SENSITIVITY EVALUATION OF "CAPP-M" IN CHILDREN WITH HEARING IMPAIRMENT

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Abstract

The present study aimed to investigate the sensitivity of 'Computerized assessment of Phonological Processes in Malayalam' (CAPP-M- Merin, 2010) in children with hearing impairment. CAPP-M is a user friendly software developed using Malayalam Articulation Test (MAT; Maya, 1990), which was administered on Malayalam speaking children, in the age range of 3-3.6 years. A total of 20 picture stimuli are included in this tool. While assessing a particular child, the clinician has to listen to the child's production of the 20 target words one by one and choose any of the four options for each target word provided on the computer screen. At the end of 20 responses, CAPP-M provides a list of processes ranked in descending order i.e., from the most occurring to the least occurring process in a single child's utterances. This tool assesses eight frequently occurring phonological processes in normal children. A mean correlation of 65% was obtained for the subject's productions and the possible productions listed in the software, for six out of eight children. For the remaining two children, the mean correlation score was 45%. The results revealed that for the children with hearing impairment considered in the study, overall 60% of their productions matched with those of the templates in CAPP-M. The phonological processes identified in children with hearing impairment from the most occurring to the least occurring were cluster reduction, idiosyncratic productions, affrication, stopping, palatalization, and metathesis.

Key words: *Computerized assessment, CAPP-M, Phonological processes.*

A child new to the world learns to speak the language of the world through experimentation and imitation of the adult forms heard. Little does the child know that its speaking apparatus is incapable, rather immature of producing exactly what is heard. In light of this incapability, the child gets armed with a strategy of his own, wherein the adult's productions are simplified making it resemble the adult's production, though not identical to it. In this way, the child is able to speak like an adult eventually by acquiring the correct forms. This process of simplification of adult speech by a child is basically described as phonological processes. Lowe (1996) defined phonological process as "systematic sound change that affects classes of sounds or sound sequences and results in a simplification of productions." In other words, the child simplifies the complex adult model by substituting sounds that are within his or her phonetic repertoire for those sounds that he or she has not yet achieved. These phonological processes are not haphazard but follow a specific developmental sequence (Stampe 1969; Compton 1970; Smith 1973). That is most children develop the ability to articulate gradually, and before perfecting an adult production they reduce the complexity of words in characteristic ways. By investigating the phonological processes, one comes near to unraveling the development of the phonological system of a child, being able to discover the intricacies of a child's development of speech. Moreover, such information is of substantial use in cases of children with communication disorders as it shows where the child lies in the process of phonological development and how deviant the child's productions are when compared to a typically developing child.

Phonological process analysis is carried out by gathering a speech sample, transcribing it in the International Phonetic Alphabet, and identifying the patterns of error (processes) in the data. However, by following such procedures some of the major difficulties one encounters are keeping track of the data on a host of different worksheets, tallying up percentages and frequency counts, and cross checking a variety of relationships found in different portions of the client's transcript. This is time consuming and laborious. Researchers therefore began investigating the applicability of computers to this task. Hence, began the era of computerized phonological assessment procedures. In English, several such computer based analysis are in use. The computerized Articulation and Phonology Evaluation System (CAPES) (Masterson and Bernhardt, 2002) is a good example of such a system that was developed to elicit and analyze phonological productions. Some other Computerized phonological analysis programs are Computer Analysis of Phonological Processes (CAPP) version 1.0 (Hodson,1985), Computer Profiling (CP) (Long & Fey,1988),

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Logical International Phonetic Programs Version 1.03 (LIPP) (Oller & Delgado,1990), and Programs to Examine Phonetic and Phonologic Evaluation Records Version 4.0 (PEPPER) (Shriberg,1986).

