ORIGINAL RESEARCH

/t/ before /ʈ/ or /ʈ/ before /t/: Emerging Trends from a Preliminary Study of Consonant Acquisition in Typically developing Sinhala-speaking Children aged 3 to 6 years

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ABSTRACT

Purpose: *Speech and language therapists use developmental norms established for consonant acquisition to determine whether a child has age-appropriate, delayed or disordered speech skills. There are currently no established norms for the acquisition of Sinhala consonants, which have implications for accurate diagnosis. The aim of this study was to document preliminary trends observed in the trajectory of consonant sound development in Sinhala-speaking young children so as to form a set of 'working norms'.*

Method: *A picture-based articulation assessment was administered to 70 typically developing children who were between 3 years and 6 years 11 months of age.*

Results: *Regarding the rate of acquisition and order of acquisition, the findings displayed trends comparable to general patterns of consonant mastery reported within cross-linguistic studies. In addition, a different rate of acquisition and order of mastery was observed for both uncommon Sinhala language-specific speech sounds showing ambient language effects and for a few common sounds occurring in Sinhala and other languages.*

Conclusion & Implications: *The convergence and divergence in the rate and order of Sinhala consonant acquisition compared to the cross-linguistic literature has important clinical implications for assessment, early identification of speech difficulties and intervention within speech and language therapy practice in Sri Lanka.*

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Key words: *speech, consonants, trajectory, acquisition, norms, Sinhala*

INTRODUCTION

For a child referred due to 'unclear speech' or concerns surrounding speech intelligibility, the task of a speech and language therapist is to make an informed decision on whether the child displays typical age-appropriate speech skills, delayed (meaning below age-level competence) or atypical disordered speech patterns. To do so, clinicians rely on established norms for speech sound acquisition and for typical speech error patterns in the ambient language or languages under consideration.

At present, in the absence of clearly established norms for phonetic and phoneme acquisition for Sinhala, Sri Lankan speech and language therapists are reliant on norms for English as published by Grunwell (1985) or Dodd, Holm, Zhu and Crosbie (2003), as well as on their clinical experience of diagnosis. Research studies on the trajectory of speech sound acquisition have called into question the current use of English speech norms with monolingual and bilingual speakers of languages other than English (Bowen, 1998; Fox & Dodd, 2001).

Cross-linguistic Studies

Rate and sequence of speech sound acquisition

Given the need for guidance in determining consonant mastery in languages that have hitherto been under-researched, attempts have been made to use cross-linguistic studies to determine potential speech acquisition trajectories for children who are monolingual and multilingual (McLeod & Crowe, 2018). While acknowledging the contested theories of Jakobson (1941/1968), Locke (1983) and Vihman (1996), McLeod and Crowe (2018) offered a review of 27 languages to determine patterns of consonant acquisition in diverse languages and document overall emergent cross-cultural patterns. This, they argued, could be a preliminary resource, relevant to languages not investigated thus far. The authors of the current study have used the review as a starting point to reflect on the emerging trends in Sinhala, given the lack of previous research.

In a cross-linguistic review of 60 articles on consonant acquisition, McLeod and Crowe (2018) found that, across 27 languages, most consonants are mastered by the age of 5 years. The review concluded that plosives, nasals and non-pulmonic

consonants are mastered early in comparison to fricatives, affricates, trills and flaps. This early acquisition pattern of nasals, plosives and approximants has been reported in languages as diverse as Japanese, Korean, Turkish and Spanish (Amayreh & Dyson, 1998; Kopkalli-Yavuz & Topbas, 1998; Goldstein & Washington, 2001; McLeod & Crowe, 2018). Conversely, fewer instances of liquids, fricatives and affricates and dorsal consonants have been reported in babbling and early childhood speech (MacNeilage, 2000; Gildersleeve-Neumann, Davis & MacNeilage, 2001). Additionally, McLeod & Crowe (2018) reported on the early acquisition of labial, pharyngeal and posterior lingual consonants in contrast to consonants requiring anterior tongue movement across the range of languages reviewed.

Of particular interest to the current study is the research on languages of the Indian sub-continent on common sounds shared across languages. For instance, one assertion within the literature is of the relatively late emergence of /r/ in Hindi (Srivastava, 1974; Lakshmi Bai & Nirmala, 1978). One explanation for the late mastery of the shared sound of /r/ is the manner of production as a trill or flap in some languages (Bortolini & Leonard, 1991). Yet another possibility proposed is the linguistic salience or 'functional load' of the target sound within the ambient language. Unfortunately, in the review of 60 articles of 64 studies undertaken by McLeod and Crowe (2018), none were of languages of the Indian sub-continent.

