17.75	16.70	16.70	14.85	14.90
	SD	1.64	1.41	2.64	2.36	2.98	3.21
	Range	15-20	14-20	10-20	11-20	6-20	7-18
11-11.11 years	Mean	18.35	18.75	17.40	16.90	15.85	15.70

SD	1.09	0.91	2.01	1.71	1.69	1.81
Range	17-20	17-20	12-20	13-19	12-18	12-19

The mean differences across the age groups were found for both the lists. However, there was no significant difference noted, hence the performance of the dichotic listening is similar for both the lists which would possibly indicate that aligning the two words in two different channels at 0 ms lag time does not alter the performance of the subjects. Hence, this could be one of the reasons for obtaining no significant difference between the lists.

Gender Effect

The mean and standard deviation was measured for both the gender across age groups using both List I and List II, which is represented in Table 4.

Table 4 *Descriptive Statistics for Males and Females across Lists and Age Groups*

Age		LIST –I						LIST-II					
		RCS		LCS		DCS		RCS		LCS		DCS	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
7-	M	15.3	1.82	10.2	4.18	8.10	3.21	14.6	2.79	11.9	2.60	8.30	2.83
	F	16.9	1.10	15.2	3.19	13.10	3.21	16.8	1.61	14.7	2.94	12.0	2.74
8-	M	16.3	2.11	13.7	4.62	10.9	4.01	16.8	2.39	13.0	3.65	10.3	3.94
	F	16.9	1.28	14.0	3.16	11.6	3.47	17.2	1.47	13.8	2.89	11.4	3.33
9-	M	15.4	3.06	15.3	2.98	11.8	3.58	16.2	2.20	14.6	3.06	11.6	3.89
	F	18.0	0.94	14.3	2.71	12.9	2.96	16.8	1.47	15.6	1.83	13.3	2.40
10-	M	17.6	1.64	15.8	2.89	13.7	3.05	17.9	1.72	15.9	2.55	14.1	3.60
	F	18.0	1.69	17.6	2.11	16.0	2.53	17.6	1.07	17.5	1.95	15.7	2.71

11-	M	18.8	1.03	17.0	1.49	15.9	1.59	19.0	0.81	16.7	1.76	15.7	1.70
	F	17.9	0.99	17.8	2.44	15.8	1.87	18.5	0.98	17.1	1.72	15.7	2.00

Note. RCS - Right Correct Score; LCS - Left Correct Score; DCS - Double Correct Score; M - Male; F – Female

It can be observed from the above Table 4 that the mean and SD scores for males and females are almost similar for single and double correct scores. This similarity is seen in almost all the age groups for both the lists except 7-7.11 years and also females' scores were better than males' scores. The independent 'paired-t' test showed no significant difference ($p > 0.05$) for single correct scores and double corrects scores between genders for both the lists except 7-7.11 years.

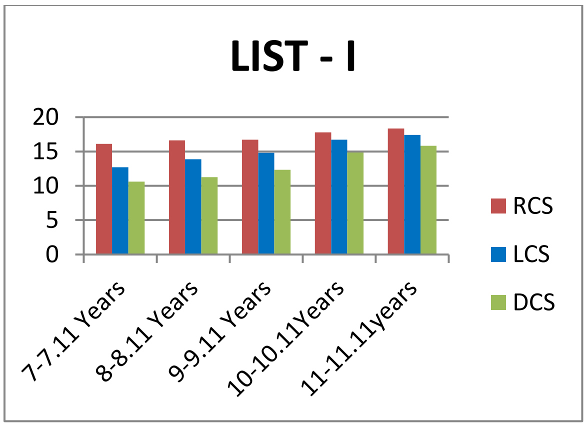
Ghent's in 1961 reported slower left hemispheric dominance in males than in females for speech tasks and also that the development of somesthetic asymmetry was delayed in boys. However, in the present study the mean scores of females across all the age groups were better when compared to males for both Single and double correct score. Girls are more proficient in language skills, producing longer utterances and having larger vocabulary than that of boys, especially during 1-5 years of age (Ruble and Martin, 1998). Contradicting this, another study in 1988 by Hyde and in 1999 by Plotnik reported relatively small difference in verbal performance between males and females.

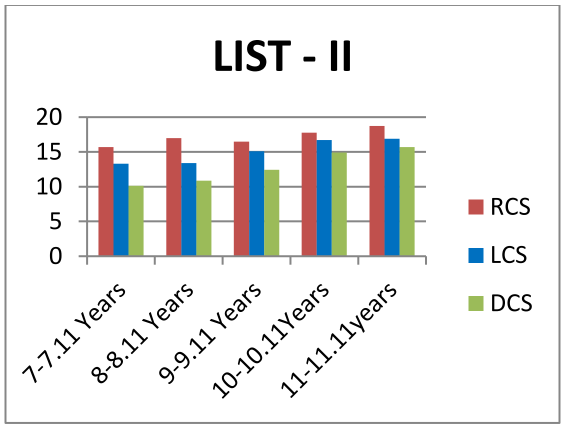
Krizman in 2012 found females exhibiting robust and quicker responses with faster acoustic components of speech than males. Girls are generally proven to have greater verbal ability than males, which is not obvious until 11 years of age (Maccoby & Jacklin, 1974), which also persists throughout the school years in verbal as well as written skills (Lynn, 1992). Bellis and Wilber (2001) also advocated that the gender effects on the auditory evaluation of inter-hemispheric transfer are small and clinically insignificant. Hence this could be one of the possible agreement of the studies discussed for the present study that females are having higher mean when compared to males in younger age group. However, no significant difference was noticed.

