

AN ARTICULATION TEST BATTERY IN MALAYALAM

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MAY, 1990

TO
MY TEACHERS

FOR ALL THEIR

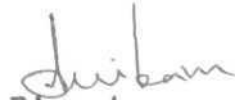
HELP

GUIDANCE and

ENCOURAGEMENT

CERTIFICATE

This is to certify that the Dissertation entitled 'An Articulation Test Battery in Malayalam' is the bonafide work in part fulfilment for the degree of Master of Science (Speech and Hearing) of the student with Register NO.M8806.



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DECLARATION

This dissertation is the result of my own study undertaken under the guidance of Dr.S.R.Savithri, Lecturer in Speech sciences, All India Institute of Speech and Hearing, Mysore-6 and has not been submitted earlier at any University for any other Diploma or Degree.

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INTRODUCTION

"Only the feet that move in order dance
Only the words that move in order sing"

(Alfred Noyes)

One may add, with a thorough knowledge about articulation that,

"Only the articulators that move in order speak
Only the words that move in order communicate".

Speech sounds are produced by precisely graduated movements of the peripheral articulators: lip, tongue, and palate. The simultaneous movements of the jaw, larynx and pharyngeal walls are equally important. Articulation, if proficient, makes speech intelligible and thus helps in communication.

Articulation, in the simplest form can be defined as "a modification of the interrupted air stream into different sounds by the movements of articulators such as tongue, lip, jaw, teeth, soft palate etc. It is a series of overlapping ballistic movements which places varying degrees of obstruction in the path of the outgoing airstream and simultaneously modifies the size, shape and coupling of the resonating cavities". (Nicolosi, Harryman and Krescheck, 1978).

Articulation is one of the five processes involved in speaking (the other processes are respiration, phonation, resonance and cerebration). All the five processes are interdependent. An abnormality in any of the five affect each of the other four processes.

Various factors affect the articulation which include organic factors, personal factors, sensory factors and structural variables (Fig.1). Articulation is considered as normal when it does not detract from the context of verbalization and it is abnormal when it detracts (Hanson, 1960). Children learning to talk must learn speech sounds which society accepts as standards. A child who fails to adopt to the standards will produce defective sounds, i.e. **defective articulation.**

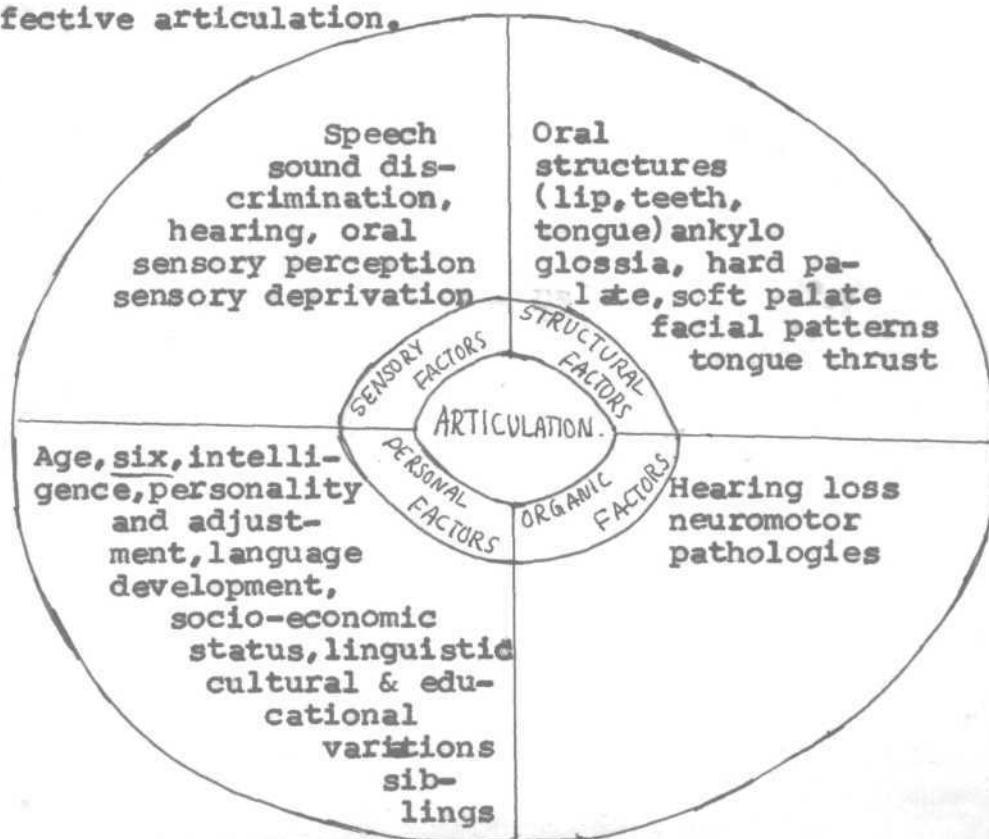


Fig.1: Factors affecting articulation.

According to McDonald (1980), misarticulations are the production of speech sounds which are not adequate acoustic representation of the phonological sequence of the language or dialect. Also, articulatory errors are viewed as failure on the part of a speaker to perceive the significant contrasts between the standard sound and the sound which he produces.

In speech pathology, various terms have been used to denote the different types of misarticulations. Some of them include lisping (sigmatism), lalling, dysarthria, dyslalia, rhotacism, pararhotacism, lambdacism, nasalisms, fricativisms etc. The commonly used terminology include substitution, omission, distortion and addition.

Articulatory disorders are the most frequently occurring among all types of speech disorders. Incidence is difficult to determine, because speech defects account for only a portion of the speakers whose disorders include articulatory deviations. In order to evaluate the articulation of these patients, tests of articulation are essential.

Van Riper and Irwin (1968) define an articulation test as a technique employed to measure the general phonemic

capacity of an individual. This is done by comparing the phonemes actually used by the individual with the phonemic structure of his language group.

Articulation tests have various purposes which are enlisted below:

1. To set up norms for the normal development of phonology.
2. To check if a child is developing normally in terms of phonology, using the normal phonological processes.
3. To determine phonetic proficiency.
4. For purposes of screening.
5. For prediction of the improvement in therapy.
6. To identify the articulatory errors that make the speech unacceptable.
7. To scrutinize the speech of a child and to determine the nature of deviancy.
8. To determine the causal factors that initiate the articulatory problem or contribute to its severity.
9. To plan the therapy carefully.

Articulation assessment should be done with a battery of evaluation instruments. It has been shown by Bankson and Bernthal(1982) that relying almost exclusively on a single articulatory test or inventory provides only a partial picture

of an individual's articulatory status and may lead to faulty conclusions and utilization of inappropriate treatment procedures. An articulation test battery can include a screening test (to identify children with misarticulation), a diagnostic test (to identify the articulatory errors of a child), a Deep Test (to identify the key environments in which the articulation is better) and a predictive screening test (to predict about a child's articulation abilities). In addition to an inventory, articulation assessment should include samples of connected speech, contextual testing and a measure of speech sound stimulability. Responses elicited through these measures are then analysed relative to the client's age, culture and intelligibility, to determine whether or not intervention is warranted, and if so, to develop a remedial program.

Articulation tests are language specific and each language has its own phonological system. In a multilingual country like India, more necessity arises for articulation tests in various Indian languages. Currently, diagnostic picture articulation tests are available in Kannada (Babu Bettagiri and Rathna, 1972), Tamil (Usha, 1986), Telugu (Padmaja, 1989), Bengali (Arun Banik, 1988), Hindi (Ruas, 1989) and Deep Test of articulation (Rohini, 1989)

la available in Kannada. Tests for prediction are not available in any of the Indian languages. In the present study development of a test battery of articulation in Malayalam is aimed at which includes diagnostic picture articulation test, Deep test of articulation and predictive screening test of articulation. This will help the speech clinician to make articulatory assessment, a recommendation and subsequently, the direction and form the treatment should take, so that several forms of data can be utilized in the decision-making process.

GENERAL REVIEW

Misarticulations, the disturbances of speech sound productions, are probably the most common type of speech disorder. The speech and language pathologist should be in a position to differentiate the normal population from the abnormal group. This can be achieved through the administration of appropriate articulation tests. This is a general review covering the types of tests, methods of eliciting response, methods of response recording, methods of analysis and standardization of the articulation tests. The review pertaining to the different tests will be presented in the respective chapters.

1. Types of tests:

- a) Screening test: This is used to assess the general accuracy of the client's articulation. It can test only those sounds, and sound clusters which are associated with significant progress in development of articulation. This has the particular function of sorting out children who are deviant in their articulatory behaviour.
- b) Diagnostic articulation test: This gives us a detailed description and analysis of a child's articulation.

A diagnostic test of articulation should provide detailed information about a child's ability to produce a wide range of speech sounds in a variety of positions and phonetic contexts (Templin and Darley, 1960).

- c) Deep test of articulation: In this type of articulation test, the phoneme to be tested is tested in many contexts in which it occurs in running speech. in order to analyze the correctness or incorrectness of the phoneme.
- d) Predictive screening test of articulation: They mainly are responsible in helping the speech pathologist predict whether or not a client, having a particular speech defect, will outgrow his problem with age. It also helps in deciding whether speech therapy is required or not.

The purposes one has in testing determines the selection of test items and test procedures. The value of the information obtained from articulation testing is related both to the precision of the instrument and to the sophistication of the examiner in its administration and interpretation.

2. Methods of eliciting response:

Method (1)	Procedure (2)	Advantages (3)	Disadvantages (4)
1. Connected speech.	<ul style="list-style-type: none"> a. Conversation with the client about such things as hobbies, TV etc. and tape recording the sample. b. To make the client read a passage orally. It has been observed that fewer errors will occur in such samples (Wright, Shelton, et al. 1969). 	<ul style="list-style-type: none"> a. This will give a picture of child's overall intelligibility, consistency of individual speech sound. 	<ul style="list-style-type: none"> a. Child should be cooperative and responsive b. In the case of severely misarticulated cases, conversational speech sample will be highly unintelligible and so interpretation will become difficult.
2. Sound inventories.	<ul style="list-style-type: none"> c. Have the client listen to a story while viewing the accompanying pictures and he is then asked to repeat the story. d. Having the client tell a story about a series of pictures selected to elicit target words and sounds. 	<ul style="list-style-type: none"> a. The stimuli typically samples target sounds in initial, medial & final positions of words. 	<ul style="list-style-type: none"> a. Speech does not occur in single words, but rather in syllable strings.

(1)	(2)	(3)	(4)
	<p>b. Prefixes pre-, inter- and post are used to describe the location of a target sound within syllables, with regard to vocalic position</p> <p>c. Imitation of a model or sentence completion.</p>	<p>b. Picture stimuli are compact and provide a wide variety of stimuli that can be adopted to the interests and abilities of almost any child.</p>	<p>b. The client's customary articulatory pattern cannot be measured through the production of a single stimulus item (McDonald, 1964).</p> <p>c. It is difficult to represent isolated sounds.</p> <p>d. The picture sometimes fails to elicit the particular word that is desired.</p>
3. Stimulability testing	<p>Asking the respondent to imitate and auditorily and/or visually model of a sound, syllable or word containing the consonant sound form.</p>	<p>Carter and Buck (1958) reported in a study of 1st grade children that stimulability testing can be used for prognostic purpose.</p>	<p>The clinician should be aware that false positive and false negative will be a problem since stimulability testing has not been shown to be totally accurate prediction of spontaneous improvement.</p>
4. Contextual testing	<p>Identification of phonetic contexts where an error is produced correctly (using word groups, sentences etc)</p>	<p>a) Provide the clinician with a measure of consistency.</p> <p>b) To determine phonetic contexts in which a particular error sound may be produced correctly.</p>	-

Table 1: Methods of eliciting responses.

3. Methods of recording responses:

According to Van Riper and Irwin (1968) the results of the examination can be reduced under three headings:

- a. General impression
- b. Specific sounds : (1) defective phoneme (2) type of defect (3) test situation (4) position within a word.
- c. Variability of definite productions.

In a simpler fashion, the responses can be scored as correct or incorrect based on the examiner's perception of whether the sound produced is within the socially acceptable phoneme boundary for a particular linguistic context.

4. Methods of analysis:

- a) Pattern analysis: The purpose of pattern analysis is to discover the organisation underlying the sound errors within the child's phonological analysis. It offers insight into the relationship among sound segments and the interaction between speech articulation and higher levels of linguistic organization. The number of segments in error may influence the direction of treatment program.
- b) Kinetic analysis: In such analysis, misarticulated sounds are reviewed to determine whether similarities

exist in terms of their voicing, manner of production and place of articulation. This facilitates the identification of patterns such as voiced for voiceless sound substitutions, replacement of linguavelar sounds by lingua-alveolar sounds.