Sinhala Language

Spoken Sinhala, an Indo-Aryan language, consists of 14 vowels and 26 consonants (Disanayaka, 1991; Karunatillake, 1992; Rajapakshe, 1993; Wasala & Gamage, n.d.). This includes 4 prenasalized voice plosives as documented in Table 1. Tak (2011) records Sinhala among a range of languages including Fijian that contains prenasalized consonants which, for Sinhala, are said to occur as a phonologically driven unitary element or phoneme, contrasting with a nasal plus consonant (NC) cluster. Table 1 below illustrates the consonant repertoire of Sinhala.

Table 1: Consonant Repertoire of Sinhala

Manner	**Place**							
	Bilabial	Labio-Dental	Alveolar	Post-Alveolar	Retroflex	Palatal	Velar	Glottal
Plosives	p b		t d[1]		ʈ ɖ	c ɟ[2]	k ɡ	
Nasals	m		n			ɲ	ŋ	

Trills			r[3]					
Fricatives		b	s	ʃ				h
Approximants		w				j		
Laterals			l					
Prenasalized stops	~ b		~ d		~ ɖ		~ ɡ	

Sources: Rajapakshe, 1993[4]; International Phonetic Alphabet, 2005

There has been one study on the trajectory of phonetic and phonemic acquisition in Sinhala- speaking preschool children by Wickremasinghe and Rajapakshe (1999), which is an estimation of speech sounds mastered from 06 months to 4 years. There is no information on sample size, data collection methods, criteria of mastery or analysis undertaken suggesting the use of cross-linguistic literature instead of speech data in Sinhala to develop the norms above

Figure 1: Acquisition of Consonant Sounds

Age	**Sound**
6 months- 2 years	p, b, c, m, s, w (plosives + nasals)
1 year – 3 years	t̪, d̪, ɟ, k, ɡ, ŋ, h (plosives + nasals)
2 years – 3 years	s, l, j (fricatives)
2 years – 4 years	ʃ, r (trills)

(Source: Wickremasinghe & Rajapakshe, 1999)

Sixteen of the Sinhala consonants can be geminate, /p: b: m: t: d: n: ʈ: ɖ: k: ɡ: c: ɟ: s: l: j: ɲ:/occurring intervocally, contrasting phonemically with the comparable singleton (Rajapakshe, 1993), though arguably few meaningful minimal pairs are available.

1 There is no agreement among local linguists regarding the place of articulation of /t/ and /d/ with Rajapakshe (1993, 2019) identifying them as alveolar while Wasala and Gamage (n.d.) recognise the placement as dental.

2 There is no agreement among linguists on the manner of articulation of /c/ and /ɟ/. For instance, Rajapakshe (1993, p.29) identifies the sounds as plosives, which has been confirmed through spectrographic assessment (Rajapakshe, 2019) while Wasala and Gamage (n.d.) categorise these sounds as affricates.

3 There are 2 allophonic variants of /r/ as a trill /r/ or a flap/tap /ɾ/depending on word-position

Objective

The main aim of this preliminary study was to determine 'working norms' for Sinhala phonetic and phoneme development in young children. Within this paper, phonetic acquisition denotes the mastery of production of individual speech sounds of the target language, in this case Sinhala, either independently or in repetition.

METHOD

Participants

Using a purposive sampling method, 70 typically developing Sinhala-speaking children between 3 years (3; 0) and 6 years 11 months (6; 11), belonging to seven age-ranges (3;0 to 3;5, 3;6 to 3;11, 4;0 to 4;5, 4;6 to 4;11, 5;0 to 5;5, 5;6 to 5;11, and 6;0 to 6;11), were included. A corresponding number of male and female participants were included (see Table 2).

