Topic: Development of Hindi Language Monosyllabic Speech Perception Test Material for Children

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Abstract: *The study aimed to develop Indian mono-syllabic speech perception tests for Hindi speaking children. The test was designed for children aged between two to six years-old. A total of 226 normal hearing children each group aged 2 years to 6 years were participated in present study.Test item were selected on the basis of most familiar, frequent consonant occurred in daily uses .Test consists of each set of 40 pictorial stimuli which scored 2 for auditory response, 1 for auditory and visual cues required, zero for no response even after auditory and visual stimulation. ANOVA test results showed that the mean scores for mono-syllabic the showed statically significantly difference between ages group across age (p < 0.05). Age 4-5 and 5-6 did not showed and statically significantly difference due to maximum ceiling effect (i.e. max score 80). To check reliability 56 subject were retested after one month of duration. Similarly same test was administered by other tester, inter-rater and test retest reliability were found high and the coefficients approximated 0.8 and .73 (p < 0.05). There no statically significant difference seen between genders for all test items. Content items were validated by 5 experience speech therapist and audiologist. In conclusion, monosyllabic picture speech perception test easy to administer and scoring which is reliable and valid for Hindi speaking children.*

I.   Introduction

Speech perception tests are widely used in audiology to measure the auditory perceptual capability of the hearing-impaired population (Jerger et. al. 1983, Mendel et. al. 1996; Derinsu et.al. 2007). Measurement of speech perception, together with other procedures, allows audiologists and special educator to assess the benefits of hearing aid and/or cochlear implant usage and to determine the needs for cochlear implant in children and adults (Franz et. al. 2005; Paul et. al. 1990; Ling 1992; Zimmerman. et. al. 2000). In current scenario in the view of cochlear implant advance many Indian state are expending on cochlear implant fitment and post rehabilitation management of children with hearing impairment. Special educator and audiologist play important role in management process of children with hearing impairment using hearing aids or cochlear implant .Their role such as to guide, counsel & support parents & caregivers as the primary models for spoken language development & to help them understand the impact of hearing impairment on the entire life (Pollack 1985; Estabrooks & Samson 1992; Ling 1990) .To help hearing impaired children integrate listening into their development of communication & social skills. To support child's auditory-verbal development through one to one teaching. To continuously assess & evaluate child's development in the above areas & through diagnostic intervention, modify the program when needed (Ling 1998; Elizabeth et al 2008). Appropriate Speech perception test tool not only help to check listening level but also provide continuous assessment & monitoring developmental changes in the listening behavior. (Ling D .1990; Franz et al 2005, Hedge 2008). Children with hearing impairment who show limited benefit with HA required quantify speech perception ability regularly. Therefore speech perception test is very crucial in rehabilitation process of hearing impaired. Speech perception tests also help in setting goals in aural rehabilitation (Eisenberg et. al. 2005; Moog &. Geers, 1990).In young children assessing listening skill require to modification because they don't have same level of language and vocabulary which adult has, therefore test items should be picturable and stimulus item should be within child vocabulary (Hegde 2010 ; Moog &. Geers, 1990; Estrabrook 1990; Ling D 1999). In Indian scenario, speech perception in children is difficult to assess due to a scarcity of age-appropriate measures and multi-lingual exposure to child. For assessment of speech perception currently western countries test tool are used by Indian audiologist and educator. There are few scales which clinically mostly used such as Ling Developmental Scales (Ling, D. 1977) uses different phonemes to capture auditory, speech, and linguistic developmental milestones in infants and toddlers with hearing loss. Similarly the Infant-Toddler: Meaningful Auditory Integration Scale (IT-MAIS, Zimmerman-Phillips, Robbins, & Osberger, 2000) evaluates the child's speech perception ability; alert to sound, and derive meaning from sound is probably the most widely used scale for the assessing young hearing impaired child. The recently developed Checklist of Auditory Communication Skills (Franz, et, al. 2005) represents an expanded and more comprehensive scale by which to document auditory skill development in