- c) Phonological process analysis: (Compton, 1975; Weiner, 1978; McReyholds and Elbert, 1978; Hodson, 1980; Shriber and Kwidtkowski, 1980). Phonological process may be defined as patterns of sound usage that are modifications or simplifications of the adult phonology.

The following are some of the common phonological processes seen in the normal development of children's phonology (Ingram, 1976).

1. Cluster reduction
2. Assimilatory process
3. Syllable structure process
4. Harmony process
5. Feature contrast process.

Quantification of the occurrence of process is achieved by calculating the percentage of instances of occurrence of a process of the total opportunities for its occurrence.

- d) Natural process analysis: Shriberg and Kwiatkowski (1980) define this as meeting the following conditions:
- (1) an underlying representation is simplified at the

production of surface level and (2) is present in a number of languages across the world. They identified eight natural processes of speech, (i) final consonant deletion (ii) velar fronting (iii) stopping (iv) palatal fronting (v) liquid simplification (vi) assimilation (vii) cluster reduction and (viii) unstressed syllable deletion.

This type of analysis is time consuming but can be abbreviated. A definite virtue of this process is the completeness and clarity of the instructions,

e) Distinctive feature analysis: Distinctive feature systems are binary systems which describe a feature

as being either present

has incorporated a distinctive feature analysis into the test format. Pollack and Ross (1972) feel that it provides a measure of the severity of the defect. This is true, but it can be misleading if applied critically.

Quantitative analysis:

This is to obtain a single score or index which would indicate degree of communication handicap. According to Templin and Darley (1960); and Barker and England (1962),

quantitative analysis can be done in terms of number of correct responses. Another method is to utilize a scoring system which assign different weights to the various types of errors. A study of this type is that of Snow and Milisen (1954b), who derived an articulation score based upon assigning a value of 1.0 to 5.0 to each sound in each position. A value of 1.0 indicates correct articulation 2.0 a mildly distorted sound, 3.0, severely distorted sound, 4.0 a substitution, and 5.0 an omission. The articulation score is the mean of these same rank order values for all sounds in all positions.

Wood (1946 and 1949) described an articulation index which takes into consideration the relative frequency with which the different speech sounds occur in speech and the different positions in which they occur in words. Each consonant was given a weighting, in relation to its frequency of occurrence as established by Travis (1931). The total of all weighting is 100. The articulation index is obtained by subtracting from 100 the weight of each sound misarticulated.

Each clinician should derive a quantitative score from whatever articulation test he uses. A valid, reliable and

quantitative index of articulation would have wide application to both research and clinical problems.

5. Organization of the data and interpretation:

The data may be organized in terms of type of phonemes, phonetic categories, distinctive features and even non-segmental aspects. Interpretation is the problem solving which is of great importance in making appropriate recommendations and planning effective treatment.

6. Standardization:

Once the test has been constructed and procedures of administering the test is determined, the test must be administered to a certain number of normal children. This is a kind of pilot study to determine how subjects perform on the test. From the results of this study, one will find out which, if any, items are too difficult or too easy for that particular age group. The test can then be suitably modified and administered to a large sample which is representative of the normal population. Norms are thus obtained for the group under consideration. Comparison of a score on any of the tests or groupings with the norms presented will indicate whether the articulation skill of the given child is average, accelerated or retarded in relation to that of his age peers.

7. Validity:

Validity is one of the most important psychometric characteristics of the test. It can be found out by different methods. For this, we should select a sample of children (age, sex, distribution, nature of articulation problem, severity, whether they had any other abnormalities like dysphonia, fluency problem, immaturity of language development etc). The test should be administered to them and speech should be elicited and recorded. The scores can be compared to the scores obtained by other valid articulation tests. If this value is high, the test can be taken as valid. We can administer the test as a whole or part by part against other tests.

Another method of finding out the validity is to make each of the articulation of the samples rated by trained judges. This should be done with regard to an equal appearing rating interval scale of severity. Again, the coefficient of correlation should be high for a valid articulation test.

8. Reliability:

This can be measured on the sample by test-retest method and then by finding out the reliability coefficient. This should be high for a good articulation test.

Thus, there are various types of tests, test methods, and data analysis. This study pertains to collect speech sample by imitation and quantitative method is used for analyzing the data.

DIAGNOSTIC PICTURE ARTICULATION TEST IN MALAYALAM

Diagnostic articulation test is used when a detailed description and analysis of a child's articulation is required. "Such a test may be used in deciding whether a child needs speech correction, but more frequently, it is used with children already identified as having articulatory problems to aid in prescribing the nature of speech correction". (Templin and Darley, 1960).

Review:

The following Table reviews the diagnostic articulation tests used in English and other Indian languages*

Name of the test	constructed by	Age	Materials	Procedure	Recordings and remarks
(1)	(2)	(3)	(4)	(5)	(6)
Photo articulation test (PAT)	Pendergast Dickey, and Selnar and Sodes (1969)	-	72 colour photographs, 9 on each of 8 sheets of the PAT booklet. The first 69 items test all the consonants of the English language 1 vowel and 1 diphthong. Rest of the items are devoted to testing vowels and diphthongs. Each photo tests only one sound.	The child is required to name each photo. No auditory visual stimulation is given for this section. - Then the child is asked to repeat after the examiner, a list of words from the supplementary test word list (with auditory visual stimulation). - The sound is also tested in isolation.	Responses are recorded on the PAT recording sheet. -If the child had made an error on a sound previously but utters the sound correctly in these items, it is circled and recorded as a pronunciation error. - The S/O/D/A or phonemic type of analysis is used for evaluating the separate scores are given to the tongue sounds, lip sounds and vowel sounds.
Templin & Darley Tests of articulation	Templin & Darley 1969	-	141 items (diagnostic test) and 50 items (therapy).	Materials were presented with	Responses are recorded on a provided

(1)	(3)	(4)	(5)	(6)
		<p>items (screening test). In the diagnostic part, 43 items make up the Iowa pressure articulation test, which checks on the adequacy of speech sounds requiring greater palato-pharyngeal closure. The rest of the items test the production of the English phonemes in words.</p>	<p>no audio-visual stimulation and have to be named by the client. The phonemes in word level were elicited by having the client name colour pictures. Next, the misarticulated sounds are tested in isolation, in syllables, in words that are imitated and conversational speech.</p>	<p>form according to a particular code so that the sounds can be analysed phonemically, according to type of error, its consistency and stimulability. Tables of norms are provided in order to interpret the clients score.</p>
<p>Edinberg Articulation test (EAT)</p>	<p>Bogle Me Isaac & Ingram (1971)</p>	<p>68 colour pictures in their diagnostic test of articulatory abilities.</p>	<p>The child is required to name the pictures. No audiovisual stimulation is provided.</p>	<p>Single word responses are recorded as right (R) or wrong (W). The total score is then converted into a standardized score. Phonemic analysis is done*</p>
<p>Test of articulation in Kannada</p>	<p>Ram Mohan Babu, Rathna, & Ramesh Betta- giri (1972)</p>	<p>Form a (Screening test) uses 13 consonants in initial and medial positions except for /n//y/ and /l/ which are tested</p>	<p>The phonemes were tested by having the child name the line-drawing on individual cards.</p>	<p>The responses are recorded on a recording sheet as correct () substitution error (the substitution phoneme is written down in phonetic</p>

(1)	(2)	(3)	(4)	(5)	(6)
			<p>only in the medial position. 5 blends (st, sk, dr, kr & ks) also are included. Diagnostic articulation test has all the phonemes of Kannada grouped in terms of phonological age in picture form. Two passages (one containing all the consonants except the aspirated ones and the other containing all including the aspiration consonants, are also used as test materials.</p>	<p>No audio-visual stimulation is given when the stimulus is not identified correctly by the subject.</p>	<p>transcription) error of omission(-), error of distortion (x., with description), A phonetic analysis was done.</p>
Tamil articulation test.	Usha (1986)	3 years & above	<p>10 vowel and 25 consonants of Tamil in all the naturally occurring positions. Test has 67 items. Black and White line drawings were used.</p>	<p>No audiovisual stimulation and the pictures have to be named by the subject.</p>	<p>Responses are recorded as correct, substitution omission and distortion and analyzed phonemically. The test can be used for both diagnostic and therapeutic purposes.</p>

(1)	(2)	(3)	(4)	(5)	(6)
Test of articulation in Hindi.	SAFA Vijaya lakshmi Kakpan Niran- Jini RUAS (1989)	3 years & above	All the Hindi speech sounds were included in all the three positions. In the test, the sounds one classified into oral vowels, nasal vowels, plosives, retroflexes, affricates, fricatives, nasals and laterals.	Naming of pictures.	The maximum obtainable score is 100. The analysis of the obtained data is under process.
Articulation test in Bengali	Arun Banik (1988)	-	Not available		
Articulation test in Telugu	Padmaja (1988)		Not available		

Table-2: Review of articulation tests. (Diagnostic):

The aim of this study was to develop a picture diagnostic articulation test in Malayalam.

Methodology;

Materials: Malayalam language has 11 vowels and 33 consonants in its phonemic system. (Appendix-I). All the phonemes were selected for the diagnostic articulation test. Initially, a list of 350 meaningful words having all phonemes of Malayalam in all the naturally occurring positions were selected. Caution was taken to include only those words which are picturable, familiar, unambiguous and elicit a single response. Each phoneme had 5 words in each position. This test was then checked for familiarity using ten young Malayalam speaking adults, who were free from any speech and hearing deviations. All of them were from middle socio-economic status and had average intelligence. They were instructed to mark the word which was most familiar. The words which were found to be most familiar by 80% of the subjects formed the items in the articulation test. Fourteen clusters in their naturally occurring positions were also added in the test. Simple, clear in detail and unambiguous line drawings depicting these words formed the material. Thus 86 cards of convenient size (7x5½ inch) each of which representing a picture/were prepared. Each picture represented a particular phoneme or one blend, in a single position. Vowels were included

only in the initial position. In Malayalam, except for six (l, ɭ, r, n, ŋ and m), consonants do not occur in the word final position. Hence the consonants, except these were tested only in the initial and medial positions. However, these consonants were tested in all the three positions.

Subjects: 240 children (15 males and 15 females in each age range) in the age range of 3.0-3.6 years, 3.7-4.0 years; 4.1-4.6 years; 4.7-5.0 years; 5.1-5.6 years, 5.7-6.0 years; 6.1-6.6 years; and 6.7-7.0 years were selected for the study. All the children were required to meet the following criteria:

1. He/she belonged to middle socio-economic status.
2. His/her mother-tongue was Malayalam.
3. He/she had no speech and language problem and had normal oral mechanism structurally and functionally, as evaluated by a speech pathologist; and
4. Has no reported hearing problem and history of ear discharge.

Administration:

Picture cards were visually presented to the subjects in order to elicit the response. Audio stimulation was given in some cases when the child was unable to respond.

Scoring:

Responses (Correct response (CR), substitution(s) with substituted phoneme); omission (O); distortion(D), addition(A),

any other type of articulatory deviation () were recorded on the response sheet, (Appendix-2). Each correct response in the test was given a score of 'one' and the total score for each subject was computed. The data thus obtained was grouped and statistical analysis was done. Mean and standard deviation were obtained for both males and females separately under each group. 'T'-test was used to find out the significance of difference between males and females in general, between males and females under each group and also between groups.

Test-Retest-Reliability:

To find out the test-retest-reliability, the test was administered to 16 children (one male and one female from each age group), using the same procedure within a span of 2 months and their responses were recorded.

Validity:

The diagnostic picture articulation test was administered to four children (2 males and 2 females) having functional articulation disorder in order to find out its validity.

Results and Discussions:

The results are discussed under the following headings:

1. Distribution of scores among different age groups
2. Distribution of scores among males and females
3. Test-retest-reliability
4. Validity.

1. Distribution of scores in different age groups:

In general, it was noticed that the articulation score was directly proportional to the age in that the scores increased as the age advanced. However, even at the age of 7 years, 100 percent score was not obtained. Scores in different age group of children are in Table-3.

For males, there was a gradual linear increase in the total score. However, for females, upto the age of 6.6, years, total score increased linearly and then it was steady. When the total score of males and females were compared it was found that females had greater scores in all age groups except at 3.7-4.0 years.