Table 2: Participant Details

Age-range	Number	Mean age	Gender	Geographical region
3;0 – 3;5	10	3;3	M=5, F=5	G=3 C=6 K=1
3;6 – 3;11	10	3;7	M=4, F=6	G=1 C=4 K=5
4;0 – 4;5	10	4;3	M=6, F=4	G=2 C=4 K=4
4;6 – 4;11	10	4;8	M=5, F=5	G=3 C=5 K=2
5;0 – 5;5	11	5;1	M=7, F=4	G=2 C=4 K=5
5;6 -5;11	13	5;7	M=7, F=6	G=2 C=1 K=10
6;0 – 6;11	6	6;2	M=3, F=3	G=2 C=1 K=3

Children with a known history of speech or language difficulties, any hearing loss or visual difficulties or cognitive or psychosocial difficulties were not included.

Contact was made with preschool teachers known to the researchers through professional contact. Meetings were set up to collect data at the participants' home or pre-school, once written consent was received through the school authorities.

Study Tool

A picture-based assessment tool was compiled based on the key principles of the Diagnostic Evaluation of Articulation and Phonology (DEAP) (Dodd et al, 2002). It included 23 picture stimuli with 45 target items to be named, with each target consonant appearing more than once in word-initial and medial and/or final positions as it occurs in Sinhala (Disanayaka, 1991), with a few identical and non-identical consonant clusters. Error sound stimulability was also checked in CV/VC production and in isolation in a repetition task.

Data Collection

Each participant was administered the articulation subtest of the Test of Articulation and Phonology – Sinhala, and was encouraged to name the target words in the test through 'wh' questions (e.g. What is this? Who is in the picture?). The participants were seen either at their nursery/school or at home. The speech data was recorded using a SONY IC-Recorder and phonetically transcribed simultaneously using the International Phonetic Alphabet (2005). The data was collected by 6 speech and language therapists trained in phonetic transcription.

Data Analysis

All the transcripts were analysed by the primary investigator, with 7 (10%) of the transcripts re-analysed by the co-investigator. The consonants were classified under three phonetic features of voicing, place of articulation and manner of articulation. The criterion for mastery of each consonant was the production of it in the assessment, either spontaneously or in imitation, in at least two word-positions as specified by Dodd and colleagues (2003). At a group level, a consonant was considered to have been 'acquired' if it was produced correctly either spontaneously or in imitation by 75% of the children in each age range at least once, as per the proposition by Dodd et al (2003). Consonant inventories indicating the presence and absence of each target consonant in 75% of children in each age range were compiled as in the review by McLeod and Crowe (2018).

Ethical Considerations

Ethical clearance was obtained from the Ethical Research Committee of the Faculty of Medicine, University of Kelaniya (No. P/210/11/2018). The study was described to each participant's parent/caregiver with an information sheet given and written consent obtained prior to data collection.

RESULTS

Given that the results are based on a small group of participants; the findings must be interpreted with care.

Overall Trends

Phonetic Acquisition

Consonant mastery per age range is given below in Figure 2.

Figure 2: Acquisition of Consonant Sounds in Sinhala

Age	Present		Absent or Emerging
3;0-3;5	Plosive	p b t d k ɡ	ʈ ɖ c ɟ
	Nasal	m n	ɲ ŋ
	Fricative		s f ʃ h
	Trill		r
	Tap or flap		ɾ
	Approximant	w	
	Lateral	l	
	Prenasalized stops		~ ~ ~ ~ b d ɖ ɡ
3;6-3;11	Plosive	p b t d k ɡ ɟ ɖ c ʈ ɖ	
	Nasal	m n	ɲ ŋ
	Fricative	s h	f ʃ
	Trill		r
	Tap or flap		ɾ
	Approximant	w	
	Lateral	l	
	Prenasalized stops		~ ~ ~ ~ b d ɖ ɡ

4;0-4;5	Plosive	p b t d c ɟ k g ʈ ɖ	
	Nasal	m n ŋ	ɲ
	Fricative	s ʃ h	f
	Trill	r	
	Tap or flap	ɾ	
	Approximant	w	
	Lateral	l	
	Prenasalized stops	~ ~ ~ b d ɡ	~ ɖ
4;6-4;11	Plosive	p b t d c ɟ k ɡ ʈ ɖ	
	Nasal	m n ŋ ɲ	f
	Fricative	s ʃ h	
	Trill	r	
	Tap or flap	ɾ	
	Approximant	w	
	Lateral	l	
	Prenasalized stops	~ ~ ~ ~ b d ɖ ɡ	

In the youngest age-range, 75% of the children in the group accurately produced 13 of the 26 target consonants spontaneously or in imitation. With reference to the same criteria, 5 additional consonants (a total of 18) were mastered by children between the age-range of 3;6 to 3;11 years. Yet another 5 consonants were mastered by those between 4;0 to 4;5 years (23 in total). By the age of 4;6 years, the remaining 3 consonants were mastered, with all consonants acquired produced either spontaneously or in imitation.

