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Auditory Discrimination Tests in Konkani – Performance of Children (6-9 Years) in Quiet and Noisy Conditions

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Abstract

Auditory discrimination skills are very important in the classroom. Deficits in auditory discrimination are also believed to be one of the causes of central auditory processing disorder (CAPD). Children with these disabilities often fall behind in school, particularly in reading and spelling, because they lack the phonological awareness needed to make relationships between sounds and the symbols that represent them. The need of the study is to develop a screening tool in Konkani language to perform a discrimination test in young children's to rule out their performance in repetition and same-different task. The study aimed to develop the normative for subject's performance in quiet and noisy conditions and to compare it with each other. 90 native Konkani speakers were taken as subjects from various rural schools. The 36 word stimulus was binaurally presented to the child through the headphone. The test conditions were repeated with response measure of repetition and same/ different tasks. Result showed that, while comparing the performance in quiet and noisy conditions, the auditory discrimination ability was significantly better in quiet conditions compared to that of noisy condition. There are no differences in auditory discrimination ability with repetition and same/different tasks. Evaluating the materials created in this study with a group of hearing impaired, CAPD individuals is a possible topic for future research and would provide a valuable comparison to this current study.

Key words:

Introduction

The hearing mechanism is an amazingly intricate system. Sound is generated by a source that sends out air pressure waves. These pressure waves reach the eardrum, which vibrates at a rate and magnitude proportional to the nature of the waves. The tympanic membrane transforms this vibration into mechanical energy in the middle ear, which in turn

converts it to hydraulic energy in the fluid of the inner ear. The hydraulic energy stimulates the sensory cells of the inner ear, which send electrical impulses to the auditory nerve, brainstem, and cortex (Stach, 2010).

Broadly stated, (Central) Auditory Processing [(C) AP] refers to the efficiency and effectiveness by which the central nervous system (CNS) utilizes auditory information. Narrowly defined, CAP refers to the perceptual processing of auditory information in the CNS and the neurobiologic activity that underlies the processing and gives rise to electrophysiologic auditory potentials (ASHA, 2005)

CAP includes the auditory mechanisms that underlie the following abilities or skills: sound localization and lateralization; auditory discrimination; auditory pattern recognition; temporal aspects of audition including temporal integration, temporal discrimination, temporal ordering, and temporal masking; auditory performance in competing acoustic signals and auditory performance with degraded acoustic signals (ASHA, 1996; Bellis, 2003; Chermak & Musiek, 1997).

CAPD is assessed through the use of special tests designed to assess the various auditory functions of the brain. There are numerous auditory tests to assess central auditory function. Types of measures those are available for central auditory assessment: Auditory discrimination tests, Auditory temporal processing and patterning tests, Dichotic speech tests, Monaural low-redundancy speech tests, Binaural interaction tests & Electrophysiological measures.

An auditory discrimination test (ADT) is a screening or diagnostic assessment tool designed to identify and diagnose deficits in auditory discrimination. ADT's measure a child's ability to detect subtle similarities and differences between speech sounds. Two of the most commonly used ADT's are Wepman's Auditory Discrimination Test (WADT) and the Goldman-Fristoe-Woodcock Test of Auditory Discrimination.

Review of Literature

Auditory discrimination skills are very important in the classroom. Deficits in auditory discrimination are also believed to be one of the causes of central auditory processing disorder (CAPD). Children with these disabilities often fall behind in school, particularly in reading and spelling, because they lack the phonological awareness needed to make relationships between sounds and the symbols that represent them.

Beving & Eblen (1973) found that youngest children scored better on the imitation task than on the "same-different" task, while the other groups did not differ in their ability to perform either task. Elliot, Connors, Kille, Levin, Ball and Katz (1979) found no age-related performance changes when the words were presented against a12-talker babble or against filtered noise. In quiet, however, performance improved between the ages of 5 and 10 years.

Nabelek and Robinson (1982) revealed that the scores declined with thresholds for all ages. The best scores were obtained by the young adults.

Neuman and Hochberg (1983) found that phoneme identification scores in reverberant conditions improved with increasing age and decreased with increased reverberation time. Dubno, Dirks and Morgan (1984) found a difference in performance in noise as a function of age were observed for both normal-hearing and hearing-impaired listeners despite equivalent performance in quiet. Nozza, Rossman, Bond and Miller (1990) found that infants are at a greater disadvantage than adults when processing speech in noise and that concern over the effects of a noisy environment on the acquisition of language is justified.

