A study of phonetic and phonological development of Sinhala speaking children in the Puttalam District aged 3;0-3;11 years

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Abstract

Normative data on speech development is essential to differentiate children with speech difficulties from typically developing children. Due to the lack of normative data on Sinhala, currently clinicians depend on norms established for English. But the normative data for one language cannot be applied to another due to language specific features. The study investigated the sounds in the phonetic inventory and phonological processes exist in Sinhala speaking children between 3;0- 3;11 years. It also identified whether gender or maternal education has any impact on the speech development. 80 monolingual Sinhala speaking children in the Puttalam district were recruited from two age bands of six months intervals. Children's speech abilities were assessed using an informal picture assessment tool developed for Sinhala, based on the *Diagnostic Evaluation of Articulation and Phonology*_ (Dodd et al, 2003). The study found that the order of acquisition of consonants is consistent with English speaking children. The phonological processes used by children showed universal and language - specific patterns.

Denasalization of pre-nasalised stops and *Lateralisation* were found as language specific error patterns in Sinhala. The study revealed significant effects of maternal education on phonological development. The findings of this study can be used to make tentative, yet clearer diagnoses and intervention of Sinhala – speaking children with speech difficulties.

***Keywords*:** Normative data, Speech development, Sinhala speaking children

Introduction In order to make clinical decisions about a client's speech skills, having a comprehensive knowledge of the typical phonological development of children is essential. In comparison to established norms of phonological development, a clinician can determine whether a child's speech skills are typical, delayed or disordered. As reported in Dodd (2003), children's speech can be analysed in terms of phonetics and phonology. Phonetics refers to the speech sound production; articulatory/motor skills. Phonology refers to the systems of rules that determine how the sounds of a language combine and influence one another. Phonological processes/error patterns are described as the consistent differences between child's realizations and an adult's target forms (Hua & Dodd, 2000). For example, *fronting* is considered a phonological process in which posterior sounds are substituted for anterior ones (eg: "key" for "tea").

As reported by Enderby and Phillipp (1986), approximately 6% of the preschool-school population is referred to speech and language therapy because of concerns about their speech skills (cited in Dodd, 2003). Broomfield and Dodd (2005) reported that the earlier intervention is provided for phonological disorders, the better the outcome, indicating that it may be easier to shape a developing system than one that is well established.

Nonetheless, one difficulty with the provision of early intervention for Sinhala speaking children with concerns about their speech is the lack of normative data as speech and language therapy is a new discipline in the country. Apart from the preliminary data from a study by Wickremasinghe and Rajapakse (1999) and the pilot study by Hettiarachchi and Ranaweera (2011), there are no clearly established norms on phonetic and phonological development for Sinhala language. Currently clinicians depend on the established norms for English by Grunwell, (1985), or Dodd et al (2003) and their own clinical experiences when making clinical decisions on Sinhala speaking children.But the normative data for English cannot be applied to Sinhala speaking children as there are language - specific features exist between languages. Applying norms of another language, results in inaccurate diagnoses, and therapy may not be effective. Some of the specific

features of the sound system of the Sinhala language are listed as follows.

- /c/ and /ɟ/ sounds are categorized as stop sounds in Sinhala whereas they are classified as affricates in English.
- There are five pre - nasalised stop sounds in Sinhala. But none in English.
- There are identical clusters (reduplication) in Sinhala which is not a feature of English language. (eg :/ra**jj**uruwo:)

Cross linguistic studies

Many studies have been conducted on the acquisition of speech sounds in many languages in the world. These studies have found some language universal as well as language specific features. So and Dodd (1995) found that though Cantonese speaking children's order of consonant acquisition was similar to English speaking children's, the Cantonese children's acquisition was more rapid. Specific phonological processes used by Cantonese speaking children including affrication of /s/. For example, /pa͡tsi/ for /pasi/; /t͡soej/ for /soej/. This pattern is unusual in English speaking children since they acquire affricates later than fricatives. In the study of phonological acquisition of Putonghua

(Hua & Dodd, 2000), it was found that the most common error patterns used by those children are initial consonant deletion (deletion of the initial consonant) and backing (occurs when the place of articulation is backed), which are considered to be atypical error patterns in English speaking children.