The 'early', 'middle' and 'late' consonants mastered indicated the following trends:

- Early sounds (by 3;0): /t p b m d n k ɡ h l/
- Middle sounds (3;0 – 3;11): /s j ʈ ɖ ŋ c ɟ w/
- Late sounds (4;0 – 4;6): /r/ɾ ɲ ʃ f b d ɖ ɡ/

Place of Articulation

Tables 3, 4, 5 and 6 present the acquisition of consonants based on place of articulation for each word-position.

Table 3: Mastery of Bilabials and Labiodental Consonants at Word-positions by Age-range

	Bilabial									Labiodental			
	p			b		m			~ b	f		w	
	I	M	F	I	M	I	M	F	M	I	F	I	M
3;0-3;5													
3;6-3;11													
4;0-4;5													

Table 4: Mastery of Alveolar and Post-alveolar Consonants at Word-positions by Age-range

	Alveolar																		Post-alveolar	
	t			d		n			~ d	l			s			r/ ɾ			ʃ	
	I	M	F	I	M	I	M	F	M	I	M	F	I	M	F	I	M	F	I	M
3;0-3;5																				
3;6-3;11																				
4;0-4;5																				
4;6-4;11																				

Table 5: Mastery of Retroflex and Palatal Consonants at Word-positions by Age-range

	Retroflex						Palatal								
	ʈ		ɖ		~ ɖ	c		ɟ			ɲ	j			
	I	M	F	I	M	M	I	M	F	I	M	F	M	I	M
3;0-3;5															
3;6-3;11															
4;0-4;5															
4;6-4;11															

Table 6: Mastery of Velars and Glottal Consonants at Word-positions by Age-range

	Velar							Glottal	
	k			ɡ		ŋ	~ ɡ	h	
	I	M	F	I	M	M	M	I	M
3;0-3;5									
3;6-3;11									
4;0-4;5									

Manner of Articulation

Tables 7, 8, 9 and 10 present the acquisition of consonants based on the manner of articulation for each word-position.

Table 7: Mastery of Plosive Consonants at Word-positions by Age-range

	Plosives																				
	p			b		t			d		ʈ			ɖ		c			ɟ		
	I	M	F	I	M	I	M	F	I	M	I	M	F	I	M	I	M	F	I	M	F
3;0-3;5																					
3;6-3;11																					

Table 8: Mastery of Plosives and Nasals at Word-positions by Age-range

	Plosives					Nasals								
	k			ɡ		n			m			ɲ	ŋ	
	I	M	F	I	M	I	M	F	I	M	F	M	M	F
3;0-3;5														
3;6-3;11														
4;0-4;5														
4;6- 4;11														

Table 9: Mastery of Approximants, Laterals and Fricatives at Word-positions by Age-range

	Approximants				Laterals			Fricatives								
	w		j		l			f		s			ʃ		h	
	I	M	I	M	I	M	F	I	F	I	M	F	I	M	I	M
3;0-3;5	■	■		■	■	■	■								■	
3;6-3;11										■	■	■				■
4;0-4;5								■	■							
4;6-4;11													■	■		

Table 10: Mastery of Trills and Prenasalized Stops at Word-positions by Age-range

	Trill/Tap		Prenasalized plosives			
	r		~ b	~ d	~ ɖ	~ ɡ
	I	M	M	M	M	M
3;0-3;5						
3;6-3;11						
4;0-4;5	■	■	■	■		■
4;6-4;11					■	

Fifteen consonant geminates appearing in word-medial position produced by the participants showed a pattern of acquisition similar to that of its comparable singleton (see Table 11).

Table 11: Mastery of Geminates at Word-medial Position by Age-range

	pp	bb	mm	tt	dd	nn	ʈʈ	cc	ɟɟ	ɲɲ	kk	ɡɡ	ss	ll	jj
3;0-3;5	■	■	■	■	■	■		■			■	■		■	■
3;6-3;11							■		■				■		
4;0-4;5															
4;6-4;11										■					

Six non-identical consonant clusters tested indicated an overall late mastery compared to the acquisition of consonant geminates (see Table 12).