It has been reported that the phonetic system of a child gain greater similarity to the adult system as age increases.

Age	Sex	Total score	Percentage	Average percentage
3-3.6	M	64.93	75.5	77.3
	F	68.07	79.15	
3.7-4.0	M	76.53	88.9	87.8
	F	74.67	86.8	
4.1-4.6	M	77.93	90.6	90.8
	F	78.27	91.0	
4.7-5.0	M	78.27	91.0	91.2
	F	78.67	91.48	
5.1-5.6	M	83.53	97.13	97.2
	F	83.6	97.21	
5.7-6.0	M	84.0	97.67	97.8
	F	84.2	97.91	
6.1-6.6	M	84.1	97.8	98.0
	F	84.53	98.3	
6.7-7.0	M	85.26	99.1	98.7
	F	84.53	98.3	

Table-3: Total score obtained by males and females of different age groups and also the average score obtained by children of different age groups.

W-nitz, 1969) a Wellman (19 31); Poole (1934); Templin (1957); Machmm (1962); Arlt and Goodban (1976); Ram Mohan Babu et al. (1972) and Usha (1986) found developmental norms of articulation development in children (Table.4). Their findings indicates that 'phoneme' development is correlated with age and that some sounds are mastered earlier than others. The results of the present study confirms those of the above in

that articulation scores and thus the articulation skill increased with age. Among the phonemes in this test first to be acquired were unaspirated stops, followed by fricatives, affricates and aspirated stops. The order of acquisition is provided in Table-4. Comparing the phonemic development in the present study with others, it could be observed that the articulatory development in Malayalam speaking children is earlier than in non-Malayalam speaking children. They acquire the articulation of s, r, l, f, c, j, at an earlier age of 3-3.6 years. While the unaspirated stops are acquired early (3-3.6 years), aspirated stops are acquired as late as 6-6.6 years (Table-4).

The acquisition pattern in Malayalam speaking children are similar to that in Tamil speaking children (Usha, 1986). Thus it seems that Malayalam and Tamil speaking children acquire phonemes earlier than other language speaking children. This might be because of language differences or a change in the norms.

Pho- neme	Well man (1931)	Poole (1934)	Templin (1952)	Mecham (1962)	Arlt & Good- ban (1976)	Babu - et.al (Kann- ada) (1972)	Usha (Tamil) (1986)	Present study (1990)
1.	2.	3.	4.	5.	6.	7.	8.	9.
m	3	3-6	3	3.5	3-0	3.0	3.0	3.0-3.6
n	3	4-6	3	3.5	3-0	3.0	3.0	3.0-3.6
h	3	3-6	3	3.5	3-0	6,1- 6.6	3.0	3.0-3.6
P	4	3-6	3	3.5	3-0	3.0	3.0	3.0-3.6
+	4-6		3	3.5	3-0			3.0-3.6
f	3	3-6	3	4.5	3-0			3.0-3.6
j	4	4-6	3-6	4.5	3-0	4.0	3.0	3.0-3.6
k	4	4-6	4	4.5	+	3.0	3.0	3.0-3.6
d	5	4-6	4	4.5	3-0	3.0	3.0	3.0-3.6
w	3	3-6	3	3.5	3-0	-	-	-
b	3	3-6	4	3.5	3-0	3.0	3.0	3.0-3.6
t	5	4-6	6	3.5	3-0	3.7- 4.0		3.0-3.6
g	4	7-6t	4	4.5	3-0	3.0	3.0	3.0-3,6
s	5	7-6	4-6	5.5	3-0	5.6	3.0	3.6-4.0
r	5	6-6	4	5.5	4-0	4.1- 4.6	4.0- 4.6	3.6-4.0
l	4	6-6	6	5.5	5-0	3.0	3.0	3.0-3.6
š	+	6-6	4-6	5.5	4-0	5.1- 5.6	5.7- 6.0	5.0-5.6
c	5	+	7	5.5	4-6	3.6	3.0	3.0-3.6
t	+	6+6	7	7.5	4-0	3.0	3.0	3.0-3.6
z	6	6-6	7	7.5	5-0		-	
j	6	6-6	6	6.5	4-0	3.0	3.0	3.0-3.6
e	+	7-6	7	6.5	4-0			-
v	5	6-6	6	5.5	4-0	4.0	3.0	3.0-3.6
z	5	7-6t	6	7.5	5-0	-	-	-
hw	+	7-6	+	7.5	5-0	-	-	-
nn	-	-	-	-	-	3.6	3.0	3.0-3.6
R	-	-	-	-	-	-	6.0	4.6-5.0
r	-	-	-	-	-	5.6	-	3.7-4.0
c ^h	-	-	-	-	-	-	-	6.0-6.6
t ^h	-	-	-	-	-	-	-	6.0-6.6
t ^h	-	-	-	-	-	-	-	6.0-6.6
k ^h	-	-	-	-	-	-	-	6.7-7.0
l	-	-	-	-	-	6.6	6.0	3.0-3.6
l	-	-	-	-	-	-	-	4.0-4.6

Table-4: The age of articulatory acquisition of the phonemes by the children (Part of this is extracted from Sander ,191.2)

on T-test, it was found that there was no significant difference between males and females except in the age group 3-3.6 years, in terms of articulatory skills (Confidence level 0.05)

Age groups (in years)	Significant difference
3 - 3.6	+
3.7 - 4.0	-
4.1 - 4.6	-
4.7 - 5.0	-
5.1 - 5.6	-
5.7 - 6.0	-
6.1 - 6.6	-
6.7 - 7.0	-

Table-5: The significance of difference between the scores of males and females in each age group + = present
- = not present.

These results agree with those of Roe and Milisen(1942) and Saylor (1945), who found no statistically significant differences between boys and girls with respect to the correct production of consonant sounds. Harris and Wintiz (1959) hypothesized that there are no teal differences between boys and girls of 5 years of age or older with respect

to articulatory skills and the differences previously emphasized may be an overflow generalization from the verbalization measures. However, Davis and Templin (1963) found that girls achieved mastery of articulation earlier than boys.

Between the different age groups, there was no significant differences between 4-4.6 - 4.7-5; 5-5.6 - 5.7-6; 5.5 - 6.6 - 6,6.6; 5.6-6 - 6.6-7 and 6,6.6-6.6-7. However, there was significant difference between the other age groups in terms of articulatory acquisition (Table-6).

Age groups (years)	Si.Di	Age groups (years)	Si.Di.
3-3.6 & 3.7-4.0	+	4-4.6 & 5-5.6	+
3-3.6 & 4-4.6	+	4-4.6 & 5.6-6	+
3-3.6 & 4.6-5	+	4-4.6 & 6-6.6	+
3-3.6 & 5-5.6	+	4-4.6 & 6.6-7	+
3-3.6 & 5.6-6	+	4.6-5 & 5-5.6	+
3-3.6 & 6.6-7	+	4.6-5 & 5.6.6	+
3-3.6 & 6.6-7	+	4.6-5 & 6-6.6	+
3.6-4 & 4-4.6	+	4.6-5 & 6.6-7	+
3.6-4 & 4.6-5	+	5-5.6 & 5.6-6	-
3.6-4 & 5-5.6	+	5-5.6 & 6-6.6	+
3.6-4 & 5.6-6	+	5-5.6 & 6.6-7	+
3.6-4 & 6-6.6	+	5.6-6 & 6-6.6	-
3.6-4 & 6.6-7	+	5.6-6 & 6.6-7	-
4-4.6 & 4.6-5	-	6-6.6 & 6.6-7	-

Table-6: significance of difference between age groups for articulatory skills. + Presence of significant of difference; - absence of significant difference.

Si.Di - Significant difference.

Walsh test was administered and no significant differences in articulatory skills between the two testings were observed indicating that the test is reliable. The scores of the two consecutive tests are in the following table. (Table-8).

Age groups	Sex	First administration	Second administration
3.0-3.6	M	60	60
	F	65	66
3.7-4.0	M	74	72
	F	78	81
4.1-4.6	M	78	79
	F	79	78
4.7-5.0	M	76	77
	F	78	78
5.1-5.6	M	87	86
	F	82	82
5.7-6.0	M	85	84
	F	84	84
6.1-6.6	M	84	85
	F	85	85
6.7-7.0	M	86	86
	F	84	84

Table-8: The scores obtained on the 2 consecutive tests.

Validity:

The test was administered to four children (2 boys and two girls) with misarticulation. The comparison between the scores obtained and the average scores in table (Table-9).

Subject's age (in years) and sex.	Average score for normal children.	Score obtained
4.6, M	77.93	52
5, F	78.67	63
4, F	74.67	70
13, M	85.26	75

Table-9: Comparison between the scores obtained and the average scores for normal children.

Comparing the two scores, it was noticed that the scores obtained by the misarticulation cases were much lesser than that of normal children. Thus, the test can differentiate normal children from misarticulation cases. However, it's validity has to be checked using a large number of cases.

Summary and conclusion:

A diagnostic picture articulation test in Malayalam was constructed and standardized.

11 vowels and 33 consonants were selected for testing. 350 words which were familiar, picturable and unambiguous were prepared using these phonemes and a familiarity rating was done. 86 words including all phonemes in Malayalam which were rated as highly familiar were considered for the test. Black and White line drawings were drawn which formed the test material.

The test was administered to 240 normal children in the age range of 3-7 years for obtaining the normative data. 15 males and 15 females from each sub-group (3.0-3.6; 3.7-4.0; 4.1-4.6; 4.7-5.0; 5.1-5.6, 5.7-6.0; 6.1-6.6, 6.7-7.0) were selected. The cards were presented visually one card at a time and audio-visual stimulation was kept minimum. Responses were recorded on the response sheet provided. A score of '1' was given to each correct responses.

The data for each age group was statistically analyzed. T-test was administered at a confidence level of 0.05 to find out the presence of significant difference within the age group between the sexes and across the age groups.

It was found that the performance varied from one age group to another. As age increased, the scores also increased.

All the vowels were found to have acquired by the children by the age of 3 years. Most of the consonants were acquired by the age of 3. except fricatives (/s/ /š/ and /s/) , lateral /l/, flap /r/, trap /R/ and aspirated phonemes (/p^h / c^h , /t^h/ and k^h/). The items of the articulation test were arranged based on the age at which each phoneme is acquired (i.e. the order of difficulty), and is presented in Appendix-3, for a diagnostic test.

When compared with Western studies, it was found that eastern population acquired phonemes earlier. The early articulatory acquisition in Malayalam speaking children may be attributed to the cultural differences or a change in norms, over years.

On T-test, it was found that there was no significant difference between males and females except in the age group 3.0 - 3.6 years, in terms of articulatory skills (confidence level 0.05).

The test was found to be reliable and also valid. However, further standardization of the test on a large population need to be done.

It can be concluded that the Malayalam articulation test (picture form) is useful as a diagnostic tool and also to aid in prescribing the nature of speech correction desired.

DEEP TEST OF ARTICULATION IN MALAYALAM: SENTENCE FORM**Introduction:**

It is well-documented that adjacent sounds influence each other during speech production (Spriesterbach and Curtis, 1951; Kozhevnikov and Chistovich, 1966) thus, as contexts change, production variability is observed. In order to describe an individual's articulatory skills and determine the phonetic strategy, it is recommended that a systematic search be conducted for phonetic contexts in which a sound may be produced correctly. Such testing allows for a more representative sampling of sound production in a variety of phonetic contexts.

Deep test of articulation is one of the diagnostic articulation tests in which each sound is tested in all possible phonetic contexts. That is, a sound is deep tested in a variety of phonetic contexts, as the sound is followed and preceded by each of the other consonants.

Deep test represents a marked departure from conventional tests of articulation. It is based upon the premise that speech is a continuous process of movements of articulators rather than a series of static positions of the structures. The function of consonants whether occurring

singly or in clusters, is either to release or arrest syllables. The movements of the articulators into and out of a given consonant affect the character of the consonant. In order to analyze the correctness of the phoneme, then, it has to be deep tested i.e. it has to be tested in many contexts in which it occurs in running speech.

The need for such testing, according to McDonald (1964a) is based on two premises: (1) three position inventories are representative of the location of sounds in written words rather than in connected speech; and (2) articulation errors, especially in children, are highly variable and inconsistent.

The purposes of the deep test of articulation are:

1. To permit evaluation of speech sounds as the audible end-products of a series of overlapping, ballistic movements;
2. To provide a test long enough to permit observation of the degree of variability present in the speaker's production of the sound.
3. The sentence or picture cards of the deep test may be used following the administration of any of the

conventional tests to given information on consistencies and inconsistencies of errors and to help search for key words and contexts.