Objectives

1) Document the speech sounds that are established in the phonetic inventory of children aged 3;0-3;11 years.
2) Document the typical phonological processes (error patterns of speech sounds in words) in children aged 3;0-3;11 years.
3) Investigate the influence of gender and maternal education on phonetic inventory and phonological processes.

Methodology

A descriptive cross-sectional study design was used in this study. The study assessed 80 monolingual Sinhala speaking children in the Puttalam district aged between 3;0 and 3;11 years in two age bands of six months intervals. Ethical approval to conduct the study was obtained by the Ethical Review Committee of the Faculty of Medicine; Ragama,

University of Kelaniya. No exclusion criteria were used in this study as suggested by Dodd et al (2003), since it leads to over identification of speech difficulties.

An information sheet along with a consent form was given to parents/guardians of the participants to be signed prior to the study. Children with consent from their parents/guardians were assessed in their preschool settings. Since, most of the participants' maternal education was either at the level of O/L or A/L, the maternal education was considered only in two groups.

The data collection tools

The demographic details of the participants were obtained using an interviewer administered questionnaire. Children's speech abilities were assessed using an informal picture based assessment tool developed for Sinhala speaking children based on the "Diagnostic Evaluation of Articulation and Phonology" (DEAP) (Dodd et al, 2003).

The assessment tool included 85 words and picture naming and imitation tasks were used to elicit responses. The sounds elicited cover all the 14 vowels in all possible three positions of words and 26 consonants in all the four possible places including initial, medial, final and in identical clusters/reduplication (see Appendix I). The assessment

tool provided opportunities for all the predictable error patterns/phonological processes.

Assessment procedure

Each child was assessed individually in their preschool setting. The assessor transcribed the child's responses online phonetically using the International Phonetic Alphabet (IPA, 2005) in the recording sheet and simultaneously audio recorded. If a child failed to produce a consonant correctly in the picture naming task, the examiner asked the child to imitate it in a syllable. If he/she failed to do so, the child was asked to produce the sound in isolation.

Measures and Analyses

The criteria used by Dodd et al. (2003), were used in determining the phonetic inventory and phonological processes/error patterns.

Phonetic inventory: A phoneme was considered to have emerged when 90% of children in an age group produced the sound at least once either spontaneously or in imitation (Dodd et al 2003).

Phonological processes/error patterns: A child is considered to be producing a particular error pattern if it is observed at least five times in the child's speech sample. An error pattern considered typical when it is used by at least 10% of children in the same age band.

Quantitative measures/phonological accuracy measures

The following quantitative measures were used to measure phonological accuracy based on Dodd et al (2003):

- Percent consonants correct (PCC): The percentage of consonants produced correctly divided by the total number of consonants elicited in the assessment.
- Percent vowels correct (PVC): The percentage of vowels produced correctly divided by the total number of vowels elicited in the assessment.
- Percent phonemes correct (PPC): The percentage of phonemes (consonants +vowels) produced correctly divided by the total number of phonemes elicited in the assessment.

Results

Phonetic acquisition/phonetic inventory: In the younger group, more than 90% of children were able to produce 12 out of 26 consonants spontaneously or through imitation. In the older group, it was increased

to 18 consonants (69%). Stops and nasal sounds were found to be acquired first. None of the prenasalised stop sounds are emerged in Sinhala speaking children by 3;11 years. Table 01 shows the emergence of phonemes in two age bands.

***Table 01**. Emergence of consonants by two age bands (90% criterion)*

Age		Present	Absent
3;0-3;5	Stop	/p/ /b/ /t/ /d/ /k/ /g/	/c/ /ɟ/ /ʈ/ /ɖ/
	Nasal	/m/ /n/	/ɲ/ /ŋ/
	Fricative	/h/	/s/ /f/ /ʃ/
	Trill		/r/
	Lateral	/l/	
	Prenasalised stop		/ᵐb̃/ /ⁿd̃/ /ɳɖ̃/ /ᵑg̃/
	Approximant	/w/ /j/	
3;6-3;11	Stop	/p/ /b/ /t/ /d/ /ʈ/ /ɖ/ /c/ /ɟ/ /k/ /g/	
	Nasal	/m/ /n/	/ɲ/ /ŋ/
	Fricative	/h/ /s/	/f/ /ʃ/
	Trill	/r/	
	Lateral	/l/	
	Prenasalised stop		/ᵐb̃/ /ⁿd̃/ /ɳɖ̃/ /ᵑg̃/
	Approximant	/w/ /j/	

Phonological processes

Similar typical error patterns were identified in both age groups including consonant harmony, denasalisation of prenasalised stops, cluster reduction, stopping and lateralization. Examples for these error patterns are exhibited in table 2.