In India, Ramadevi (2006) developed a computerized assessment tool for profiling the phonological production of children with hearing impairment. However, only the presentation of the stimuli was computerized, with the major other tasks left solely to the hands of the clinician. Merin (2010) developed another computerized assessment tool 'Computer based Assessment of Phonological Processes in Malayalam (CAPP-M). This is a user friendly software program developed to assess the phonological processes in Malayalam speaking children, in the age range 3-3.6 years. The framework of this tool was developed using the Malayalam articulation test (MAT; Maya 1990). MAT was administered on 30 (15 boys; 15 girls) typically developing Malayalam speaking children. The tool tests 20 words which outnumbered the other erroneous production of the children from MAT. For these 20 words, three most frequently occurring production of each target word is included (Appendix 1). To accommodate any novel or idiosyncratic productions as well, an option named 'any other' was also provided. Therefore, a page of the software contained a picture of the target word, IPA transcriptions of the correct production, three most occurring productions, and the option 'any other' having a total of five options/ templates. The clinician's task is to present the stimuli, listen to the child's production and click on the pattern produced by the child (Appendix 2). Automatically, a count of the phonological processes is registered by the tool. After completing the administration of the 20 test words, on clicking an option 'Report', a list of the phonological processes produced by the child is presented in a descending rank order. The tool provides a quick assessment of the various phonological processes present in the child tested. This newly developed tool can be used as a quick screening tool in children.

Children with hearing impairment comprise a major population with many articulatory problems. In a busy diagnostic setting, detailed phonological assessment of the child may not be possible, despite its relevance. This is because the task is tedious, laborious and time consuming. Use of a computer to replace the manual effort will therefore be significantly appreciated. Though such a tool has been developed for Malayalam speaking children, its sensitivity in evaluating the disordered population has not been explored. Only after its validity is established in the disordered population, will it serve as a clinical tool. The present study aimed to investigate the sensitivity of 'Computer based assessment of Phonological Processes in Malayalam' (CAPP-M., Merin, 2010) in children with hearing impairment.

Method

Participants: 12 native Malayalam speaking children diagnosed as delayed speech and language with hearing impairment, in the age range 3.5-5.3 years were considered for the study. Demographic data of the children are depicted in Table 1. These children were devoid of any other psychological or neurological illness.

Table 1: *Demographic data of participants*

Sl. No.	Participants	Duration of speech and language therapy attended	Chronological age	Degree of hearing loss
1	Participant 1	8 months	3.5	B/L Severe
2	Participant 2	1.2 years	5.3	B/L Moderately severe
3	Participant 3	1.5 years	4.9	R- Moderate L- Moderately severe
4	Participant 4	2.1 years	4.8	R-Severe L- Moderately severe
5	Participant 5	1.9 years	5.0	B/L Moderately severe
6	Participant 6	11 months	4.3	R-Severe L- Moderately severe
7	Participant 7	2.2 years	4.5	B/L Severe
8	Participant 8	1.3 years	4.7	B/L Moderately severe

Inclusion criteria for participant selection: Children who obtained a language age of 3-4 years, on Computerized Linguistic Protocol for screening (CLIPS, Anitha; 2004) was included as the participants of the study. Eight among the 12 children passed these criteria.

Materials: Computerized Linguistic Protocol for Screening, -CLIPS, developed by Anitha, 2004

(which gives an estimate of the receptive and expressive language age), Computer based Assessment of Phonological Processes in Malayalam -CAPP-M; Merin, 2010 (assess the phonological processes in Malayalam speaking children) were administered.

Procedure: Administration of CLIPS: CLIPS was initially administered on 12 children considered for the study. After the children were comfortably seated, each child was shown a PowerPoint Presentation of the picture stimuli. The receptive and expressive language age was obtained. Eight children, who surpassed the test by procuring a language score of 3-4 years, were the participants for administration of CAPP-M.

Administration of CAPP-M: CAPP-M was administered on the eight children who obtained a language age of 3-4 years. On completion of the test items, a list of phonological processes produced by the child were then obtained in a descending rank order. In order to test the sensitivity of the tool for children with hearing impairment, the clinician made a manual calculation of the percentage of child's productions that matched the four options (excluding 'any other') and obtained a mean percentage score.