4. Deep test can be very useful in the exploration of phonetic environments in which consonant production may be correct.

The Deep test of articulation (McDonald,1964) has two forms. The picture form and written sentence form. In the picture form, two different sets of picture cards are used simultaneously to 'deep' test the sound in a variety of phonetic contexts, as the sound is preceded and followed by vowels, and as the sound is followed and preceded by each of the other consonants.

As with the picture test,with the sentence test, two different sets of sentences are used, one set for the consonant preceded by a vowel and the other consonants immediately preceding the consonant being 'deep tested'.

Limitations of the deep test:

1. It can be extremely long and laborious.
2. It cannot 'deep test' more than two sounds at one meeting if they are evaluated in all phonetic contexts.
3. The results are not valid for children with certain types of speech problems.

4. The children who speak slowly and children with multiple articulation errors have difficulty blending the two separate words into one single word without pausing. Yet these children do not have difficulties in speaking when pauses are part of natural speaking situations. Children with neuromuscular disorders involving the articulators have trouble also in joining words without a pause, particularly when fricatives are blended together.
5. These children are not able to make the articulatory adjustments necessary to produce all the 'funny words' in the picture forms of the test.
6. The construction of 'funny words' can provoke too much laughter and thus reduce motivation.
7. Some children/may even resist saying the word because of these reactions and thus negate the validity of any test results.
8. Many hours of listening to the responses of children to the list item would be necessary before concluding the findings to be valid.

In spite of these limitations, the deep test of articulation has definite advantages over other diagnostic articulation tests. This necessitates its inclusion in the test

battery for the assessment of articulation disorders. At present, 'deep test of articulation' is available only in English and Kannada.

Review of literature: Various deep tests have been constructed so far both in sentence and picture forms which are described in table (Table-10).

Name of the Test ₁	Constructed ² by	Materials used	Age range	Procedure	Other particulars
	3.	4.	5.		6.
Deep test of articulation of /r/	Dorsay (1959)	50 items sentences which present /r/ in a representative sample of more than 2000 contexts.	-		-
Deep test of articulation in English: Picture form	McDonald (1964)	13 consonants are tested in real words, but the combination results in a nonsense syllable.	Kindergarten & above	In this test, pairs of pictures are named to make a 'funny big word' out of the two little words. They are instructed to name the pictures as a bisyllable, i.e. with no pause between the words.	For both (b) and (c): Distinctive feature analysis is done. This help in identifying correct production that are valuable starting points for therapy and also as an indicator of progress resulting from speech training. A sequential numbering system has been used for the picture in the picture deepest and for the sentences in the sentence Deep test.
Deep test of articulation: sentence form.	McDonald (1964)	13 consonants are tested in which short sentences are employed length of utterance of most sentences is 4 to 5 words with a few containing 7 to 8.	Any one who third grade	Having the child read the sentences which are written at an easy reading level for the average 3rd grade child. If the child is not able to read, picture form is used.	

1.	2.	3.	4.	5.	6.
SDTA (screening deep test of articulation)	McDonald (1968 & 1976)	Pairs of pictures are used to elicit '9' commonly misarticulated consonants.	Kindergarten and above	The child is required to name the pairs of pictures, with no pause between the words. Score for each subject is obtained and interpreted in terms of phonetic contexts in which each tested consonant was articulated correctly.	A phonetic profile can be drawn for each child tested, which portrays the pattern of a child's development of articulatory skill. SDTA indicates when further deep testing is needed.
Deep test of articulation test for /s/ (Modification of McDonald's list).	Zenell and Shelton (1972)	3 lists of items (2, 3 & 4) which differ systematically from McDonald's items were selected, each list having A & B subtests.			
DTA for /s/(modification of McDonald's list).	Rockman & Elbert (1984)	/s/ in word initial (CV or CVC), final (CVC) word initial-two morphemes (CVC+inflection) word medial-one morpheme (CVCVC).			

1.	2.	3.	4.	5.	6.
Deep test of articulation in Kannada sentence form.	Rohini (1989)	13 key phonemes are used in meaningful, simple, 3 word sentences, where target words contain sounds in all possible combination. On the whole, 305 sentences i.e. 305 target words) are tested including 108 clusters.	5 years and above.	The children were required to repeat the sentence after the tester. Each correct articulation was given a score of one.	A therapy program can be made on the basis of the easy-difficult phonetic environments by locating the phonetic environments in which the key phoneme is articulated correctly.

Table-10: Various Deep test of articulation,

In this study, a deep test of articulation is; developed in Malayalam language.

Methodology:

Materials: Eight most commonly misarticulated phonemes on the Malayalam articulation test (Picture form) were considered as the key phoneme viz.

- a) Palatal voiced stop / j /
- b) Retroflex voiceless fricative /š/
- c) Alveolar voiceless fricative /s/
- d) Palatal voiceless fricative /ɟ/
- e) Alveolar voiced flap /r/
- f) Retroflex voiced lateral /ɭ/
- g) Alveolar voiced trill /R/
- h) Palatal retroflexed voiced fricativised lateral /ɻ/

Meaningful easy words were selected with these phonemes in the initial and medial positions and also in all possible clusters. The vowel contexts considered includes /a/ or /ā/ /i/ or /ī/, /u/ or /ū/, /e/ or /ē/ and /o/ or /ō/. The meaningful words were selected from I, II, and III standard Malayalam Text books, so that they would be easy as well as familiar for the children. These words were embedded in a simple two or three word sentences with target word in the initial or medial position. Totally, the test comprised of '87' sentences to test 87 target words, including 27 clusters. The phonetic contexts for the selected phonemes are in table (Table-11).

	Vowel;		Consonants	
	Preceding	Following	Preceding	Following
ɳ	a, i, u, ē, ā	a, i, u, e, ō	ʈ, k, t	m, t
r	a, ū, ī, p	a, ī, u, e, o	-	d, g
R	a, i, ē, o	a, i, u, ē, ō	k	k, m, p, t, v
ʃ	a, i, u, ē, ō	a, ī, u, ē, ō	-	v, r, C
ɭ	-	a, i, u, e, o	l, h	-
j	a, ī, ū, ō	a, i, ū	j, n	n
ʂ	a	u, i, u, ē, ō	t, p, k, ɳ	k
ɽ	-	a, i, u, ō	C	-

Table-11: Phonetic environments used in the deep test of Malayalam.

All the sentences produced were written down with one sentence for a phoneme in one page, thus forming a book-let (Appendix.4).

Subjects: 90 Malayalam speaking children (15 males and 15 females in each group) in middle socio-economic group from I, II and III standard with the age range of 5-6, 6-7, and 7-8 years were selected as subjects for the study. None of them had any speech and language problem and all had normal oral mechanism structurally and functionally as evaluated by a speech pathologist, and had no reported hearing problem and history of ear discharge.

Testing: The child was seated comfortably facing the tester and each child was examined individually. Each child was asked to repeat, the sentences which were read by the tester one at a time.

Templin (1957), Antony et al (1971) found no significant difference between spontaneous vs imitative responses. These studies justify supplementing the information gained from spontaneous responses by accepting repeated 'answer-words' as equally valid. Hence the method of eliciting responses by imitation was used here.

Whenever the subject made mistake in the utterance of target phoneme, the whole sentence was repeated and consistent misarticulations after two repetitions were considered as an error.

Interpretation: Responses (correct response (CR), substitution (s with the substituted phoneme), omission (0), distortion (D), addition(A), any other type of articulation deviation ()) were recorded on the response sheet (Appendix-5) for each child. Each correct response in the test was given a score of 'one' and the total score for each subject was computed. The data thus obtained was grouped and statistically analyzed. The mean and/standard deviation were obtained

for both males and females separately under each group.

'T'-test was used to find out the significance of difference between males and females in general, between males and females under each group and also between groups.

Results and Discussion:

Results are discussed under the following headings.

1. Distribution of total score
2. Distribution of scores among subgroups
3. Item analysis
4. Order of difficulty of the items.

1. Distribution of total score:

The articulation score increased as the age advanced, in both males and females. Females exhibited higher total scores than males. Even/at the age of 8 years the children did not attain 100% scores.

Age groups	Sex	Total score	Percentage	Mean score	Percent-age
5-6 years	M	73.9	84.9	74.66	85.8
	F	75.4	86.67		
6-7 years	M	81.4	93.56	81.2	93.33
	F	81.0	93.1		
7-8 years	M	83.5	95.97	83.4	95.86
	F	83.27	95.71		

Table-12: Total scores obtained by different age group.

The findings of Wellman (1931), Poole (1934) Templin (1957) and Rohini (1989) indicates that 'phoneme' development is correlated with age and that some sounds are mastered, earlier than others. The results of the present study confirms those of the above in that articulation scores and thus the articulation skill increased with age.

T-test results showed no significant difference between males and females in any of the three age groups studied in terms of articulatory skills (Confidence level 0.05).

Distribution of scores among sub-groups:

A. I Standard (5-6 years):

These children obtained a score of 74.66 with 85.8% within the group, males obtained a score of 73.9 as against the females score of 75.4 with 84.9% and 86.67 percent respectively. The phonetic environment which were uttered incorrectly by these children are enlisted in Table-13.

B. II Standard (-6-7 years):

The children in this age obtained a score of 81.2 with 93.33%. Within the group, males and females obtained

scores of 81.4 and 81.0 (i.e. 93.56% and 93.1%) respectively. The phonetic environment which were uttered incorrectly by these children are enlisted in Table-14.

C. III Standard (7-8 years):

The children in this 'Sub-group obtained a score of 83.4 with 95.86%. Within the group, males and females scored 83.5 and 83.23 (i.e. 95.97% and 95.71%) respectively. The phonetic environments which were misarticulated by these children are enlisted in Table-15.

3 Item analysis:

An item analysis was carried out on the 7830 responses of the 90 children to the 8 items to obtain the information on the item correct/wrong and to test the item in order of difficulty. (a) to (h) of Fig.3 and Table-16 shows the percentage of items correct in various age groups among males and females.

Item analysis of the responses obtained indicate that, in males, the percent response, correctly articulated increased as the age increased for all the items. In females, the percent correct response increased for /r/, /ř/, /l̥/ and /l̥/. For /ʃ/ /R/, /j/ and for /s/, there was an increase in score from the age group 5-6 to 6-7 years, but the scores decreased slightly for 7-8 years (Table-16).

Phonemes	Vowels		Consonants	
	Preceding	Following	Preceding	Following
s	i, ē	u, e	t, k, t	t
r	ū, ī	ī	-	d. g
R	a, i, ē, o	-	-	k, v, t, m, p
v	a, i, u, ē, ō	a. ī, u, ē, ō		v, r, c
!	-	-	-	h
j	ū	-	J, ŋ	ŋ
S	a	a. i, u, ē, ō	n, t, p, k	k
l		a, i, u, ō	C	-