Fallon, Trehub and Schneider (2000) concluded that children required more favourable SNR's than adults to achieve comparable performance in low noise, an equivalent decrease in SNR had comparable consequences for all age groups. Klatte, Hellbruck, Seidel And Leistner (2000) concluded that children from reverberating classrooms performed lower in a phonological processing task, reported a higher burden of indoor noise in the classrooms than children from classrooms with good acoustics.

Abraham (2009) developed auditory discrimination test in Kannada and revealed that there was significant difference between the age groups and concluded that, as age increases the performance was better. Kallikadan (2009) developed auditory discrimination test in Tulu and found that as age increases there is an increase in performance of quiet and noisy conditions. Varghese (2009) developed auditory discrimination test in Malayalam and found that there was improved performance in quiet and noisy conditions as age increases.

Klatte, Lachmann, and Meis (2010) concluded that children were more impaired than adults by background sounds in both speech perception and listening comprehension. Neuman, Wroblewski, Hajicek and Rubinstein (2010) concluded that more reverberant the environment, the better the SNR required. Dadgar, Ghorbani, Bakhtyari, Khatoonabadi

(2012) concluded that child's ability in discrimination of sounds was increased with age. Wróblewski, Lewis, Valente and Stelmachowicz (2012) concluded that speech recognition decreased in the reverberant conditions and with decreasing age.

Need of the Study

The review indicates that auditory discrimination test in various languages have been developed for use in western literature. Despite their usefulness in providing information of the child's language status particularly at central levels, such attempt in Indian languages such as in Konkani are yet to be found. There is a need to develop discrimination test in Konkani and compare the performances of typically developing children in quiet and noisy conditions. Thus the present study is a primary step in developing an auditory discrimination test in Konkani using minimal pair words and test performance in 6-9 year typically developing children.

Aim

1. To develop auditory discrimination test in Konkani using minimal pair words.
2. To evaluate the test in 6 – 9 year old typically developing children.
3. To compare the performance of subjects in quiet and noisy conditions in the age groups 6-7 years, 7-8 years, and 8-9 years.

Methodology

Subject and Stimulus

In order to develop an auditory discrimination test in Konkani, 90 native Konkani speakers were taken as subjects from various rural schools. Prior to study, all children were confirmed to have hearing within normal limits. Oral peripheral mechanism examination was carried out. Their academic performances were significantly good. The subjects were then divided into 3 groups based on their age, each group consisting of 30 participants. The group I contained subjects between ages 6-7, group II contained children with age ranged from 7-8 years, group III ranged from 8-9 years age.

To develop a word list, 50 minimal pairs which appeared quite frequently in daily Konkani usage were listed. These words were analysed by two Speech language pathologists. Finally most frequently used 36 Konkani minimal pair selected. The entire set of stimuli

consisted of 36 word pairs out of which 30 word pairs were minimal pairs, which differed in a single feature and 6 word pairs were catch trials in which each word pair consisted of a single word repeated once. Recording was done in sound treated room using PRAAT software (version.5.1) by a native Konkani female speaker at a sampling rate of 44100 HZ. Later, using Audacity software, white noise was added to the entire stimulus duration with SNR kept at 0 dB SNR. The stimulus was binaurally presented to the child through the headphone. The test conditions were repeated with response measure of repetition and same/ different tasks were conducted on successive days to avoid learning effect.

Scoring was done separately for quiet as well as in noisy conditions. The scores obtained for the repetition and same- different were calculated and entered separately in a response sheet. For each correct response the child was scored with zero. Statistical analysis was done using t-test and p-test. The tests were analysed to find out Mean, Standard deviation, t-value and p-value in all conditions.

Results and Discussion

The present study aimed to find the normative value for the performance of children on listening to minimal pairs in quiet and noisy condition for the age range 6 – 7, 7 – 8, and 8 – 9 years. Mean, standard deviation, t – value and p – value was obtained. The obtained data was statistically analysed and results are discussed below.

Age group		Mean	Std. Deviation	t value	p value
6 to 7	Quiet- R	35.53	.819	.433	.679
	Noise-R	35.10	1.494		NS
7 to 8	Quiet- R	36.00	.000	-	NS
	Noise-R	36.00	.000		
8 to 9	Quiet- R	36.00	.000	-	NS
	Noise-R	36.00	.000		

Table 1: Shows the mean difference, standard deviation, p – value, t – value and significance for the different conditions under various age groups for Repetition task.

Age group		Mean	Std. Deviation	t value	p value
6 to 7	Quiet-SD	33.63	1.938	.433	.898
	Noise-SD	33.20	2.310		NS
7 to 8	Quiet-SD	36.00	.000	-	NS
	Noise-SD	36.00	.000		
8 to 9	Quiet-SD	36.00	.000	-	NS
	Noise-SD	36.00	.000		

Table 2: Shows the mean difference, standard deviation, p – value, t – value and significance for the different conditions under various age groups for Same-different task.