children with significant hearing loss. In western countries there are comprehensive standard test available such as Northwestern University-Children's Perception of Speech (NU-CHIPS, Elliott & Katz, 1980), Early Speech Perception (ESP) Test, and the Pediatric Speech Intelligibility (PSI) Test (Jerger & Jerger, 1984). All three measures are closed-set identification tasks and require picturing-pointing responses. In India Hindi is the native language of most people living in Delhi, Uttar Pradesh, Uttarakhand, Chhattisgarh, Himachal Pradesh, Chandigarh, Bihar, Jharkhand, Madhya Pradesh, Haryana, and Rajasthan state Kuiper, K., ed. (2010). Hindi is one of the official languages of India. In the 2001 Indian census, 258 million (258,000,000) people in India reported Hindi to be their native language. In India according to PWD act 1995, monosyllabic word score is mandatory to certify hearing impairment. Therefore to cover these huge numbers of population great need felt to develop Hindi speech perception test. In Hindi language different 11 vowels and 33 consonants occurs therefore we tried to cover all most frequent occurring consonant in test items. The tests were targeted for children aged between 3 to 6years old.

II. Materials And Methods

Subjects: Subjects were Hindi speaking children who speak only Hindi as their mother tongue, recruited from several kindergartens around Mumbai and different part of Hindi belt. All subjects had normal hearing, speech, vision and physical development as reported by their parents and teachers. Detail audiological testing was conducted to for assessing normal hearing skills. The number of participants and subject age groups were different for each phase of the study.

Phase one: Familiarity check and item selection

In the first phase of the study in which targeted children's vocabulary were collected, 56 children 2-3 aged two years old participated to ensure items used in the tests would be within the vocabulary of the two year olds, the youngest targeted age group. A total of 56 children aged three years old participated in the second phase, which was the pre-test.

Second phase: pilot study

A pilot study was conducted in the second phase which involved 20 children between three to six years of age.

Final phase:

1: 226 each age group Field testing (2-3, 3-4, 4-5, and 5-6 years)
2: 56 subjects for Test – retest, 56 subjects for inter tester testing

Last Phase:

The last phase, which was the field testing study 226 children of the newly developed material Tests, 226 children aged between three to six years old, participated. There were 226 children in each age group: 2years to 2year 11month, 3years to 3 years 11 months (3 – 3.11), 4 years to 4 years 11 months (4 – 4.11), 5 years to 5 years -6years. Hindi mother tongue subject enrolled in present study, 56 of the subjects involved in the final phase participated in the test-retest reliability study and another 56 subjects participated in the inter-rater reliability study.

Considerations in the Development of the Tests

Developing speech perception tests for children is challenging due to the limitation of vocabularies and language. It is important to make sure that test items are within the vocabulary that are mastered by the tested children and the response task should be age-appropriate to ensure correct interpretations (Martin 1987; Mendel & Danaher 1996; Clark et al. 1997, Kramer S. J. (2014).).A number of important factors must be taken into consideration when assessing speech perception in children. These include a combination of child, task, tester, and environmental influences on test outcomes (Boothroyd, 2004). Child factors include the state of the child during testing, such as their attentiveness to the task. Moreover, children must demonstrate the requisite motor skills to perform the response task being asked of them (e.g., head turn, manipulation of objects, picture pointing, pushing a button), as well as the phonological, receptive and expressive language skills needed to participate in speech perception testing (Martin M. 1987). Tester and environmental factors include the audiologist's aptitude to work with the pediatric hearing-impaired population, the general feel of the facility, and caregiver attitudes and behaviors. In the present study, to ensure that the test items are age-appropriate, the items were selected from vocabularies that were mastered by 65 two-year-old children in the first phase and the selected items were also pre-tested on another group of three-year-old children in the second phase. Besides, the response task for all tests are picture-pointing and the format used are closed-set. This was to ensure that the children's performance in the tests was not affected by the limitation of their expressive language. There were

other considerations taken into account in the selection of test items. In present study we tried to cover all the important consonants and vowels in Hind, based on the frequency of occurrence of consonant (Bhagwat 1996).