Results

The present study intended to test the sensitivity of the newly developed tool (CAPP-M; Merin, 2010) in eight children with hearing impairment, that is, to what extent the child's production matched the patterns in the display of the software. This was done by calculating the percentage of the child's production that matched the templates in the tool. (as shown in Table 2). Table 2 indicates that mean percentage score for all the participants considered was 60%. Only Subjects 1 and 6 showed a correlation of < 50%. (Mean percentage=45%). The remaining six participants obtained a correlation of > 50% (Mean percentage= 65%).

Table 2: *Percentage of correlation between the child's production and the template*

Sl. No.	Subjects	Number of templates matched	Percentage of Templates matched
1	Subject 1	9	45
2	Subject 2	13	65
3	Subject 3	1	55
4	Subject 4	14	70
5	Subject 5	15	75
6	Subject 6	9	45
7	Subject 7	13	65
8	Subject 8	12	60

The phonological processes identified for the eight children with hearing impairment, in a descending rank order are: Cluster reduction, idiosyncratic productions, affrication, stopping, palatalization, and metathesis.

Discussion

This study aimed to evaluate the sensitivity of CAPP-M (Merin, 2010) in children with hearing impairment. Participants for the study were 8 Malayalam speaking children with hearing impairment in the age range of 3.5-5.3 years, with a language age between 3-4 years. CAPP-M was administered on all the participants selected. The phonological processes produced by each child were automatically estimated. The mean percentage score of the child's productions that matched with those of the templates in the software developed were then calculated. The results indicate that for 6 out of 8 children, a better correlation was obtained between the child's production and the templates listed in the tool. Two children were found to exhibit a poor correlation. This could be attributed to three major factors- the severity of hearing loss, duration of speech and language therapy attended and the chronological age of the child. The six subjects with better correlation had a lesser degree of hearing loss, had attended speech and language therapy for a longer duration and were also older than the two subjects who acquired poorer correlation. This study is in consonance with the findings of Gordon-Brannan, Weiss (2007) who reported a direct correlation between hearing loss and articulatory skills of the hearing impaired. Serious attention is driven to the fact that an adequate language age alone (here, as indicated by CLIPS), does not result in normal articulatory skills in children with hearing impairment.

Conclusion

CAPP-M serves as a quick, easy and automatic tool for assessment of phonological processes. However, with inclusion of sufficient database of productions of children with hearing impairment and other communication disorders, it will serve as a promising screening tool for assessment of phonological processes in Malayalam speaking children.

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Appendix 1

The list of target words and their variable productions considered in the software (CAPP-M; Merin, 2010)

SL. No	Correct Production	1	2	3
1	dōktəR	dōtəR	dōkʈəR	dōʈəR
2	nəkʂəʈRəm	nəʃəʈəRəm	nəkʈʃəʈRəm	nəʈʃəʈəRəm
3	sImhəm	sImgəm	tʃImən	tʃImgəm
4	bRəʂə	bətʃə	bRəʃə	bəʃə
5	puspkəm	puʈəkəm	puʃʈəkəm	putʃəkəm
6	bIskətə	bIkətə	bIʃkətə	
7	vəsʈRəm	vəsʈəRəm	vəʈRəm	vəʈəRəm
8	ʂəRtə	tʃəRtə	ʃəRtə	ʈəRtə
9	paʈRəm	paʈəRəm	paʈəm	-
10	tʃ ə̃əɖɾən	tʃ ə̃ɖəɾən	tʃə̃ɖən	-
11	skutəR	kutəR	tʃutəR	-
12	pRāvə	pāvə	paRvə	-
13	tʃəkRəm	tʃəkəRəm	tʃəkəm	kəkəRəm
14	bəsə	bəʃə	bətʃə	bəʈə
15	kəsɛra	kəʃɛra	kətʃɛra	kəʈɛra
16	sə̃dʒi	ʈə̃dʒi	ʈə̃di	-
17	ʃə̃gʰə	tʃə̃gʰə	ʈə̃gʰə	-
18	mɛʃa	mɛtʃa	mɛʈa	-
19	surjen	ʃurjen	ʈurjen	tʃurjen
20	ɛʃu	ɛtʃu	ɛʈu	-

Appendix 2

A sample from the tool