Developing a word list to assess articulation skills in Sinhala speaking children with cleft lip and/ or palate, age range 2.5 years to 3.0 years

L. B. T.C Lokubalasuriya, S.P Rathnayake

Abstract

Cleft Lip and Palate (CLP) affects the individual's articulation and resonance. 0.79 per 1000 birth prevalence was observed in the Sri Lankan (SL) context. Early intervention could prevent articulation errors and the identification can be done using language assessment. In SL context we have no standardized assessments to identify this condition. Developing an assessment is a need in the field of Speech and Language Therapy in SL. The study was design to identify test materials and vocabulary for the age range 2.5yrs to 3.0yrs, develop a word list to assess cleft type errors and evaluate the suitability of the identified words. 18 typically developing children were selected. Play based structured observation was used to select the words for the tool and a pre test was conducted. 95 words were identified as high frequency words and out of those, 24 high frequent words were selected for the tool. After modification, the tool was administered for the 30 typically developing children. Except sound /s/ in word medial position all other sounds were produced in more than 75% accurately. The study

concluded that except /s/ in medial position all other sounds could be used to assess children at the age range of 2.5-3.0 years.

Keywords: Cleft lip and palate, Articulation, Children, Sinhala, Word list

Introduction

Cleft lip and palate (CLP) is one of the common congenital deformities which give rises to articulation errors that make the individual's speech unintelligible. Communication problems associated with CLP is one main area that Speech and Language Therapists (SLTs) are working and Cleft type speech characteristics are the articulatory errors mostly seen with the children with CLP. Several authors concluded that speech characteristics related to CLP are mainly based on abnormal nasal resonance, abnormal nasal airflow, and altered laryngeal voice quality, nasal or facial grimace and atypical consonant production (McWilliams *et al.* 1990; Bzoch, 1979; Sell *et al.* 1994; Sell *et al.* 1999; Wyatt *et al* 1996).

Children's speech sound development can be analyzed according to phonetic acquisition or phonemic acquisition. The Articulation Assessments looks at a child's ability to produce individual speech

sounds, in words or in isolation, by establishing the child's phonetic inventory.

Based on the protocols (Sell 2004) of the treatment for cleft, identifying speech errors in early stages of life (e.g. 2-3 years), could facilitate the intervention successfully. To identify these cleft type speech errors clinicians use cleft assessments, which usually consist of spontaneous speech sample, production of single words and or sentences (Sell 2004). These tests should be validated according to the language norms of that culture and linguistic variability. There are tools/assessments developed based on English norms and on few other languages (Sell 1996, 2006). The Great Ormond Street Speech Assessment GOS.SP.ASS (Sell *et al.* 1994; Sell *et al.* 1999) is one of the standardized comprehensive screening procedures which are used to describe speech characteristics associated with cleft lip and palate. Cleft Audit Protocol for Speech (CAPS) (Harding *et al.* 1997), Templin- Darley Test of articulation (Templin and Darley 1969) are few others.

Wellman *et al.* 1931; and Templin 1957 noted that the required minimum percentage of children in an age group who can produce a sound correctly as defined as 75%. Prather *et al. 1990* studied Articulation development in normally developing children aged two to four years. In their study, they considered the sound was assigned to an age level when 75% or more of the sample correctly produced the sound in both word initial and final position.

In SL, the incidence of CLP has been reported to be 0.83 per 1,000 births, and isolated cleft palate (CP) to be 0.19 per 1,000 births (Amaratunga and Chandrasekera, 1989). Currently in Sri Lanka we do not have any standardized assessments to identify the cleft errors. Speech and Language therapists carry out informal assessments to assess cleft type errors based on standardized English articulation assessments to assess articulation skills. Materials used in those assessments are not applicable to use with Sinhala speaking children, because they are culturally and linguistically not appropriate for Sinhala speaking context. Therefore it is very important to have culturally appropriate formal assessment and materials to assess characteristics of the speech come with CLP in Sri Lanka. We report here high frequency words used by children and a suitable word list that may be used to assess cleft type errors based on its assessment in a sample of typically developing 2.5-3.0 year old Sinhala speaking children.

Methodology

This study was conducted in two phases: in phase 1, words were identified and develop the wordlist to assess articulation skills in Sinhala speaking children with CLP; in phase 2, the wordlist was tested on typically developing Sinhala speaking children aged 2.5 to 3.0 years.

Phase 1

A cross sectional study conducted in home based setting. 18 typically developing children aged 2.5 to 3.0 years were selected from a list of children maintained by Public Health Midwives(PHM) on Wennappuwa area. In all children, Sinhala was the first language. Children with delayed motor, speech, social, play behavior (according to the CHDR-Child Health Developmental record card and history) milestones and a past history of developmental delay were excluded from the study. All participants were screened for language, comprehension, cognition and speech using an informal screening tool by three independent investigators to check eligibility and suitability for the study. Informed written consent was gained from the parents.