Test Procedure
Item selection:
In the first phase of the study, the Hindi word list forms which are picturable, these words were taken from KG junior and senior Hindi Book. Same word list were given to 65 parents or caregivers of children aged 1-2 years to 2- 3 years together monosyllabic to mark familiarity of each words in three point rating scale to check words are within the vocabulary of these children. Similarly to avoid parental biases same subject reception was assessed by researcher on individual basis. Child was tested with picture identification task. One test plate was containing 3 distraction pictures with one target picture to assess reception. The mean score and standard deviation was calculated by statistical method. The test was administered in a quiet room with minimum or no visual and audible distractions. Adequate lighting conditions in the test room to facilitate good visibility of picture plates. Child and tester were seated next to each other with the tester's chair slightly behind that of child's chair to avoid any visual cues. Tester was seated on the side of better hearing ear in case of hearing aid users, whereas on the implanted side for cochlear implanted users. Most familiar words selected to form final forty test items. The selected items were drawn in picture cards and then present and scored recorded for each stimulus. Finally test stimulus items formed by considering both score i.e. parent familiarity checked score and receptive vocabulary assessment scores. The newly developed tests were then trialed on 20 subjects (five in each age group) further modifications were incorporated based on the results of the pilot study.

Tests Composition
In this 40 monosyllabic word which has single syllable stress such as aam, ful etc were used to check speech perception.

Scoring and administering criteria; in first step, the target words are presented by providing auditory information only. The child is expected to point the picture representing the spoken word. Child does correctly auditory the score of 2 is given for each of the correct response.
In the second step, If the child is not able to perceive the target word through auditory information the target word is then presented by providing both auditory and visual information both cues like lip, tongue and jaw movements score 1 for each correct response. The visual cues act as supplementary information for the words which are not perceived auditory. No response given by the children with both auditory and visual cues scored as 0 for no response.

Field-Testing
All test items were field-tested 224 subjects on each age group. The stimuli were presented using live voice and in auditory-alone mode. Subjects were requested to point the corresponding picture card of the test item after each presentation of the stimulus. Even though the formal instruction of the test was for subjects to point correct picture card, verbal responses were also accepted. Repetition of stimulus-presentation during the test was not allowed. A few practice trials were given to ensure that subjects understood the test procedure and the required responses.
All test item result was tested and the scores of the subjects were recorded. To obtain information on test-retest and inter-rater reliability, 56 subjects were retested by the same tester after four weeks of the field test sessions. To find out inter-test reliability another 56 subjects were retested by a different tester. Both testers were qualified audiologist and had experience more than 5 years in field of audiological management, native Hindi speakers. The testers were briefed on the testing and scoring procedures.

Content Validity
Content validity evidence of the for all test items were collected from experience group of panelists that consisted of five audiologist & five speech therapist , five postgraduate audiology & speech sciences students. All members of the panel were native Hindi speakers and received Hindi education in primary and secondary schools. The members had experiences in administering speech tests and had basic knowledge on language development. Content validity was performed prior to the field study.

Data Analysis

ANOVA test was used to analyze the difference in test scores among different age groups, genders. Spearman Correlation was used to analyze the correlation of the scores of the test and those of the repeated test in the test-retest reliability

Subjects

Table 1 showing mean and SD of age in months across different age range

Sr.No	Age	Means (months)	SD
1	2-2 years11month	32.767	2.7699
2	3-3 years11month	44.69	2.922
3	4-4years11month	57.482	2.894
4	5-6years	67.917	2.434

Descriptive Analyses

To find out statistical significant difference between different age group ANOVA test was used.