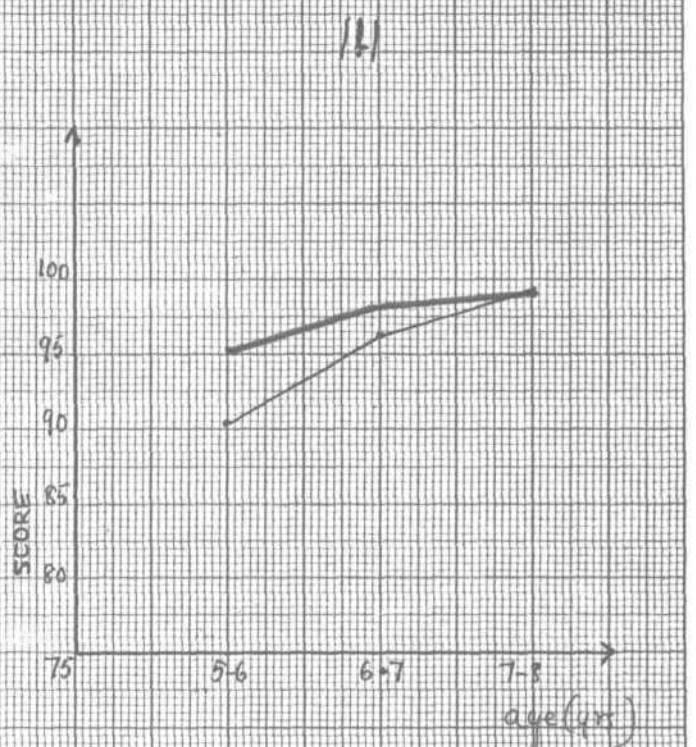
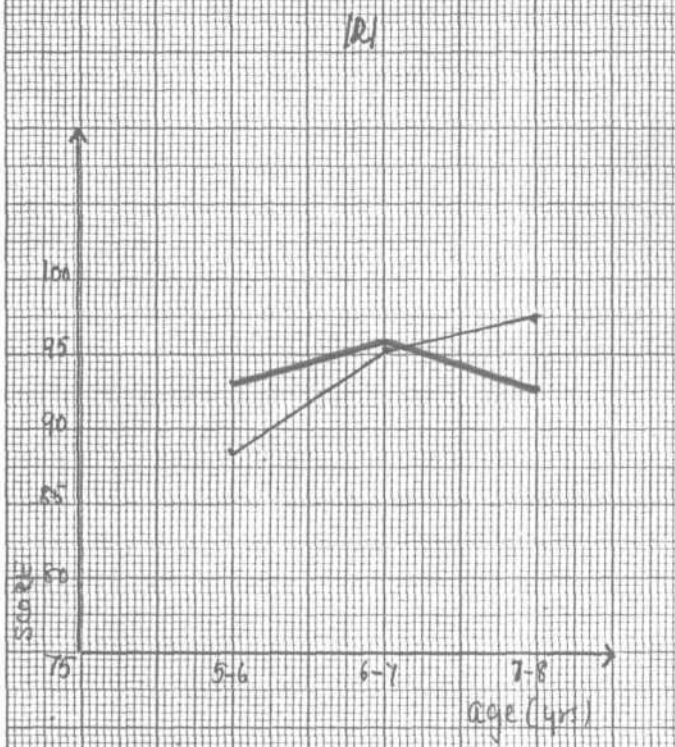
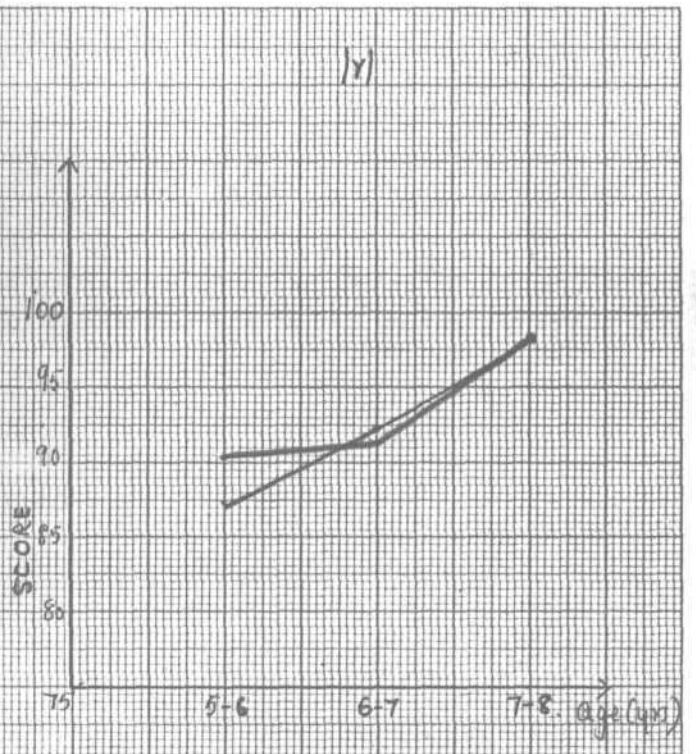
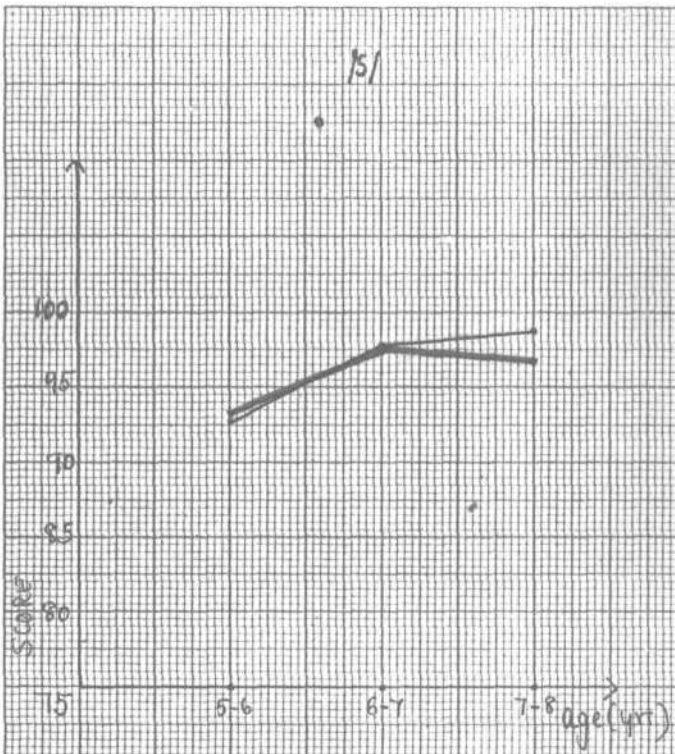
Table-13: Phonetic environments uttered incorrectly by the age group 5-6 years.

Pho- nemes	Vowels		Consonants	
	Preceding	Following	Preceding	Following
s	u, ō	u	ʔ, t -	
r	a, ū	e, u	-	g, d
R	-	-	-	v, k, m
s	a, i, u, ē, ō	a, i, u, ē, ō	-	v, r, c
l	-	-	-	h
j	-	-	j.n	n
s	a	i, u, ō	k, t	k
l -	a, i, u, o	-	-	c

Table-14; Phonetic environments uttered incorrectly by the age group 6-7 years

Pho- nemes	Vowels		Consonants	
	Preceding	Following	Preceding	Following
s	u	u, e, i	t	t̥
r	ī	-	-	d, g
R	-	i	-	v m
s	-	ē	-	v r
l	-	-	h	-
j	-	-	j	n
s	a	a, i, u, ē, ō	p, t, k, n	k
l	-	-	c	-

Table-15: Phonetic environments uttered incorrectly by the age group 7-8 years.



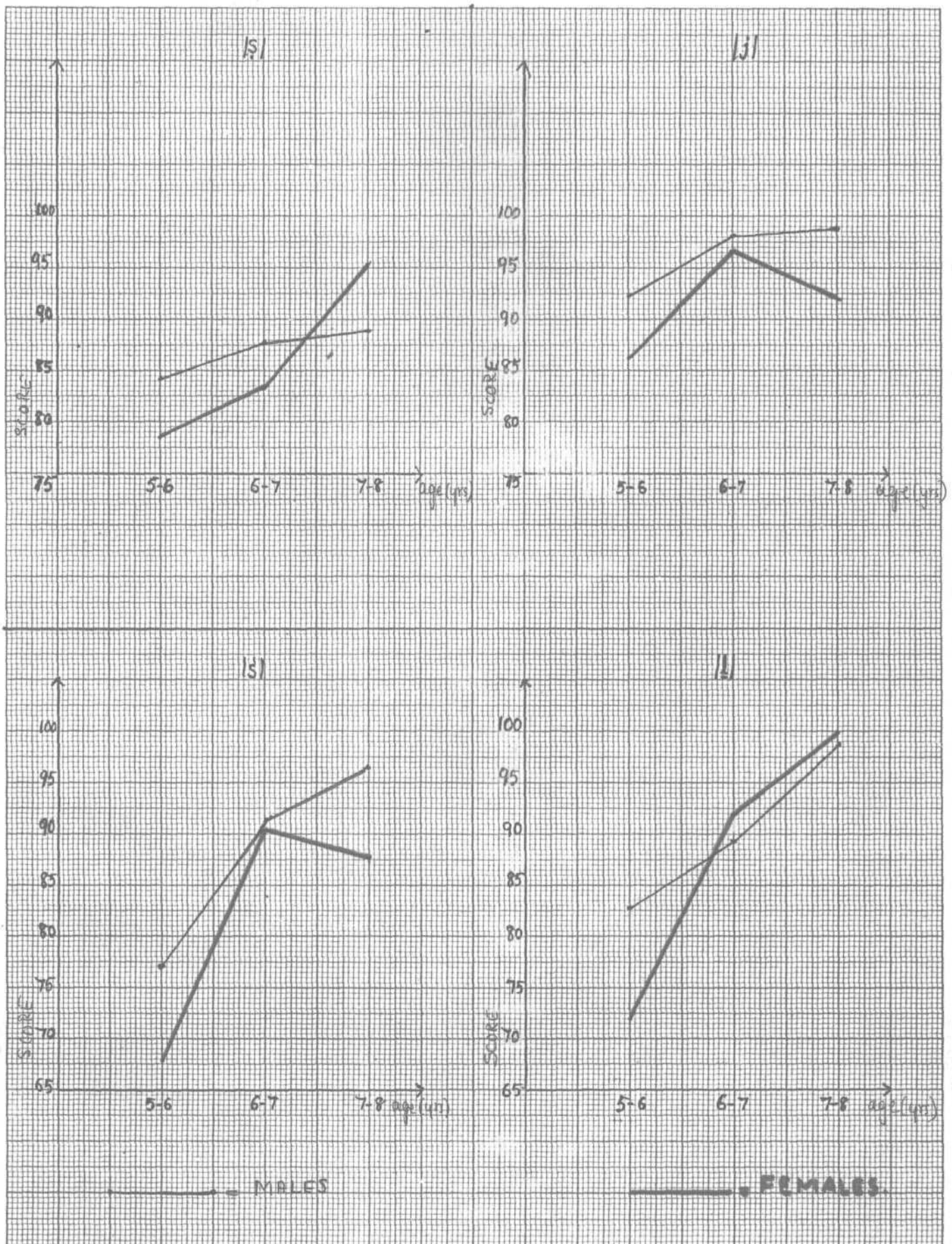


Fig 3: Articulation Scores obtained for 8 phonemes by the 3 age groups

Pho- nemes	Sex	5-6 years		6-7 years		7-8 years	
		Percent- age	Average	Percent- age	Average	Percent- age	Average
s	M	92.9	93.1	97.8	97.6	98.7	97.8
	F	93.3		97.3		96.9	
r	M	87.3	89.1	92.1	91.8	98.8	98.8
	F	90.9		91.5		98.8	
R	M	88.8	91.3	95.1	95.3	97.8	95.3
	m	93.8		95.6		92.9	
š	M	84.1	81.3	87.7	85.4	88.7	92.3
	F	78.5		83.1		95.9	
ḷ	M	90,5	92.9	96.2	97.2	99.1	99.03
	F	85.4		98.1		99.0	
j	M	92.7	89.9	98.0	97.4	98.7	95.4
	F	86.0		96.7		92.0	
s	M	77.0	72.4	91.5	90.8	96.4	90.8
	F	67.9		90.0		87.9	
ḷ	M	82.7	77.4	89.4	90.7	98.7	90.7
	F	72.0		92.0		100.0	

Table-16: The percentage of items correct in various age groups among males and females.

The most difficult item was /s/ (voiceless palatal fricative) for the agegroups 5-6 years and 7-8 years, but for the age group 6-7 years, it was /ʃ/ (voiceless retroflex fricative). These were followed by other fricatives, flap and trill. Results from Malayalam picture articulation test showed that /s/ was acquired by the children of this language only by 5-5.6 years. They acquire /R/ by 4.6-5.0 years, /ʃ/ by 4 - 4.6 years. The results from deep test of articulation can be explained on the basis of this acquisition pattern. In Kannada /h/ and fricatives were the most difficult (Rohini, 1989). However, some of the phonemes used in Kannada deep test were different than that used in this test.

Order of difficulty of the items:

Based on the percent of scores obtained for each phoneme from the item analysis, the phonetic environment of the items were listed in the order of difficulty, for each age group (Table-17).

For each phoneme, the order of difficult of phonetic environments in each age group was calculated which are in the figures-4,5, and 6. In general, the vowel environments were the easiest and the consonant environments were the most difficult. Among the consonant environments, fricatives,

Age (Years)	Sex	1	2	3	4	5	6	7	8
5-6	M	s	j	ɻ	R	r	š	ɹ	s
	P	ɻ	a	š	r	ɹ	j	s	8
6-7	M	j	s	ɻ	R	r	s	ɹ	^v s
	F	ɻ	a	j	R	ɻ	r	s	š
7-8	M	ɻ	r	s	ɹ	j	R	s	š
	F	ɹ	ɻ	r	s	š	R	j	s

Table-17: The order of difficulty of phonetic environments, in different age groups.

flaps and trill environments were found to be the most difficult. However, no particular pattern in the order of difficulty was found.