Table 12: Mastery of Target Non-identical Consonant Clusters by Age-range

	mb	ŋc	tr	kr	fr	skr
3;0-3;5						
3;6-3;11						
4;0-4;5						
4;6-4;11						

DISCUSSION

On the whole, the trajectory of Sinhala consonant acquisition uncovered in this preliminary study is in general agreement with cross-linguistic studies for common shared sounds. Divergent patterns for language-specific uncommon speech sounds, in both the order and rate of speech sound development, were also uncovered.

Mean Age of Acquisition of Consonants in Sinhala

Overall, all Sinhala consonants were acquired by 4 years 6 months (54 months) by the children included in this study at a 75% criterion of mastery for an age-group. For Sri Lankan Tamil, 75% of the sounds of the Western coastal dialect were acquired by children between 3;6 - 3;11 years, with the exception of /ɳ, ɲ, h, ʃ, l, ɽ/ (Saleem & Hettiarachchi, 2014). There was, however, a difference in the criterion used, with Saleem and Hettiarachchi (2014) opting for a 90% criterion of mastery at least once, either spontaneously or in repetition, as per Hua and Dodd's (2000) proposition. All consonant sounds are reported by Wickremasinghe and Rajapakshe (1999) to have been mastered by 4 years, whereas in the current study complete mastery of the Sinhala consonant repertoire was only achieved by children at 4 years and 6 months. This difference may be reflective of the former study not including prenasalized stops, which were sounds acquired late within the current study.

In the systematic review of cross-linguistic research, McLeod and Crowe (2018) noted that 8.4% of data points were not acquired by the oldest age group included (a mean age of 67.26 months) at a comparable criterion of mastery. The rate of Sinhala consonant acquisition is similar to the rate of a majority of Spanish sounds acquired at 4 years (Mann & Hodson, 1994), but later than for Turkish by 3 years (Topbas, 1997) and Cantonese by 3 years 6 months (So & Dodd, 1995).

The relatively early acquisition of most sounds by 3 years 11 months, and almost all consonants of Sinhala by 4 years 3 months, is much earlier than the stipulated 5 years for mastery of most consonant sounds of the 27 languages within the review by McLeod and Crowe (2018).

The relatively early mastery of Sinhala consonants may be due to the manner of articulation, with a wide range of plosives and nasals constituting the language. The more complex prenasalized stops unique to the language and the /f/ and /ʃ/, which are sounds borrowed from English, were among the later sounds mastered. A comparably late acquisition of /ʃ/ beyond 3 years11 months has been found for Sri Lankan Tamil compared to English (Saleem & Hettiarachchi, 2014), in which language too this is a borrowed sound. Nevertheless, this finding is comparable to the age of acquisition for /ʃ/ across 27 languages (McLeod & Crowe, 2018).

Age of Acquisition of Sinhala Consonants based on Place of Articulation

Overall, bilabial, labiodental, alveolar and velar consonants were mastered earlier in Sinhala than retroflex consonants, with a mixed picture emerging for palatals. The only previous study on Sinhala speech sound development states a general trend of very early bilabials /p, b, m/ and labiodental /w/ between 6 months and 2 years (Wickremasinghe & Rajapakshe, 1999). McLeod and Crowe (2018) found that bilabial and labiodental sounds are mastered early, between 1 year 10 months and 2 years 11 months, across 27 languages, at a 75% - 85% criterion of mastery. The exception in Sinhala is the early acquisition of many of the alveolar sounds (/t, d, n, l/). This may reflect the interaction between place and manner of articulation as the four early sounds produced in contact with the alveolar ridge are plosives (/t, d/), nasals (/n/) or laterals (/l/) in Sinhala. Wickremasinghe and Rajapakshe (1999) also note /t/ and /d/ as early sounds acquired between 1 year and 2 years 6 months, though they describe the sounds as dentals, /n/ has been missed out, and /l/ is said to be mastered between 2 years and 3 years of age.

There was a comparatively late mastery of the retroflex sounds /ʈ, ɖ/ and the prenasalized voiced retroflex in Sinhala. This corresponds with the general trend of late acquisition of sounds produced using the anterior tongue (McLeod & Crowe, 2018). Comparably, a late acquisition of the voiceless retroflex sound /ʈ/ was found for Sri Lankan Tamil (Saleem & Hettiarachchi, 2014) and the late mastery of both /ʈ/ and /ɖ/ reported for Indian Tamil (Denktash, Ramasankar, Nagaraj, & Srinivasan, 2010; Kala & Lilith, 2016).