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
2years- 2 years 11month	3y-3y.11m	-4.45877*	.28198	.000	-5.2517	-3.6659
	4y-4y.11m	-6.80640*	.27436	.000	-7.5779	-6.0349
	5y-5y.11m	-7.08775*	.31649	.000	-7.9777	-6.1978
3years- 3years.11month	2y-2y.11m	4.45877*	.28198	.000	3.6659	5.2517
	4y-4y.11m	-2.34763*	.27711	.000	-3.1269	-1.5684
	5y-5y.11m	-2.62898*	.31888	.000	-3.5257	-1.7323
4years- 4years.11month	2y-2y.11m	6.80640*	.27436	.000	6.0349	7.5779
	3y-3y.11m	2.34763*	.27711	.000	1.5684	3.1269
	5y-5y.11m	**-.28135**	**.31216**	**.846**	**-1.1591**	**.5964**
5years-6years	2y-2y.11m	7.08775	.31649	.000	6.1978	7.9777
	3y-3y.11m	2.62898	.31888	.000	1.7323	3.5257
	4y-4y.11m	**.28135**	**.31216**	**.846**	**-.5964**	**1.1591**

Table 1.1 showing comparison of speech perception score across the different age range.

After ANOVAs Test indicates that means score obtained by different age group having statically significant difference except 4 years to 4years 11month and five years to six year age range.

In the age range 4 years to 4years 11month and five years to six year age range all subject got maximum score which leads to ceiling score i.e. 80. Therefore in ANOVA test both the age group not having statically significant difference.

Normative score of speech perception test.

		Range	Minimum	Maximum	Mean	Std. Deviation
Monosyllabic	2y-2y.11m	24.00	36.00	60.00	49.34	7.40034
	3y-3y.11m	12.00	48.00	73.00	60.32	8.63095
	4y-4y.11m	16.00	64.00	80.00	74.5	4.72056
	5y-6 years	4.00	76.00	80.00	78.33	3.57704

Table 1.2 showing the normative value of speech perception score across each age group mean score and SD.

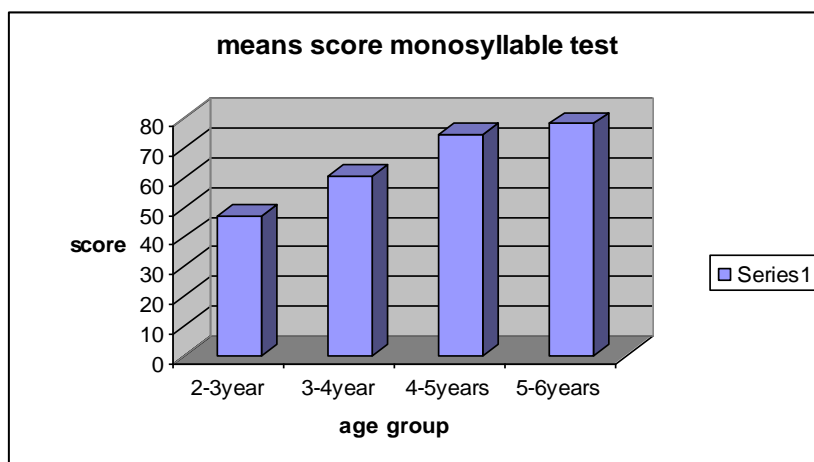This table can serve as normative value for comparing disorder pollution.

Table: 1.3 showing the means score across each age group

From the table 1.3 it can be seen speech perception score is increasing with the age at 5- 6 years means ceiling score obtained that is 80.

Reliability of test score between two tester

Subtest		Inter test reliability checked	
		score	Score
Monosyllabic	Pearson Correlation	1	.764[**]
	Sig. (2-tailed)		.000
Between two tester	Pearson Correlation	.764[**]	1
	Sig. (2-tailed)	.000	

Table: 1. 4 showing correlation score between two testers.