In summary, the deepest has provided the sentences for 8 phonemes to be deep tested and the scores obtained here can be used as standard or cut-off scores. However, the test-retest-reliability and the validity of the test should be assessed. Also, the test need to be standardized on a large population.

Summary and conclusion:

The present study was aimed at developing a Deep Test of Articulation in Malayalam language. Eight commonly mis-

articulated phonemes on the Malayalam Articulation Test (picture form) were selected for this, (/s/ /r/ /R/ /š/ /s/ /l/ /j / and /l/. Meaningful easy words were selected with these phonemes in the initial and medial positions and also in all possible clusters. The vowel contexts considered included /a/ or /ā/, /i/ or /ī/, /u/ or /ū/, /e/ or /ē/ and /o/ or /ō/. Meaningful words were selected from I, II and III standard Malayalam Text books, so that they would be easy as well as familiar for the children. These words were then embedded in a single 2- or 3- word sentences with target word in the initial or medial position.

Totally, the test comprised of 87 sentences to test 87 target words, including 27 clusters. The subjects considered for the study included 30 Malayalam speaking children (15 males and 15 females) each from I, II and III standard within the age range of 5-6, 6-7 and 7-8 years, each having normal speech and hearing and belonging to middle socioeconomic status. The subjects were individually tested and instructed were to repeat the sentences after the tester. Whenever the child incorrectly articulated, the same sentence was repeated twice and if the articulation was incorrect, it was considered as an error.

Each correct articulation of the subject was given a score of 'one' and the total score of each subject was grouped and statistically analyzed. On T-test, it was found that there was no significant difference between males and females in all the three groups studied in terms of articulatory skills. Across the groups, all the age groups showed significant differences in the score obtained.

The results indicated that the articulation scores increased as the age advanced, in both the sexes. On item analysis, it was found that the items /š/ and /s/ were the most difficult to articulate. The vowel environment was the easiest and the consonant environment was the most difficult.

It can be concluded that the present test helps in evaluating articulation in detail, with which the phonetic environment in which the phoneme is correctly articulated can be located. A therapy can be programmed on the basis of these easy difficult phonetic environments. However, the reliability and validity of the test need to be assessed and the test has to be standardized on a large population and norms are to be developed.

PREDICTIVE SCREENING TEST OF ARTICULATION IN MALAYALAM(PSTAM)

Introduction:

Prediction is one of the functions of an articulation test. Predictive screening test of articulation is designed specifically and solely as a prognostic tool (Van Riper and Erickson, 1964).

The length of time required for the learning and maturation of articulation varies with different individuals, and at least until the age of eight, increases in chronological age often are accompanied by normal and spontaneous decreases in the number of phonemes which a child misarticulates. Physiological, intellectual or emotional factors may impede this process, but even in the apparent absence of such limitations, some persons fail to acquire normal articulation until they have received speech therapy. (Van Riper and Erickson, 1964).

The purpose of predictive screening test of articulation is to assist the clinician in identifying these children who, although have been judged currently to have misarticulation, may nevertheless be expected to overcome their articulation errors without professional help and conversely to identify those who are least likely to attain

normal articulation without assistance (Van Riper and Erickson, 1964). The predictive screening test of articulation is viewed, then as a supplement to existing standardized tests rather than as a substitute for any of them.

Dependable early identification of children who definitely will require therapy can ensure that these children begin to receive sufficiently intensive help before their articulatory errors are strongly habituated.

Review of literature:

The general procedure employed in studies designed to perform this function involve the selection of (a) age levels and the intervals over which the prediction is to be made (b) measures to be used as predictive variables and (c) articulatory tests which will measure improvement at the end of the test interval. A variety of measures have been selected as potentially predictive. Included are such measures as the number of articulatory errors, the ability to correct an articulatory error when stimulated with the correct production of the sound, the ability to learn non-English sounds performance and intelligence and motor tests and performance on speech sound discrimination tests. The studies pertaining to PSTA are in Table-18.

Study by	Age of sub-jects	NO. Of sub-jects	Materials used	Procedure	Results.
1.			4.	5.	6
Reid (1947)	2. 8 yrs 8 mns (Mean)	3. 38 (experimental group) and 41 (control group)	4. Articulation score, mental age, IQ (California Maturity Test), Chronological Age (Fontaine's auditory memory span test(40) Templin's sound discrimination test. Pattern's kinesthetic sensibility test with additional but undecorated kinesthetic tests of speech mechanism and California test of personality scores were assessed and compared with speech improvement.	5. The experimental group received speech correction while the control group did not. It centred upon the child's defective sounds and administered twice a week for periods of 30 to 40 minutes. Articulatory improvement was determined for both the groups after 6 months, (testing was done one month after completion of the speech correction program for experimental group.	6 IQ and speech discrimination were found to have predictive value.
Snow & Mill- sen (1954)	Ist grade & 2nd grades	38 1st graders and 43 2nd graders.	One imitative test & one picture test. 25 consonants were tested in words in the 3 word positions in both.	The children were enrolled in speech correction classes. Both the spontaneous and imitative utterances were tested again on the picture test 6 months later and responses were scored again.	The difference scores between the initial oral test and initial picture test was correlated with the difference score between the initial picture test and final-picture test. The correlations were 0.71 and 0.533 for grade I and grade II respectively.

2.	2.	3.	4.	5.	6.
Petit (1957)	5 yrs (Mode)	60	A 69 item consonant articulation test scored according to the index devised by Wood(1949).	Speech instruction was not given. The subjects were retested after 8 months on the same articulation test and the gain score was computed. Correlations were computed between the gain score and a hand tapping test(the number of simultaneous taps with both hands per second), IQ as measured by CMMS, initial articulatory score, personality score as measured by California test of personality and a nonsense test of articulation.	The significant factor found were initially articulatory score initiation articulatory score and personality score (They are negatively correlated, indicating that higher the score on pretest measures. the lower the articulatory gain)
Carter and Buck (1958)	Ist graders who had functional articulatory problems.	77	Spontaneous, imitative and nonsense syllable articulation tests.	Speech instruction was not given. The three tests were administered at the beginning of their first grade. The spontaneous (picture) test was again administered at the close of the year.	The children who showed a high percentage of correlation of defective sounds/from the spontaneous to the nonsense syllable test were for the most part successful in achieving normal articulation by the end of the year without therapy.

1.	2.	3.	a.	5.	6.
Bteer & Drexler (1960)	K.G (mode)	93	An 18 item test of articulation. Variables selected were IQ, social maturity (SO) number of articulation error in the initial, medial & final positions; errors of omission in the final positions, total errors and errors an individual consonant and consonant groups.	54 of the subjects participated in a 12 week speech improvement program at the conclusion of which articulation test were again administered to the entire group. 5 years later, the articulatory ability of the same children was retested.	The predictive variables found were (1) the total number of errors in all positions within words (2) errors in the final positions (3) errors or omissions in the final position and (4) errors on the (f) (1) consonant group and amount of improvement during the intervention program.
Mary Stuart and Fargubar (1921)p	KG	300	Spontaneous picture articulation test, test of initiation and test of auditory discrimination	These 3 were administered. A retest of spontaneous speech was made 7 months later, speech therapy was not given.	The ability to imitate the correct form of a misarticulated sound in words and nonsense syllables had prognostic value.
VanRiper and Erickson (1964)	Ist grade	167	111 experimental items from the 500 test items suggested as having possible prognostic value collected from a survey of available literature and interviews with experienced speech clinicians.	speech instruction was not given. The same subjects were retested after 2 years by means of a simple phonetic inventory & by the elicitation of samples of spontaneous connected speech.	47% of the subjects had spontaneously mastered normal articulation during the interval between the beginning of the first grade and beginning of the 3rd grade.

1.	2.	3.	4.	5.	6.
				<p>On the basis of observations, each subject was classified as a member either of the still defective group or the normal articulation group</p> <p>On the basis of this dichotomization the analysis were performed over each of the original 111 items.</p>	<p>On the 57 items thus identified, these 47 which required no special materials for the administration were selected for inclusion in the PSTA.</p>
				<p>Remarks: PSTA would yield a useful predictive index, easy to administer, involved only a simple pass-fail judgement for scoring, the administration timer ranged from only 5-10 minutes. The PSTA could function equally well in a population other than used in the derivation of items.</p>	<p>A cut-off score of 34 is used. This indicate that all cases whose score is 33 or less on the PSTA are included in the therapy and those who score 34 or more are excluded from therapy.</p>

Table-18: Review on predictive screening test of articulation.

The review indicates that the predictive screening tests have been developed over the past few decades and are being used effectively. The present study intends to develop a predictive screening test in Malayalam.

Predictive screening test of articulation in Malayalam:

Construction of the test: Initially, a format was prepared to select phonemes to be included in the predictive screening test of articulation. The format included all the phonemes in Malayalam and the developmental sequence of these phonemes based on the diagnostic test results. (Appendix-6). This format was, then, given to 70 speech and language pathologists who had experience in the area of articulation and its disorders for about 3-10 years, and they were instructed to suggest the phonemes for predictive testing and also the criteria for the selection. 41 of 70 responded and the responses were analyzed for the phonemes to be included in Predictive screening test of articulation. The number of times a phoneme was selected was calculated and converted to percent to enable the selection of phonemes for Predictive screening test of articulation.

The subjects reported various criteria for selecting the phonemes (Table-19) though nine criteria were used.

the selection of phonemes was mainly on the basis of item difficulty.

With respect to the number of times a phoneme was selected, /s/ was selected 70.7% of the times (highest) and n 0.09% of the times (lowest). The phonemes were ordered according to the percent obtained (Table - 20) and were selected for testing based on the method adapted by Van Riper and Erickson (1964). 11 phonemes and 9 clusters were selected and cut-off percents were 36.6 for both phonemes and clusters. Only one cluster was selected inspite of four clusters obtaining scores of 36.6. -nk was selected as /k/ was the most difficult environment. The method of Van Riper and Erickson (1964) was adapted and the predictive screening test of articulation was divided into eight parts to test for the ability to articulate, articulatory movement, discriminatory ability and rhythm which are described.

Part-I: The purpose of this group of items is to determine the accuracy of the child's response to auditory stimulation with words containing specified single consonant sounds. The 11 phonemes selected for Part-I include /s/, /r/, /š/, /R/ /s/, /k/, /g/ and /p/ in their

Sl.NO.	Criteria	No.of responses	Percent
1.	2.	3.	4.
1.	Item difficulty	9	21.9
2.	Place of articulation + item difficulty	6	14.6
3.	Manner of articulation @nd item difficulty	6	14.6
4.	Place, manner and sequence of development	6	14.6
5.	Frequently miaarticulated	5	12.2
6.	Sequence of acquisition (ie. the speech sounds which are acquired later in development	3	7.3
7.	Place and manner of articu- lation	3	7.3
8.	Place of articulation	2	4.9
9.	Short vowels (as representa- tives of vowels) and difficult consonants	1	
	Total	41	

Table-19: Various criteria for selecting the phoneme.

Pho- neme 1.	Perce- ntage 2.	Pho- name 3.	Perce- ntage 4.	Pho- neme 5.	Perce- ntage 6.	pho- neme 7.	Perce- ntage 8.	Blends 9.	Percent age. 10
ɚ	70.7		36.6	c	24.4	1	14.6	sk	51.2
r	70.7	j	34.15	ŋ	24.4	n	.097	-ntya	48.8
ʒ	68.3	b	34.15	h	21.9	n	.09	kr	43.9
l	68.3	m	34.15	v	21.9	Blends		-nk	36.6
ɚ	56.1	tʰ	31.7	pʰ	19.5			-nt	36.6
R	56.1		31.7	l	19.5	Str	68.3	-nc	36.6
t	41.5	d	31.7	d	17.1	kša	56.1	-nt	36.6
k	39.02	t	29.3	n	17.1	tra	56.1	-nd	34.15
g	39.02	tʰ	29.3	Vow els	14.6	sta	56.1		
p	39.02	tʰ	24.4	n	14.6	pr	53.7		

Table-20: Percent selection for various phonemes.

initial and medial positions and /l/ /t/ and /cʰ/ in their medial positions. Words with these phonemes were selected from the diagnostic articulation test.

Part-II: The purpose of this group of items is to determine the accuracy with which specified two and three consonant blends are articulated in words which the child says when imitating single presentation of these words by the examiner.

The 9 blends selected include stra, ksa, tra, sta, pra, n%ya, kra, nka and nca, in their medial position and only /ska/ in their initial and medial positions. Words with these blends were selected from the diagnostic articulation test.