Table 02*. Examples for the typical error patterns used by children aged 3;0-3;11 years*

Phonological process	**Target word**	**Adult realizations**	**Child's responses**
Consonant Harmony *(consonants have same place of articulation)*	Frog	/ **g**emba:/	/**b**emba:/
Denasalization of prenasalised stops *(prenasalised stops become denasailsed stops)*	Mango	/a**b̃**ə/	/a**b**ə/
Cluster reduction*(Deletion of one consonant from the cluster)*	Triangle	/**tr**ikone:/	/**t**ikone:/
Stopping *(Replacement of fricatives with stops)*	Sky	/aha**s**ə/	/aha**t**ə/
Lateralization(Replacement of / r/ with /l/)	Pig	/u:**r**a:/	/u:**l**a:/
Fronting *(uses articulation further forward)*	Tree	/**g**asə/	/**d**asə/

From the phonological processes, *fronting* is the most commonly used process by both age groups. The percentages of children who use phonological processes/error patterns by the two age groups are shown in Figure 1

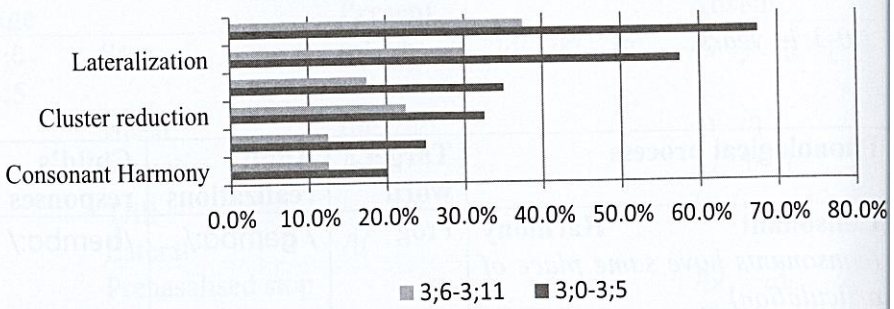

Figure 1: U*se of typical error patterns by the two age groups*

Phonological accuracy

*Age :*_Children's phonological accuracy was measured in PCC (percent consonants correct), PVC (percent vowels correct) and PPC (percent phonemes correct). The older children's (3;6-3;11) phonological accuracy on each of these measures were better than the younger group (3;0-3;5). Independent sample t-tests revealed significant differences in PCC ($t(78) = 0.000$, $p < 0.05$), PVC ($t(78) = 0.005$, $p < 0.05$) and PPC ($t(78) = 0.000$, $p < 0.05$) measures between two age groups.

Gender: Independent sample t-tests found no significant differences between the genders on phonological accuracy measures in the older or younger groups.

Maternal Education: The means and standard deviations of two maternal education groups indicated that children with higher maternal education (Grade 12/13, A/L and above) have better phonological accuracy on each measure than children who have mothers with low education. It revealed significant differences in PCC measures on maternal education in the younger ($t(38) = 0.043$, $p < 0.05$) and older ($t(38) = 0.030$, $p < 0.05$) age groups and significant difference in PPC of children with higher maternal education in the older group ($t(38) = 0.030$, $p < 0.05$).

Discussion and Conclusions

Age – Phonetic inventory

According to Jakobson's "laws of irreversible solidarity", nasals, front consonants and stops (found in virtually all the languages) would be acquired earlier than their oppositions, orals, back consonants and fricatives respectively. The sequence of sound acquisition found in this study was consistent with this theory and the findings of Grunwell (1985) and Dodd et al (2003). Stop sounds, approximants and lateral sounds and nasals including /m/ and /n/ emerged first in Sinhala-

speaking children. Fricatives and trills were found to be later sounds. However none of the pre nasalised stop sounds found to be emerged by 3;11 years.

Age – phonological processes

The study identified the existence of similar error patterns between the two age groups of Sinhala speaking children including *consonant harmony, denasalisation of prenasalised stops, cluster reduction, stopping, lateralization* and *fronting*.