Pearson Correlation test was used to check correlation of speech perception score when same test were administered by two different testers. Result of the test indicated that 0.76 score which shows that score of test highly correlated and reliable between two testers.

Reliability of test score between test – retest by the same tester

Speech perception score test retests reliability obtained after a month by same tester.

subtest		score	Score
Monosyl	Pearson Correlation	1	.834[**]
	Sig. (2-tailed)		.000
Re Monosyl	Pearson Correlation	.834[**]	1
	Sig. (2-tailed)	.000	

Table: 1. 5 showing correlation score between test and retest after one month.

When the same subject were re-tested after a month correlation result were obtained between test and re-test on Pearson Correlation test. Result of the test indicated that 0.83 score, which shows that score of test highly correlated and reliable Jacob Cohen (1988).

Gender effect

ANOVA test used to check compare means score of each age group and male & female subject.

Group Statistics

	gender	N	Mean	Std. Deviation	Std. Error Mean
2-2 years11month	female	74	47.8378	6.65598	.77374
	Male	150	46.7533	6.47342	.52855
3-3years11month	female	89	618135	8.17767	.86683
	Male	135	60.3778	8.02502	.69068
4-4 years11month	female	94	75.8149	4.37591	.45134
	Male	130	74.3846	4.38706	.38477
5-6 years	female	85	77.2824	3.61087	.39165
	Male	139	76.3381	4.38303	.37176

Table 1.6 showing descriptive result of male and female across each age group

		Levene's Test for Equality of Variances					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
2-2 years11month	Equal variances assumed	.004	.951	.091	222	.928	.08450
3-3years11month	Equal variances assumed	.056	.814	-.149	222	.882	-.16429
4-4 years11month	Equal variances assumed	.004	.952	.051	222	.959	.03028
5-6 years	Equal variances assumed	4.871	.028	1.669	222	.096	.94422

Table 1.7 showing ANOVA test result of male and female across each age group

Table: 1.7 ANOVA showed that there was no significant difference between the performance of different age groups male and female. But comparing female subject has slightly higher means score but that is not statically significant difference.

Content Validity: All of the members of the panel (100%) rated the test item. Some panel members suggested that certain items were difficult for the three-year-olds. The test items were modified based on the panel's comments.

III. Discussion

This study reported the development of closed-set Hindi speech perception tests for children aged 2 to 6years old. The test-retest and inter-rater reliability were also examined. Results revealed that all subjects performed well in the all test item. In such a test, subjects need to be able to discriminate between monosyllabic words. Moreover, the test items were selected from the vocabularies that were mastered by children as young as two years old. Hence, the test is suitable for the assessment of children aged two to six year-old. A previous study reported by reported that India having multi language situation which make it too difficult to test two years old children due to limited vocabulary Rout(2012) Mayadevi, C. (1974).. All items used in this study are monosyllables. Thus, potential users of these tests should be cautious when interpreting the results from two to four years old children as the present study showed even some of normal hearing children had less score. As for the gender effect in test items, the results supported in part the finding by Norris et al. (1989) Elliott, L.L., & Katz, D. (1980) in which there were no significant difference between gender on children speech and language performance. However, female subject having slightly higher means score compared to male children. Similar finding seen by Karmiloff & Karmiloff-Smith (2002) that girls were faster and better than boys in speech and language development. The present results also showed that there was no significant difference between the mean scores of subjects 5 -6 years and 4-5 years as both age group had maximum score as a result of a