Under Quiet and Noisy Conditions (Repetition Tasks)

The first group 6-7 years showed a mean of 35.53 in quiet condition and 35.10 in noisy condition whereas 7-8 years group showed a mean of 36.0 and 36.0 respectively. In 8-9 years group, the mean of 36.0 were seen in quiet condition and 36.0 in noisy condition. Results indicated no significant difference between quiet repetition and noisy repetition tasks.

Under Quiet and Noisy Conditions (Same/Different Tasks)

The first group 6-7 years showed a mean of 33.63 in quiet condition and 33.20 in noisy condition whereas 7-8 years group showed a mean of 36.0 and 36.0 respectively. In 8-9 years group, the mean of 36.0 were seen in quiet condition and 36.0 in noisy condition. Result suggestive of no significant difference between quiet same/different and noisy same/different tasks.

Age group		Mean	Standard deviation	ANOVA F	P value
Quiet - R	6 to 7	35.53	.819	9.733	.000
	7 to 8	36.00	.000		
	8 to 9	36.00	.000		HS
Noise - R	6 to 7	35.10	1.494	10.892	.000
	7 to 8	36.00	.000		
	8 to 9	36.00	.000		HS
Quiet – SD	6 to 7	33.63	1.938	44.062	.000
	7 to 8	36.00	.000		
	8 to 9	36.00	.000		HS
Noise – SD	6 to 7	33.20	2.310	44.062	.000
	7 to 8	36.00	0.00		
	8 to 9	36.00	0.00		HS

Table 3: Showing the mean, standard deviation, p value, ANOVA F and significance for repetition and same-different tasks under different age groups.

When the overall scores were compared of the subjects across the 3 age groups it was seen that there was an age related change in the performance of the subjects, with the older age group subjects performing better than the other age groups. These changes in performance were seen in both the quiet and noisy conditions, for both the repetition as well as the same- different task. From the above table it clearly shows that all 4 conditions (Quiet-R, Quiet –D, Noise-R, Noise- D) showed highly significant difference (p = .000) among three age groups.

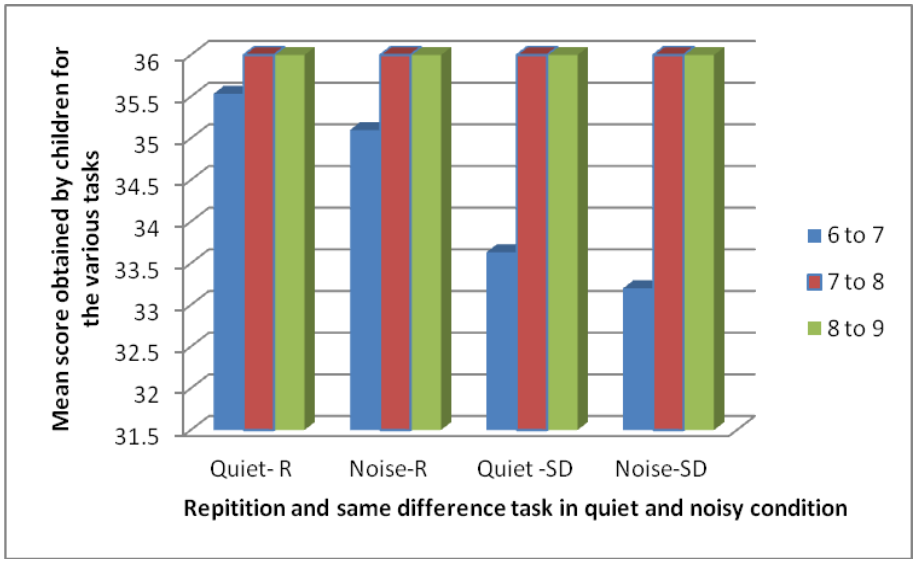

Figure 1: Represents and compares the scores obtained by each group for specific task and conditions.

From figure 1, it is evident that the mean scores for the 8-9 years old group of children were better than the scores of children of 6-7 years, also the mean scores of 7-8 years group were better than those of the 6-7 years old children, in both quiet and noise condition for both type of tasks.

Discussion

The present study investigated the ability of 6-9 years old children to discriminate minimal pairs in quiet as well as in noisy condition. The children were asked to respond to the minimal pairs by repetition and by indicating same/ different. In 6-7 age groups, the auditory discrimination ability was significantly better in quiet condition compared to that of

noisy, but other 2 age groups (7-8 & 8-9 years) showed no significant difference in both tasks.