Part-III: The purpose of this item is to determine the accuracy with which all of the phonemes are articulated in a sentence which the child repeats after hearing the examiner say the sentence. Two Malayalam sentences were selected in which all the phonemes of the predictive screening test were embedded.

Part-IV: The purpose of these items is to determine the child's ability to produce the /s/ and /š/ in isolation following auditory stimulation. The items included are (a) production of /s/ in isolation, sustained for three seconds and (b) production of /š/ in isolation, sustained for three seconds.

Part-V: The purpose of these items is to determine the child's ability to articulate the /c/y / j / , /p/, /t/ and /k/ sounds correctly in specified syllables. Items for this part include /ca ca ca/ /ja ja ja/ and /p t k /. (/s/ and /z/ as given by Van Riper and Erickson (1964) was not selected because /z/ is not a phoneme in Malayalam).

Part-VI: The purpose of this item is to determine the child's ability to move the tongue independently of the jaw and lips in producing the syllable /la/.

Part-VII: The purpose of this item is to determine the child's ability to discriminate between a correct and an incorrect production of a phoneme and to identify the incorrect production. The items include two sentences in which words containing correctly and wrongly articulated /s/ and /r/ are used, (i.e. surian/turian and radio/dadio).

Part-VIII: The purpose of this item is to determine the child's ability to replicate a hand clapping rhythm presented by the examiner.

The test is given in the Appendix-7.

As this is only a proposed test it should be administered to children of a particular age group who are followed for a duration of one year. The scores from the two administration should be compared and a cut-off score which would yield approximately equally small degrees of false positives and false negatives, should be selected. The cut-off score will identify those children needing therapy and those who should be excluded from therapy.

/t^h and /p^h/ had scores of 12 (29.3%) and 8(19.5%) respectively. As these two phonemes occur late in the acquisition, these may be included in the test. For the similar reason, /p/, which is appearing earlier in the developmental sequence may be excluded from the test.

The effect of the several variables as listed below can also be studied by testing each one and by finding out the correlation between the score for that particular item and the number of corrected phonemes after the specified duration for each child.

1. Articulation test scores - spontaneous speech imitation and nonsense syllable.
2. Self correction of the misarticulations made.
3. Interpersonal and intrapersonal discrimination.
4. Stereognosis (shapes, letters and numbers).
5. Speech sound discrimination.
6. Imitation ability.
7. Diadokokinesis and
8. Improvement during early lesions (only to those whom a speech instruction is provided.)

With the administration of this test to children for a period of time, if standardized, it could be an useful tool in predicting children with articulation disorder and thus helps in early rehabilitation.

Summary and conclusions:

A predictive screening test has been developed on the basis of methods given by Van Riper and Erickson (1964). Phonemes selected as having predictive value by 41 speech pathologists were analyzed and 11 phonemes and 9 clusters were selected for the test.. In the same lines of PSTA (Van Riper and Erickson, 1964), different tasks for 8 parts of the test were developed. Wherever necessary, modifications were made for Malayalam Language. However, as this is only a proposed test, standardization is to be done.



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APPENDIX-AI

Phonemes of Malayalam language

Vowels: a, ā, i, ī, u, ū, e, ē, o, ō,

Consonants

	Bilabials	Labiodentals	Dentals	Alveolars	Retroflex	Palatal	Velar	Glottal
Stops	p, p ^h	b, b ^h		t, t ^h		c, j, c ^h	k, g, k ^h	
nasals	m		n	ɳ	ɳ	ɳ	ŋ	
fricatives				s	ʂ	ʃ		h
laterals				l	ɭ	ɻ		
flaps				r				
trills				R				
frictionless continuant.		v				y		

APPENDIX-AIII

MALAYALAM DIAGNOSTIC ARTICULATION TEST

Name _____ Age _____ Sex _____
 Examiner _____ Date: _____

Age in years	Phoneme to be tested	Checkword	Response
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3.0-3.6

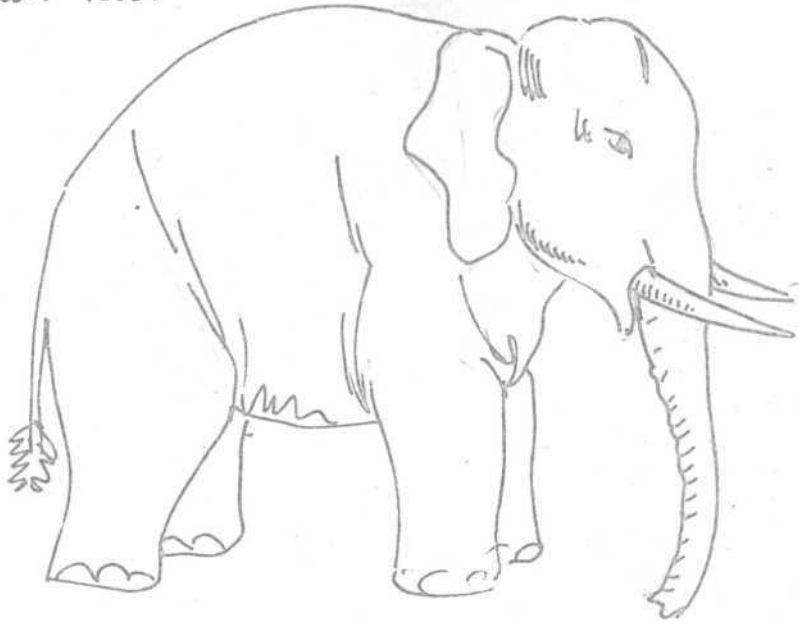
/a/ അ	/annān/ അന്നാൻ		
/ā/ ആ	/āna/ ആന		
/i/ ഇ	/ila/ ഇല		
/ī/ ഇ	/īca/ ഇച്ച		
/u/ ഉ	/uRi/ ഉറി		
/ū/ ഉ	/ūññi/ ഉണ്ണി		
/e/ ഏ	/eli/ ഏലി		
/ē/ ഏ	/ēñi/ ഏണി		
/o/ ഒ	/onna/ ഒന്ന്		
/ō/ ഓ	/ōla/ ഓല		
/k/ ക	/kuda/ കുട		
/	/takōl/ താക്കോൽ		
/g/ ഗ	/gāḍa/ ഗാḍ		
	/bāga/ ബാഗ്		
/ṅ/ ങ	/māṅa/ മാṅ		
/c/ ച	/cippa/ ചീപ്പ		
	/pūca/ പൂച്ച		
/j/ ജ	/jannal/ ജനൽ		
	/gajam/ ഗജം.		
/ñ/ ണ	/ñanda/ ണണ്ട്		
	/ñāññūl/ ണ്ണൂൽ		

1.	2.	3.	4.
/t/ ട		/tāppa/ ടാപ്പ്	
/d/ ഡ		/dōkta/ ഡോക്ടർ	
		/rōḍa/ റോഡ്	
/n/ ണ		/kīṇar/ കീണർ	
		/tūṇ/ തൂണി	
/t̄/ ത		/t̄atta/ തത്ത	
		/mōt̄iram/ മോതിരം	
/d̄/ ദ		/d̄īpam/ ദീപം	
		/maḍḍalam/ മദ്ദളം.	
/n/ ന		/nakṣat̄ram/ നക്ഷത്രം.	
/p/ പ		/pūva/ പൂവ്	
		/uduppa/ ഉടുപ്പ്	
/b/ ബ		/basa/ ബാസ്	
		/riban/ റിബൺ	
/m/ മ		/māla/ മാല	
		/āma/ ആമ	
		/maram/ മരം	
/y/ യ		/yēṣu/ യേശു	
		/muyal/ മുയൽ	
/l/ ല		/lōri/ ലോറി	
		/alamāri/ അലമാരി	
		/viral/ വിരൽ	
/l̄/ ല്ല		/vala/ വല്ല	
		/vāl/ വാൾ	
/v/ വ		/vida/ വീട്	
		/cevi/ ചെവി	
/h/ ഹ		/simham/ സിംഹം.	

1.	2.	3.	4.
	/-nt/ ന്ന	/pānta/ പാന്ത	
	/-t/ ററ	/pūmpāta/ പൂമ്പാത	
	/-nt/ ന്ന	/pantā/ പന്ത	
	/-nt/ ന്ന	/sanci/ സഞ്ചി	
	/-nd/ ന്ദ	/tīvandi/ തീവന്ദി	
	/-nk/ ന്ക	/panka/ പങ്ക	
3.7-4.0	/s/ സ	/sūrian/ സൂരിയൻ	
		/kasēra/ കസേര	
	/p ^h / പ	/p ^h alam/ പലം	
	/r/ ര	/rājāva/ രാജാവ്	
		/ceruppa/ ചെറുപ്പം	
	/-t _n ya/ ത്വ	/int _n ya/ ഇന്ത്വ	
4.0-4.6	/s/ ശ	/ṣank ^h / ശംഖ്	
		/mēṣa/ മേശ	
	/l/ ഴ	/kōli/ കോഴി	
4.7-5.0	/R/ റ	/Rēdio/ റേഡിയോ	
		/uRump / ഉറമ്പ്	
		/kāṣ/ കാർ	
	/-nd _n ra/ ന്ദ്ര	/cand _n ran/ ചന്ദ്രൻ	
	/pra/ പ്ര	/prāva/ പ്രാവ്	
	/kra/ ക്ര	/cakram/ ചക്രം	
	/t _n ra/ ത്ര	/pā _n tram/ പാത്രം	
5.0-5.6	/ś/ ഷ	/śarta/ ഷർട്ട്	
		/braś/ ബ്രഷ്	
	/st _n a/ സ്ത	/pustakam/ പുസ്തകം	
5.7-6.0	/ska/ സ്ക	/skuta:/ സ്കൂട്ടർ	
		/biskat/ ബിസ്കറ്റ്	

1.	2.	3.	4.
6.0-6.6	/c ^h / ഷ /ṭ ^h / ഴ /ṭ ^h / ഴ /ṣtra/ ഴ	/c ^h āya/ ഷായ /kat ^h akali/ കഥകളി /miṭ ^h āyi/ മിരയി /vasṭram/ വസ്ത്രം	
6.7-7.0	/k ^h / ഷ /ḳṣa/ ക്ഷ	/k ^h agam/ ഷഗം /muk ^h am/ മുഖം /naḳṣaṭram/ നക്ഷത്രം .	

Few pictures used in Malayalam Diagnostic Picture
Articulation Test:-



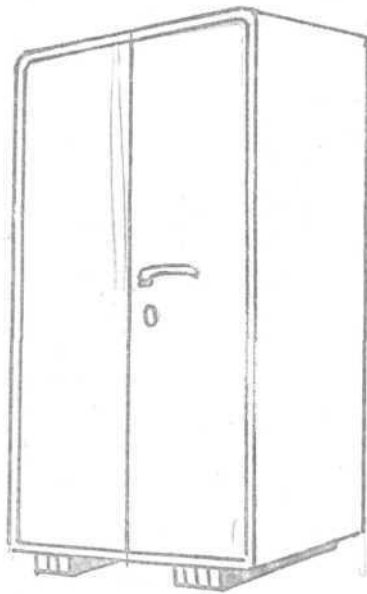
/āna/ എന്ന



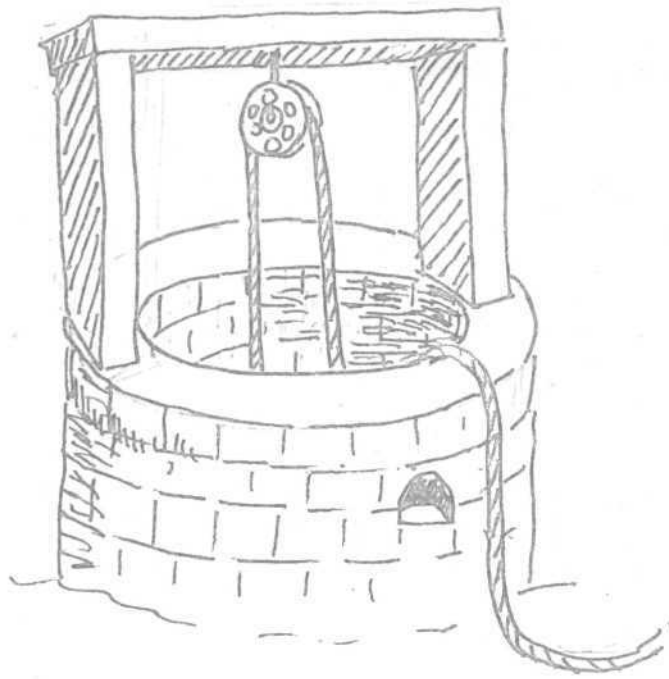
/ila/ ഇല



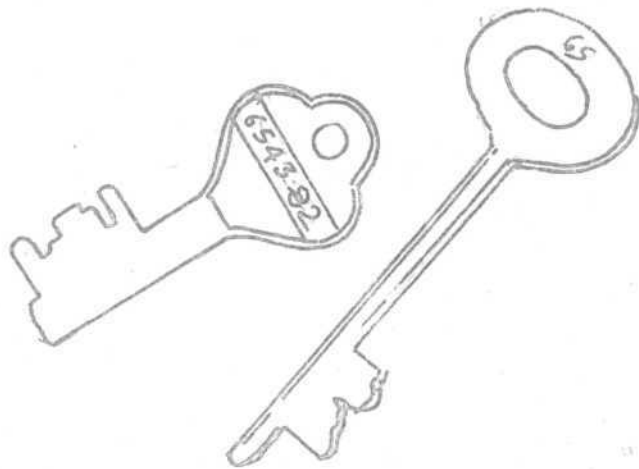
/kasēra/ କେମ୍ବର .