ceiling effect of basic speech & language development. This finding is consistent with a previous study which reported in India. The criterion of test-retest and inter-rater reliability were met if the correlation coefficient between tests were 0.90 and above (McClauley & Swisher 1984). However, some social researcher might argue that the 90% criterion for reliability was too high given the complexity of speech and language functioning and disorders. Additionally, the variability in daily performance that arises from different speech and language disorders suggests that 0.90 criterion is fairly high. Thus, Jacob Cohen (1988) suggested that correlation coefficient as low as 0.80was considered as the threshold of acceptability for reliability. Thus, the present study set 0.76 and 0.8 correlation coefficients as the standard for strong reliability. In any study involving test-retest and inter rater reliability, an appropriate length of test-retest interval is important. A short interval between the tests will lead to learning practice effect, yet, a long interval between the tests might be invalids a result of maturation effect (Garson 2008) Hegde M (2008). Garson (2008) suggested that a typical interval is several weeks. Hence, in the present study, the test-retest interval selected was one month. The reliability study showed that the test-retest and inter-rater correlation coefficients the set criterion for correlation coefficient (0.76).

IV. Conclusion

With the implementation of newborn hearing screenings and early identification of hearing loss across the country, there is increased interest in measures to assess the speech perception abilities of children. Hindi speech perception test was developed in this study to quantify the ability of Hindi speech sound perception in the age range between two to six-years old. As all the test items chosen in the study were monosyllabic, the study showed that some children in this age range i.e. two to three year-old children had not fully mastered few items of the test. Hence, the test users are warned to be cautious for interpretation of the result findings for three and four-year-old children. There was a significant age effect seen in the means score of speech perception. Gender did not affect the test scores of both tests. The tests were also found to be reliable and valid. Hence, it is recommended that this test list items can be used in clinical setting for assessment, management and monitoring of intervention strategies for young children.

Reference

[1]. Barker, B.A., Bass-Ringdahl, S.M. (2004). The effect of audibility on audio-visual speech perception in infant cochlear implant recipients. In R.T. Miyamoto (ed.), Cochlear Implants. International Congress Series 1273 (pp. 316-319). Amsterdam: Elsevier.

[2]. Barker, B.A., & Tomblin, J.B. (2004). Bimodal speech perception in infant hearing and cochlear implant users. *Archives of Otolaryngology - Head & Neck Surgery,* 130, 582-587.

[3]. Berko Gleason, J. (2005). The development of language (6th ed.). Boston, MA: Pearson Education.

[4]. Boothroyd, A. (1984). Auditory perception of speech contrasts by subjects with sensorineural hearing loss. *Journal of Speech and Hearing Research*, 27, 134-144.

[5]. Boothroyd, A. (1985). Evaluation of speech production in the hearing-impaired: Some benefits of forced-choice testing. *Journal of Speech and Hearing Research*, 28, 185-196.

[6]. Boothroyd, A. (1991). Speech perception measures and their role in the evaluation of hearing aid performance in a pediatric population. In J.A. Feigin and P.G. Stelmachowicz (Eds.), Pediatric Amplification: Proceedings of the 1991 National Conference (pp.77-91). Omaha, Nebraska: Boys Town National Research Hospital.

[7]. Boothroyd, A. (2004). Measuring auditory speech perception capacity in very young children. In R.T. Miyamoto (ed.), Cochlear Implants. International Congress Series 1273 (pp. 292-295). Amsterdam: Elsevier.

[8]. Carter, J.A., Lee, J.A., Murira, G.M., Gona, J., Neville, B.G.R. & Newton, C.R.J.C. (2001). Review: Issues in the developmentof cross-cultural assessments of speech and language for children. *International. Journal Language Communication Disorders*. 40:385-401

[9]. Chen, X., Richard, C., Li, W.L., Hao, M.L., Wu, X.C. & Shu, H.(2004). Phonological awareness of bilingual and monolingual Chinese children. *Journal of educational Psychology*. 96: 142-151.

[10]. Clark, G.M., Cowan, R.S.C. & Dowell, R.C. (1997). Cochlear Implantation for Infants and Children - Advances .United States: Singular Publishing Group, Inc

[11]. Derinsu, U., Gumus, Z.G. & Akdas, F. (2007). Standardization of the speech tests used with cochlear implant patients. Marmara Medic J. 20: 6-11.