The phonological processes used by the children acquiring Sinhala phonology revealed both universal tendencies and language specific constraints on acquisition. Among them, consonant *harmony, stopping* and *fronting* are similar processes used by Sinhala and English speaking children. However, use of *Fronting* and *Stopping* error patterns are similar across many languages including Cantonese and Putonghua (So and Dodd,1995 ; Hua and Dodd 2000).

Apart from that language-specific phonological processes were identified including *denasalisation of prenasalised stops* and *lateralization.* There are no prenasalised stop sounds in the English language. The findings of Hettiarachchi and Ranaweerra, (2011) also revealed the presence of this process until 5 years old.

In the process of Lateralization, /r/ is replaced with /l/ by Sinhala speaking children. In English, /r/ is replaced by /w/ sound the gliding of liquids process (Dodd et al, 2003). However as cited in Hua and Dodd (2000), Bortolini and Leonard (1991) have discovered that /r/ is frequently replaced by /l/ in Italian, Hindi, Igbo, Portuguese, Quiche and Spanish speaking children. So the *lateralization* process is shared in many languages except English. One of the possible reasons for that is unlike in English, these languages including Sinhala, the production of /r/ sound is same as it produces as an alveolar trill or flap.

Effect of gender on phonological development

The study found no gender differences on phonological accuracy measures including PCC, PVC and PPC. So the findings of gender in relation to phonological development are keeping with Dodd et al. (2003).

Effect of maternal education on phonological development

The study found that low maternal education has a significant impact on phonological accuracy in children in both age groups in PCC measures and PPC measures in the older group. These findings are consistent with most of the studies done in relation to speech development and maternal education (Tomblin et al.1997;Campbell et al. 2003). In the study by McLeod (2010), from the ten studies she has reviewed on

maternal education, eight of the studies including Campbell (2003), Chervie-Muller (2005), Peter (1997), and Tomblin (1997) revealed that low maternal education is a risk factor for developing speech and language difficulties in children.

Clinical implications

The findings of the study are sensitive to specific features of Sinhala. Therefore, the findings of the study can be used to make tentative yet clearer diagnoses of Sinhala – speaking children with speech difficulties and in planning and implementing intervention.

Recommendations

As future directions, it is recommended a larger study with an increased sample size. The present study was conducted only in the Puttalam district. In the future it would be much beneficial if studies would be carried out across several districts in the country. So that normative data which are sensitive to sociolinguistic variations could be obtained.

The present study assessed only children aged between 3-4 years. In future studies, more findings could be obtained if the age range is extended between 2;0 years to 7;0 years. This will lead in the identification of delayed phonological error patterns when comparing to younger age groups.

Appendix 01

Sounds	Initial position	Medial position	Final position	Identical clusters
/p/	panɑ:wə	æpəl	sup	ɑ:ppə
/b/	balla:	saban/ŋ	-	ibba:
/t/	taruwə	katurə	dat	sapattuwə
/d/	dat	maduruwa:	-	muddə
/ʈ/	ʈajərəjə	raʗuʈan	kærəʈ	peʈʈijə
/ɖ/	ɖakkuwə	kuɖəjə	-	poɖɖak
/c/	chokələʈ	karəpinca:	ʈo:c	ko:ccijə
/ɟ/	ɟambu	kaɟu	friɟ	raɟɟuruwo:
/k/	kuɖəjə	makuluwa:	ke:k	akka:
/g/	gasə/gahə	tæ:gi	bæ:g	aggala:
/m/	maduruwa:	samənələja:	ais kri:m	amma:
/n/	naja:	panɑ:wə	-	anna:si
/ɲ/	ɲa:nə kata:	-	-	ratiɲɲa:
/ŋ/	-	waŋgeɖijə	aŋ	-
/f/	fæ:n	ʈofi	-	-
/s/	samənələja:	ahasə	bas	kossə
/ʃ/	ʃə:ʈ	mæʃin	-	-
/h/	ha:wa:	nahajə	-	-
/r/	raʗuʈan	taruwə	ka:r	-
/l/	lu:nu	malə	æpəl	balla:
/ʗ/	-	aʗə	-	-
/ɖ̃/	-	waɖ̃ura:	-	-

/ɖ̃/	-	aɖ̃anəwa:	-	-
/g̃/	-	gag̃ə	-	-
/j̃/	-	-	-	-
/w/	wad̃ura:	pana:wə	-	awwə
/j/	jaturə	ʈajərəjə	-	ajja:

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