/alamāri/ ଚେମ୍ବରୀ .



|kinar| കുണ്ട .



|tākōl| താക്കോൽ



|simham| సింహం.



|maram| మరం.

APPENDIX-IV

Deep Test of Articulation in Malayalam; Sentence form.

ന -

1. സർപ്പം ഇഴുകുന്നു. x
2. സിംഹം അലറി. x
3. സൂര്യൻ ഇവിടെ വന്നു. U '21 - 4
4. സേന ജയിച്ചു. x
5. സോമൻ ലഡ്ഡു തിന്നുന്നു.

- ന

6. കമ്പോൾ ഉറങ്ങിയിട്ടുണ്ട്.
7. പൈസ പോക്കു നിലയുണ്ട്.
8. അമ്മയ്ക്ക് ചിലർക്ക് കുറവാണ്.
9. ജെപ്പി ചോലം ചോലിച്ചു.
10. നോസായ് വാടി.

ന +

11. അമ്പൻ മാംഗം തിന്നുന്നു.
12. നമുക്ക് ചുട്ടുകൊടുത്തു.
13. നമ്മുടെ വെള്ളത്തിൽ ജീവിക്കുന്നു.
14. അത് സൂര്യൻ നല്ലതാണ്.
15. അത് സൂര്യൻ വാടി.

10-

1. രസം തജ്ഞാഖി.
2. ഇതു രീതി മറ്റണം.
3. ശ്രദ്ധ ചെത്ര വേണം?
4. അമ്പന്റെ രോഗം ദ്രേദമാഖി.

-10

5. മരം വളർന്നു.
6. ഇതു കീറി കടിക്കുമോ?
7. അമ്പർ പുര മേഞ്ഞു.
8. ചെറുതേ വേഗം കിട്ടിപ്പ.
9. അമ്മ മോരു കടിച്ചു.

10+

10. സമുദ്രം വളരെ വലുതാണ്.
11. ചെറിയത് അത്രയും തോന്നി.

n-

1. നവ ഉഷ്ണമാവിൽ നല്ലതാണ്.
2. റിബൺ തലയിൽ കെട്ടാം.
3. റേഡിയോ ഓൺ ചെയ്യൂ.
4. ഞാൻ റൊട്ടി തിന്നും.

-n

5. പാന ചെയ്യി.
6. ഉദ്യോഗസ്ഥൻ നിന്നു മങ്ങി.
7. ഉറി മുകളിൽ തൂങ്ങുന്നു.
8. കൂടുതൽ ചേറ്റ് ഉണ്ടു്.
9. ലോറി പോയി.

n+

10. കൃഷി നല്ല തൊഴിലാണ്.
11. ഗൃഹങ്ങൾ ഓടുന്നു.
12. കൊമ്പ്ര തിന്നാൻ കൊള്ളാം.
13. ഇത്ര ചിത്രം നന്നായി.
14. ദിന ചർച്ച കണ്ടു.
15. ദിനമേ പൂരം ~~മുറുട്ടു~~.

ശ-

1. ശശി വീട്ടിൽ വന്നു.
2. ശിശു പാൽ കുടിക്കുന്നു.
3. നിങ്ങൾക്ക് ശുഭം ഭവിക്കട്ടെ.
4. ശേഷം പിന്നെ പറയാം.
5. ശോഭ ഹിമിടെ പേച്ചി.?

- ശ

6. പശു പാൽ തരുന്നു.
7. കുട്ടിയുടെ കീഴെ നിറഞ്ഞു.
8. അയാൾ കുട്ടനാലം കാണിച്ചു.
9. മേശ മറിഞ്ഞു വീണു.
10. അമ്മ ദോശ ഉണ്ടാക്കി.

ശ+

11. നമുക്ക് വിശ്വാസം വേണം.
12. അമ്പർക്ക് ശ്രദ്ധയ്ക്ക് ഉണ്ടാകും.
13. ഹനിക്കു് അത്യാഹ്ലം ഭജാനി.

- ൫

1. ഈ വള അമ്മയുടേതാണ്.
2. ഞാൻ വിളക്കു് കൊളുത്തി.
3. ഈ കുളം വരണ്ടു.
4. ഇവിടെ മരിച്ചുപോട്ടോ.
5. സ്വർണ്ണം ഭൂമിയിൽ.

൫+

6. അമ്പൽ വെള്ളം കുടിച്ച്.
7. ഞങ്ങൾ അച്ഛനോടൊപ്പം വെള്ളം കുടിച്ചു.

ഋ-

1. ഋലം രലിനമാക്കരുത്.
2. ഋീവൻ വിലയ്ക്കുകയാണ്.
3. ഋലി ചാല കുടിച്ചു.
4. അമ്പൻ ജോലി ചെയ്തു.

- ള

5. ളലള പാട് പാടി.
6. വിളയാ നടുക്ക് രണന.
7. ളല കുള അടച്ചു.

ഌ+

8. അമ്പൽക്ക് ലളള ഭോന്നി.
9. ള്ലാനം ചിപ്പോഴും നല്ലതാണ്.
10. അഞ്ജനം കണ്ണിൽ പുരട്ടണം.

ഷ -

1. ഇന്ന് ഷഷ്ടി ദിവസമാണ്.

- ഷ

2. മഷി കൂപ്പിയിടുണ്ട്.
3. ഞങ്ങൾക്ക് വിഷമം തോന്നി.
4. സൂക്ഷമ കാരണം.
5. വേഷം പലതരം ഉണ്ട്.
6. ചോഷം ചിത്ര കേരമാലി!

ഷ +

7. കൃഷ്ണൻ പണിതുന്നു.
8. പക്ഷി പന്നം പോലി.
9. രാഷ്ട്രം പഠിക്കുന്നു.
10. ചുഷ്പം വാടി.
11. പരിഷ്കാരം കൂടി വരുന്നു.

-ഗൃ

1. മൃഗ രൂപത്തിൽ.
2. കിഴവൻ ചോലി.
3. പുഴ കവിഞ്ഞു.
4. കോഴി കൂമ്പി.

ഗൃ +

5. ഗിര കാഴ്ച കണ്ടു.

APPENDIX-V

Response sheet for Deep Test of Articulation - Sentence form.

Name _____ Age: _____ Class: _____ sex: _____

Speech Mechanism: _____ Date: _____

Phoneme	Phonetic environment	Response				
		CR	S	0	D	A
/s/	sa					
	si					
	su					
	sē					
	sō					
	as					
	is					
	us					
	es					
	ōs					
	ms					
	st					
	ts					
	sk					
st						
/r/	ra					
	rī					
	rū					
	rō					
	ar					
	īr					

Phoneme	Phonetic environment	CR	S	Response		
				0	D	A
/R/	ur					
	er					
	ōr					
	ḍr					
	gr					
	Ra					
	Ri					
	Rē					
	Ro					
	aR					
	iR					
	uR					
	ēR					
	ōR					
	kE					
	mE					
	PR					
	tR					
	kR					
	vR					
/s/	sa					
	si					
	si					

Phoneme	Phonetic environment	CR	S	Response			
				0	D	A	r [^]
/š/	ūj						
	jj						
	jn						
	nj						
	śa						
	aś						
	iś						
	uś						
	ēś						
	ōś						
	śn						
	kś						
	śtr						
	śp						
	śk						
/l/	a _l						
	i _l						
	u _l						
	ōl						
	<u>lc</u>						

(CR - correct response; S - substitution; O - omission

D - distortion; A - addition, - any other type of articulation deviation)

APPENDIX AVI

The format prepared for predictive screening test of articulation in Malayalam

We would like to prepare a predictive screening test in Malayalam. Following are the phonemes in Malayalam language and the articulatory development is as in Table-1.

Vowels: a, ā, i, ī, u, ū, e, ē, o, ō, 3

Consonants.

	Bilabials	Labiodentals	Dentals	Alveolars	Retroflex	Palatal	Velar	Glottal
stops	P, b, p ^h	t, d, t ^h	nat ^h			c, j, c ^h	k, s, k ^h	
nasals	m		n	n	n	n		
fricatives				s	s	š		
laterals				l	l	l̥		
flaps				r				
trills				R				
frictionless continuant.		v				y		

Table:!

3-3.6 years: Vowels, k, g, , c, j, n, t, d, n, t, d, n, p, h, t:

b, m, y, l, v, l, n, -nt̥, -t̥, -nt, -nc

-nd, -nk

3.3-4 years: All the above + s, p^h, r, -nty

4-4.6 years: All the above + s, l̥

4.7-5 years: R -ndra, pRa, kRa, tRa

5-5.6 years: š, sta

5.7-6 years: ska

6*6.6 years: c^h t^h, t^h, stra

6.7-7 years: k^h, kša (not yet)

With these two (tables) please indicate which phonemes would be suitable for a predictive screening test in Malayalam. Please write the criteria based on which selection was made.

Thanking you,

Name:

Age:

Sex. F/M

Mother tongue

Education

suggested phonemes for testing.

Criteria:

APPENDIX VII

Predictive screening test of articulation in Malayalam

Items	Response
<u>Part-1</u>	
a. /śarta/ ചർട്	
b. /braś/ ബ്രഷ്	
c. /rājāva/ രാജാവ്	
d. /ceruppa/ ചെരുപ്പ്	
e. /śank ^h a/ ശംഖ്	
f. /mēṣa/ മേശ .	
g. /kōḷi/ കോഴി.	
h. /Rēdio/ റേഡിയോ	
i. /uRumpa/ ഉറമ്പ്	
j. /sūrian/ സൂര്യൻ	
k. /kasēra/ കസേര	
l. /pūmpāta/ പൂമ്പാറ്റ	
m. /kuta/ കുട	
n. /tākkōl/ താക്കോൽ	
o. /gaḍa/ ഗാദ	
p. /bāga/ ബാഗ്	
q. /pūva/ പൂവ്	
r. /uduppa/ ഉടുപ്പ്	
s. /c ^h āya/ ചായ	
<u>Part-2</u>	
a. /vastram/ വസ്ത്രം	
b. /nakṣatram/ നക്ഷത്രം .	

Items	Response
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- c. /pātram/ പാത്രം
- d. /pustakam/ പുസ്തകം
- e. /prāva/ പ്രാവ്
- f. /skūta:/ കൂട്ടർ.
- g. /bisket/ ബിസ്കറ്റ്
- h. /inṭya/ ഇന്ത്യ
- i. /cakram/ ചക്രം
- j. /panka/ പങ്ക .

Part-3

- a. /palaya bāgum śartum ac^han
kondupōyi./ പഴയ ബാഗും
ചർച്ചയും അച്ചൻ കൊണ്ടുപോയി.
- b. /Rāṭriyil suriarasmi illa/
രാത്രിയിൽ സൂര്യൻ്റെ മൂലം

Part-4

- a. /a/
- b. /ś/

Part-5

- a. caacaacaa
- b. jaajaajaa
- c. p t k

Part-6

lalala

Items	Response
Part-7	

a. /s/ sūrian uḍicu, tūrian

uḍicu. / സൂരിൻ ഉദിച്ചു.

തൂരിൻ ഉദിച്ചു.

b. /R/ iṭṭoru uḍumpāṇa,

iṭṭoru uḍumpāṇa /

ഇത് ഒരു ഉറുമ്പാണ്.

ഇത് ഒരു ഉറുമ്പാണ്.

Part-8

Clapping rhythm .