[12]. Eilers, R.E., Wilson, W.R., & Moore, J. M. (1977). Developmental changes in speech discrimination in infants. *Journal of Speech and Hearing Research,* 20, 766-780.

[13]. Eisenberg, L.S., Shannon, R.V., Martinez, A.S., Wygonski, J., & Boothroyd, A. (2000). Speech recognition with reduced spectral cues as a function of age. Journal of the Acoustical Society of America, 107, 2704-2710.

[14]. Eisenberg, L.S., Martinez, A.S., & Boothroyd, A. (2003). Auditory-visual and auditory-only perception of phonetic contrasts in children. *The Volta Review*, 103, 327-346.

[15]. Eisenberg, L.S., Martinez, A.S., & Boothroyd, A. (2004). Perception of phonetic contrasts in infants: Development of the VRASPAC. In R.T. Miyamoto (Ed.), Cochlear Implants. International Congress Series 1273 (pp. 364-367). Amsterdam: Elsevier.

[16]. Eisenberg, L.S., Johnson, K.J., Martinez, A.S., Cokely, C.G., Quittner, A.L., Tobey, E.A., Wang, N-Y., Fink, N.E., Niparko, J.K., & the CDaCI Investigative Team (2005). 10th Symposium on Cochlear Implants in Children, Dallas, TX, March 15-19.

[17]. Elliott, L.L., & Katz, D. (1980). Development of a new children's test of speech discrimination (Technical Manual). St. Louis, MO: Auditec.

[18]. Franz, D.C., Caleffe-Schenck, N., & Kirk, K.I. (2005). A tool for assessing functional use of audition in children: Results in children with the MED-EL COMBI 40+ cochlear implant system. *The Volta Review*, 104, 175-196.

[19]. Garson,D.,(2008). Reliability: Reliability Analysis. Retrieved April13, 2008 from http://www2.chass.nsu.edu/garson/pg765/reliab.htm.