Age of Acquisition of Sinhala Consonants based on Manner of Articulation

On average, plosives, nasals, approximants and lateral sounds were acquired earlier in Sinhala compared to fricatives, trills, flaps/taps and prenasalized stop sounds. This is in line with the assertion by Wickremasinghe and Rajapakshe (1999) of a trend of early plosive and nasal mastery. The most stable consonants used within Sinhala baby talk include plosives, nasals and laterals (Meegaskumbura, 1980), which may reflect the trajectory of speech sound mastery observed. The trend of early acquisition of plosives and nasals is commensurate with previous research on languages of the Indian subcontinent, including Sri Lankan Tamil (Saleem & Hettiarachchi, 2014), Indian Tamil (Denktash et al, 2010; Kala & Lilith, 2016), Hindi (Kaur, Anand & Subbarao, 2017), Malayalam (Sameer, 1998), and Telugu (Srilakshmi, 2005).

Additionally, the voiced palatal approximant /j/ was an early Sinhala sound acquired in the 3 years to 3 years 5 months age range, similar to Arabic in which it is acquired by 2 years 6 months (Amayreh & Dyson, 1998). McLeod and Crowe (2018) reported marked variability in the age of acquisition for the equivalent voiced palatal /j/ across Greek, Turkish and Xhosa, with a range from 24 to 72 months (2;0 – 6;0 years) noted. It is unclear whether this reported wide variation reflects the age- ranges included in the different studies reviewed.

The early acquisition of /c/ observed for Sinhala is an important finding, given the lack of consensus among local linguists on whether it is a plosive or affricate. The target palatal sound /c/ was acquired relatively early by the youngest group of participants in the 3 years to 3 years 5 months age group, suggestive of a relatively simpler manner of acquisition. Wickremasinghe and Rajapakshe (1999) too identify /c/ as a very early sound between 6 months and 2 years. A follow-up study to verify this trend would need to include a younger age group of children between 2 years and 2 years 11 months.

Saleem and Hettiarachchi (2014) register evidence of early mastery of both /c/ and /ɟ/ in Sri Lankan Tamil by children between 3 years and 3 years 5 months, classifying the sounds as plosives. This early mastery noted is in spite of a 90% criterion for an age group expected in that study, though only one production was required with no analysis of production based on word-position. If the equivalent sound is an affricate in Sinhala (Wasala & Gamage, n.d.), then this early acquisition would be in contrast to the general late acquisition pattern of affricate sounds within some of the cross-linguistic literature (Amayreh & Dyson, 1998; Kopkalli-Yavuz

& Topbas, 1998). Additionally, /c/ appears in two key kinship terms within early child vocabulary: /ɑ:cci/ (grandmother) and /ɑppɑcci/ (Kandy dialect word for father) suggestive of a 'functional load' hypothesis for its early mastery (Pye, Ingram & List, 1987; So & Dodd, 1995). Further acoustic analyses of Sinhala may be beneficial to verify the characterisation of the sound as a plosive or affricate.

The children in this preliminary study had acquired /r/ in all word positions by 4 years 3 months. The late acquisition of /r/ gains support from studies of the region, such as Indian Tamil (Denktash et al, 2010; Kala & Lilith, 2016) and Hindi (Lakshmi Bai & Nirmala, 1978), Quiche (Pye et al, 1987), Portuguese (Yavas & Lamprecht, 1988), German, Swedish and Xhosa (Mowrer & Burger, 1991) and Spanish (McLeod & Crowe, 2018). One probable explanation that can be proposed is the limited frequency of occurrence of this consonant in early childhood vocabulary in Sinhala compared to a sound such as /t/. For instance, /r/ and /ɾ/ occur in child words which are later concepts such as 'ratu' /ɾɑtu/ (red), while /t/ has an immediate 'functional load' appearing in kinship term of 'thaththa' /tɑ:ttɑ/ (father), food items 'bath' /bɑt/ (rice) and objects such as 'toppi' /toppijə/ and shoes /ʂapattu/. Moreover, this relatively late acquisition of /r/ and /ɾ/ is substantiated by Sinhala baby talk that shows an absence of this sound (Meegaskumbura, 1980).