Age effect

The descriptive statistics of right correct score, left correct score and double correct score for all the age groups is depicted in the table 4.1. The mean scores for single correct scores and double correct scores are noted to be increased as the age increased from seven years to 12 years for both the lists. Especially between the ears, the right ear scores have higher scores compared to left ear scores across all the age groups indicating right ear advantage for both the list. Also, we can find that the mean double correct scores are lesser for all the age groups as compared to single correct scores.

Figure 1 Mean of ear specific correct scores across age groups.





(A) *(B)*

Figure 1: Mean score for right correct score, left correct score and double correct score for 7-7.11 years to 11-11.11 years for List I & II.

It can also be inferred from Figure 1(A) & (B) that the mean right correct scores, left correct scores and double correct scores were increased as the age increases from 7 to 12 years for both the lists. Especially right correct score is higher compared to the left correct score and double correct score across the age groups. But the mean value is much lesser for double correct score compared to right ear correct score and left ear correct score.

Independent paired 't' test was done to investigate the significant difference across age groups of single and double correct scores within each list . Independent paired 't' test revealed a significant difference for right correct scores (t value = -5.02, $p < 0.01$),left correct scores (t value = -4.31, $p < 0.01$) and double correct scores (t value = -5.35) across age groups for the list I , and right correct score (t value = -5.13, $p < 0.01$), left correct score (t value = -4.59, $p < 0.01$) and double correct score (t value = -6.57, $p < 0.01$) across age groups for list II.

It can also be inferred from Figure (A) & (B) that, the mean right correct scores and left correct scores and double correct scores were higher for 11-11.11 years compare to the 7-7.11 years. This indicates significant difference were observed 7-7.11 years and 11-11.11 years.

The present findings of the study are supported since the dichotic word scores increased with the advancement of age can be due to the differential myelination of the subcortical and the cortical structures. The corpus callosum and certain auditory association areas may not have completed myelinogenisis until 10 to 12 years or older (Salamy, Mendelson, Tooley & Chapline, 1980; Hayakawa et al., 1989). Also somatosensory evoked potential used to measure interhemispheric transfer function denotes that the maturity of the corpus callosum ranges from 10 to 20 years of age (Salamy et al., 1980).

Berlin, Hughes and Lowe-Bell (1973) as well as Willeford and Burleigh (1994) reported increase in the brain ability to process two channel stimuli as function of age showing right and left ear score increased significantly with age. However, ear advantage varies with the type of stimulus used. Bellis (1996) reported that linguistic stimuli indicate more pronounced the maturational effects. The REA is computed by comparing right ear scores to left ear scores during simultaneous presentation condition. Unlike more linguistically loaded tests of dichotic CVs does not show significant maturational effect in normal hearing children ages 7 to 15 years. The dichotic CV showed higher right ear advantage (Berlin et al., 1973) on other hand dichotic sentences also shown right ear advantage as the age increases (Willeford & Burleigh, 1994).

Differences are accounted for by age-related changes occurring in the central auditory processing system and specifically involves the decreased conduction of the corpus callosum (Bellis & Wilbur, 2001). Left-ear scores were reduced as compared to right-ear scores due to maturation of corpus callosum is not completed to transfer complex stimuli from the right hemisphere to the left hemisphere. As the age increases the myelination of the corpus callosum is completed, the interhemispheric transfer of information improves and left ear scores approach to those obtained in adults (Musiek, Gollegly, & Baran, 1984).

The double correct scores were decreased in all the age groups compared to single correct scores due to the inability to process simultaneous for both channel at the younger age and also suggested that the single correct scores must be used to calculate the norms rather than double correct scores. Interpretation of ear effects in dichotic listening to the double correct scores does not provide information compare to single correct scores (Dermody, Mackie, and Katach (1983) as the similar findings are in consensus with present study.

Effect of Handedness

The present study was carried out children with right handed from 7 to 12 years. Results of the current study revealed right handed children had higher right ear advantage due to left hemisphere dominant for speech perception. The results were agreement with previous finding of dichotic listening task with right handed person this was done by Branch, Milner and Rasmusson (1964) found that 90% of right handed people had language lateralized in the left hemisphere and 60% of left handed subjects exhibited left hemisphere language processing. These results, indicate left handed people being more ambidextrous than right handed people. The means that left handed people may have more connections between their hemispheres, resulting in less lateralization. Due to the left hemisphere lateralization, researchers restrict testing to right handed subjects when measuring dichotic speech recognition.

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