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[20]. Hegde M. N. & Hegde M. N. (2008). Hedge's Pocket Guide to treatment in speech-language pathology. Clifton Park, NY: Thomson Delmar Learning.
[21]. Houston, D.M., Pisoni, D.B., Kirk, K.I., Ying, E.A., & Miyamoto, R.T. (2003). Speech perception skills of deaf infants following cochlear implantation. A first report. *International Journal of Pediatric Otorhinolaryngology*, 67, 479-495.
[22]. Houston, D. M., Ying, E. A., Pisoni, D.P., & Kirk, K.I. (2003). Development of pre-word-learning skills in infants with cochlear implants. *The Volta Review*, 103, 303-326.Hegde, M. N. (2010). Introduction to communicative disorders. Austin, Tex: Pro-Ed.
[23]. Jacob, C. (1988). Statistical Power Analysis for the Behavioral Sciences (2nd ed.), New Jersey: Lawrence Erlbaum Associates, ISBN 0-8058-0283-5, retrieved 10 July 2010
[24]. Jerger, S., Jerger, J. & Abrams, S. (1983). Speech audiometry in the young children. *Ear & Hearing*. 4: 56-66.
[25]. Jerger, S., & Jerger, J. (1984). Pediatric Speech Intelligibility Test. St. Louis: Auditec of St. Louis.
[26]. Johnson, K.C., Wygonski, J.J. & Eisenberg, L.S. (2005). Choice reaction time (CRT) in assessing pediatric word and sentence recognition. 10th Symposium on Cochlear Implants in Children, Dallas, TX, March 15-19.
[27]. Jusczyk, P.W., & Luce, P.A. (2002). Speech perception and spoken word recognition: Past and present. *Ear and Hearing*, 23, 2-40.
[28]. Karmiloff, K. & Karmiloff-Smith, A. (2002). Pathways to Language. United States: Harvard University Press
[29]. Kaye, A. S. (1997), Phonologies of Asia and Africa, Eisenbrauns, ISBN 978-1-57506-019-4
[30]. Kishon-Rabin, L. Taitelbaum-Swead, R., Ezrati-Vinacour, R., Kronnenberg, J., & Hildesheimer, M. (2004). Pre-first word vocalizations of infants with normal hearing and cochlear implants using the PRISE. In R.T. Miyamoto (Ed.), Cochlear Implants. International Congress Series 1273 (pp. 360-363). Amsterdam: Elsevier.
[31]. Kosky, C., & Boothroyd, A. (2003). Validation of an on-line implementation of the Imitative Test of Speech Pattern Contrast perception (IMSPAC). Journal of the American Academy of Audiology, 14, 72-83.
[32]. Kramer S. J. (2014). Audiology: science to practice. San Diego, CA: Plural Publishing
[33]. Kuhl, P.A., (1992). Psychoacoustics and speech perception: internal standards, perceptual anchors, and prototypes. In L.A. Werner and E.W. Rubel (Eds.). Developmental psychoacoustics (Chapter 12, pp. 293-332). Washington D.C.: American Psychological Association.
[34]. Kuiper, K., ed. (July 2010), Culture of India, Rosen Publishing Group, ISBN 978-1-61530-203-1
[35]. Ling, A.H. (1977). Schedules of development in audition speech language communication for hearing-impaired infants and their parents. Washington, D.C.: The Alexander Graham Bell Association for the Deaf, Inc
[36]. Martin M. (1987).Speech Audiometry. United Kingdom: Taylor &Francis Ltd.
[37]. Martinez, A.S., Eisenberg, L.S., Boothroyd, A., & Johnson, K.C. (2005). Auditory-visual and auditory-only perception of CV and VCV stimuli in young children. 10th Symposium on Cochlear Implants in Children, Dallas, TX, March 15-19.
[38]. Mayadevi, C. (1974). The development and standardization of a common speech discrimination tests for Indians. Unpublished Master's dissertation submitted to University of Mysore.
[39]. McClauley, R.J. & Swisher, L. (1984). Psychometric review of language and articulation tests for preschool children. *Journal of speech and hearing disorder*. 49: 34-42.
[40]. Paul PV, Quigley SR (1990). Education and deafness. White plains, NY: Longman 1990
[41]. Rice, M. L., & Warren, S. F. (Eds.). (2004). Developmental language disorders: From phenotypes to etiologies. Mahwah, NJ: Erlbaum.
[42]. Roberts, M. Y., & Kaiser, A. P. (2011). The effectiveness of parent-implemented language interventions: A meta-analysis. *American Journal of Speech-Language Pathology*, 20, 180-199.
[43]. Roth, F., & Worthington, C.K. (2015). Treatment resource manual for speech-language pathology. Clifton Park, NY: Delmar, Cengage Learning.
[44]. Reed, M. (1970). Deaf and partially hearing children. In: Mittler P. Ed. The psychological assessment of mental and physical handicapped. London: Menthen 1970.
[45]. Ross M. (1990). Hearing – impaired children in the mainstream. Parkton, MD: York Press 1990. .
[46]. Rout, N., Khanna, M. (2012). Concerns of Indian Mothers with Children Having Severe-to-Profound Hearing Impairment at Diagnosis and after 1-3 Years of Therapy. Rehabilitation Research Practice. Epub 2012 Aug 5.
[47]. Scarborough, H., & Dobrich, W. (1990). Development of children with early language delay. Journal of Speech, Language, and Hearing Research, 33(1), 70-83.
[48]. Werker, J.F., & Tees, R.C. (1999). Influences on infants speech perception processing: Toward a new synthesis. Annual Review of Psychology, 50, 509-535.
[49]. Zimmerman-Phillips, S., Robbins, A.M., & Osberger, M.J. (2000). Assessing cochlear implant benefit in very young children. Annals of Otology, Rhinology, and Laryngology, 109 (Supplement 185), 42-43.