In keeping with the findings of the cross-linguistic review of languages (McLeod & Crowe, 2018), the current study found the relatively late mastery of /r, ʈ, ɖ/, all requiring anterior tongue placement. The target sound /r/ is produced as an alveolar trill or flap in Sinhala, as it is in Hindi (Lakshmi Bai & Nirmala, 1978; Locke, 1980), Igbo (Nwokah, 1986), Italian (Bortolini & Leonard, 1991), Portuguese (Yavas & Lamprecht, 1988), Quiche (Pye et al, 1987), Indian Tamil (Denktash et al, 2010; Kala & Lilith, 2016) and Spanish (Anderson & Smith, 1987), which may account for its late acquisition. For Sri Lankan Tamil, /r/ produced as an alveolar trill had been mastered by 3 years 11 months-old children speaking Western Coastal Sri Lankan Tamil (Saleem & Hettiarachchi, 2014). In contrast, for Indian Tamil, Sivapriya, Perumal, and Savitha (2009) noted a much later mastery of trills and flaps. The perceptually comparable /r/ sound is a late sound in many languages. This includes Arabic, in which it is mastered between 4 years and 6 years 4 months (Amayreh & Dyson, 1998), Putonghua, in which the sound is acquired between 4 years1 month and 4 years 6 months (Hua & Dodd, 1995) and English, in which it is by 4 years 6 months (Grunwell, 1985) or 6 years (Dodd et al, 2003).

Acquisition of Complex Nasals and Prenasalized Stops

Although /m/ and /n/ appeared to be acquired early, the palatal nasal /ɲ/ was mastered much later by the Sinhala-speaking children in the study. Unfortunately, the study by Wickremasinghe and Rajapakshe (1999) does not include information on the mastery of this language-specific complex sound. This is, however, in contravention to the presumed general pattern of early acquisition of nasals (McLeod & Crowe, 2018).

Regarding the velar nasal /ŋ/, which is a shared sound between Sinhala and English, the preliminary findings suggest earlier mastery of the sound in Sinhala than proposed for English by Sander (1972) at 6 years and Smit, Hand, Freilinger, Bernthal, and Bird (1990) between 7 years and 9 years, although slightly later than the 3 years to 3 years 5 months age range stipulated by Dodd et al (2003). The variation in the criterion for mastery used in these studies may account for the vast discrepancy in the age-range of mastery for /ŋ/ in English (Lof, 2004).

In contrast to Sinhala, early acquisition of the palatal nasal /ɲ/ between 3 years and 3 years 11 months, and late mastery of the velar nasals has been reported for Spanish (McLeod & Crowe, 2018). This may be due to the phonetic frequency of these sounds in the ambient language. In Sinhala, arguably, the palatal nasal /ɲ/ seldom occurs in child vocabulary with a low functional load, and is infrequently observed in adult speech as well. It is assumed that the reverse may be true of Spanish. That said, this dissimilarity in findings can also be attributed to a difference in the criteria used, with the Spanish studies adopting a 90% criterion (McLeod & Crowe, 2018) in contrast to the 75% criterion of the current study. A comprehensive study incorporating the frequency of occurrence of this target sound in preschool children's vocabulary in Sinhala would be of value.

In addition, the complete mastery of all the complex nasalized sounds including 'prenasalized' stop sounds in Sinhala was only achieved after 4 years. As prenasalized stop sounds have not been included in the review by Wickremasinghe and Rajapakshe (1999), no comparison is possible. There is also no speech sound equivalent in the cross-linguistic studies consulted for prenasalized stop sounds, and thus, no comparison is possible. This finding of late mastery does comply with the general last acquisition of complex sounds (Goldstein & Washington, 2001).

CONCLUSION

Broadly speaking, the overall pattern of early acquisition of Sinhala consonants involving lips (labial), the posterior tongue (palatal and velar) and pharynx (glottal) in contrast to sounds produced with the involvement of the anterior tongue placement (alveolar and retroflex; the latter in particular) is commensurate with the general principles from cross-linguistic studies. The rate of acquisition was rapid compared to some of the cross-linguistic literature. Data from this preliminary study indicates a comparable trend in rate and order of acquisition of shared sounds but a contrast in both for language-specific sounds. These findings can serve as 'working norms' for consonant acquisition for Sinhala within speech and language therapy clinical practice. It highlights the need to establish normative data for Sinhala without an over-reliance on established norms for English. The next phase of this study will aim to verify the trends observed using a larger sample of children from across the country, taking heed of possible dialect variations.

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