While comparing the response task, it is noted that the scores obtained for the same/ different task is poorer than repetition task in group I age group, no significant difference seen in other two groups. But statistical analysis couldn't identify any significant differences between the response tasks. This indicate that both the task, i.e. repetition as well as indicating same/different can be used to identify the auditory discrimination ability.

The present study's results indicate that on first trial of testing, the subjects found it difficult to discriminate the words in noisy condition. These results in general indicate usefulness of same/different task as a better tool in auditory discrimination tests. The results of the present study and the normative can help researchers to develop further research. The study shows an increase in auditory discrimination scores with age. The performance of children in both the tasks is becoming better in both quiet as well as in noisy conditions.

Summary and Conclusion

Auditory discrimination refers to the ability to differentiate behaviourally between auditory stimuli of many types**.** It is the ability to identify and distinguish between different sounds. Auditory discrimination test evaluates the auditory discrimination ability of the person. The auditory discrimination can be affected by the variables like age, context and conditions. Most of the auditory discrimination test materials have been developed for use with individuals who speak American English. However, there remain many languages without developed materials for speech audiometry. Hence, the present study describe and record a set of high quality digital speech materials that can be used to evaluate the auditory discrimination abilities of individual whose native language is Konkani. The study aimed to develop the normative for subject's performance in quiet and noisy conditions and to compare it with each other.

While comparing the performance in quiet and noisy conditions it is observed that, the auditory discrimination ability was significantly better in quiet conditions compared to that of noisy condition. Although significant improvement in the auditory discrimination ability was observed across the age, a slight increase in score can be noted. This result shows that the auditory discrimination ability increases with age in children. There are no differences in auditory discrimination ability with repetition and same/different tasks. But a slightly poorer performance is observed while using same/different task in 6-7 years age group.

The minimal pairs used in the present study can be used to test the auditory discrimination ability in children with mother tongue Konkani. We can effectively screen out children who are at risk for speech discrimination difficulties due to learning disability, auditory processing disorder, hearing losses etc.

Directions for Future Research

Evaluating the materials created in this study with a group of hearing impaired, CAPD individuals is a possible topic for future research and would provide a valuable comparison to this current study. Understanding how hearing impaired, CAPD populations perform on auditory discrimination tests in imperative diagnosis and treatment. The test-retest reliability of the word lists developed in this study is another possible area of investigation. Test items in this were administered to each subject only once. Information on consistency in performance of the same subject across a second administration can be further taken up.

Limitation of the Study

The present study only used 30 subjects due to time constraints, and hence the data obtained in this study can be administered in a higher number of subjects for validation. While words used in this study are the common words used in the Konkani language in Dakshina Kannada District, it is necessary to develop minimal pair list representing the other dialects in Konkani language. The number of subjects in each group can be increased.

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Appendix

Test material/ word list

ಮೀಟ್ _ ಮೂಟ್	ಧಂಪ್ _ ಧುಂಪ್	ಕೊಂಬೋ _ ಕಾಂಬೋ	ಧೀಸ್ _ ತೀಸ್
ಪಿಡೋ _ ಪಾಡೋ	ಮೂಸ್ _ ಮಾಸ್	ವಾಟ್ _ ವಾಡ್	ತೀಕ್ _ ತೀಕ್
ಕಾಂಟ್ _ ಗಾಂಟ್	ಹಾತ್ _ ಹಾತ್	ಹಟ್ _ ಹಡ್	ಕಡಿ _ ಕಡಿ
ಸರ್ _ ಸಲ್	ಮೂಸ್ _ ಮೀಸ್	ಧೂಕ್ _ ಧೀಕ್	ಬೊಂವ್ _ ಮೊಂವ್
ತಾನ್ _ ಧಾನ್	ಮೀಟ್ _ ಪೀಟ್	ಮಾಡ್ _ ಮೋಡ್	ಸೋರ್ _ ಸುರ್
ಊಟ್ _ ಊಡ್	ಕೂಡ್ _ ಕೀಡ್	ಮೇಜ್ _ ಪೇಜ್	ತಾನ್ _ ತಾನ್
ಮೀಟ್ _ ಮೀಟ್	ಗೀಟ್ _ ಗೂಟ್	ರಾಕ್ _ ರಾಗ್	ಗೊಂವ್ _ ಗಾಂವ್
ಥ್ಯ್ _ ಧಂಯ್	ಗುಡ್ _ ಗೊಡ್	ಊಟ್ _ ಊಟ್	ಮಾಯಿ _ ಮುಯಿ
ಸರ್ _ ಸರ್	ಮಾರ್ _ ಮೋರ್	ರಾನ್ _ ಲಾನ್	ಮಾಸ್ _ ಮೀಸ್

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