A minimum 20 minutes play based observations were conducted. The play session was video recorded. The recording was later viewed and nouns used by children were documented. Only the nouns beginning with 18 consonants, /p, t, ʈ, c, k, b, d, ɖ, ɟ, g, j, r, l, w, s, h, m, n/ (the Sinhala language has 16 vowels and 40 consonants in written alphabet), excluding the pre-nasalized consonants, were recorded. 95 words were documented. Based on the frequency of times a word was used, the most commonly used high frequency words were selected for the tool.

Phase 2

The developed wordlist was pre-tested on 5 children in the age of 2.5 to 3.0 years to check the words and objects appropriateness for the age. Based on the pre-test, 2 words having /ch/ and /t/ sounds in word initial position had to be modified.

A toolkit was developed using miniature toys of the objects in the world list using locally available and safe material. The modified tool was pilot tested on 3 children in the age f 2.5 to 3.0 years to check the feasibility of administration of the tool. Last the tool was assessed on 30 typically developing children aged 2.5 to 3.0 years recruited from the same PHM areas but who did not participate in Phase 1 of this study. The cross sectional study was conducted at home setting after obtaining informed written consent from the parents. The children were asked to name the given object (of the selected word). If the child was unable to name the object spontaneously, first and second repeat attempts were given. The interview session with the child was video recorded and reviewed later to note the responses. The responses were rated for resonance. .

Data Analysis and coding

Frequency distribution was generated using Microsoft excel software. In phase 2, a child who failed to articulate a sound after 3 attempts (spontaneous, first and second repeat attempts) was considered as

"unable to articulate a particular sound". Data were analyzed using Microsoft Excel and SPSS version 16.0 software package. The competency levels for sounds in both consonant positions (initial and medial) were categorized based on the principle suggested by Wellman *et al.* (1931), Templin (1957) and Prather *et al.* (1990), as if 75% of the participants produced the sound correctly, the word was considered an acceptable word for the articulation tool.

Ethical considerations

Ethical clearance for the research was obtained from the Ethical review committee, Faculty of Medicine, University of Kelaniya. Written consent was taken from the parents/ guardian for their children to participate in the study, keep recordings and publish the data. Further written consent was taken from the Medical Office for Health, to take the child index register. Child willingness for participating to the study was considered. If the child did not seem to like to participate or if the child showed discomfort, he/she was not included in the study. Confidentiality of the information and the audio/ video recordings taken were maintained.

Results

Ninety six nouns having 18 consonants in the initial and medial positions were documented. Of the 95 words, 18 words with the

consonant in the initial position were initially selected and twelve of these words were also used for the consonant in the medial position. Six additional words having the consonant in medial position were selected from the list of original words. There were a total of 24 words used in the study (Table 1).

Table 1. List of words used and frequency of use.

Word (Sinhala)	Word (Phonetics)	Number of subjects produced the word
පනාව	p^{a}ɑnɑ:w^{b}a	10
තොප්පිය	t^{a}oppija	13
ටොෆි	$ʈ^{a}$ofi	3
චොක්ලට්	c^{a}oklaʈ	3
කෝප්පෙ	k^{a}o:pp^{b}e	12
බෝලෙ	b^{a}o:le	16
දොඩම්	d^{a}oɖ^{b}ɑm	8
ඩෝසරය	ɖ^{a}o:saraja	8
ජනේලෙ	$ɟ^{a}$ɑn^{b}e:le	8
ගෙම්බා	g^{a}emb^{b}ɑ:	9
යතුර	j^{a}ɑt^{b}ur^{b}a	10
රෝස මල	r^{a}o:s^{b}a mala	6
ලණුව	l^{a}ɑnuwa	12

වළල්ල	w[a]ɑlalla	9
සමණළයා	s[a]ɑm[b]analaj[b]ɑ:	15
හැන්ද	h[a]ænd[b]a	14
මල	m[a]ɑl[b]a	18
නහය	n[a]ahaja	7
රටකජුකජු /	raṭa kaj[b]u/ kaj[b]u	8
සරුංගලේ	saunɡ[b]ale:	7
පුටුව	puṭ[b]uwa	5
කෝච්චිය	ko:cc[bi]ja	13
කකුල	kɑk[b]ula	7
ගහ	gɑh[b]ɑ	7

[a] Word with consonant in initial position

[b] Word with consonant in medial position

/mɑla/ (flower) was the most frequently produced word among children (18 out of 18). There was no difference in production between less syllabic and more syllabic words and both were produced simultaneously. Boys showed more interaction with toy vehicles while girls showed more interaction with accessories, dolls and toy kitchen items. The performance of children on producing sounds of consonants in word initial and medial positions are presented in Table 2.

Among 2.5 to 3 year olds, fricative simplification for sound /f/ produced as /p/ was the most frequently observed (53%) developmental pattern. In addition, weak syllable deletion (omission of /h/ in word medial position), stopping of /s/→/t/ in word medial position and use of /l/ for /r/ in word medial position were other developmental patterns observed.

Table 2. Performance of children on producing sounds of consonants in word initial and medial positions

Sound		2.5 to 3.0 years			
		Produced		Not Produced	
		N	(%)	n	(%)
P /p/	Initial	30	(100.0)	00	(0.0)
	Medial	29	(96.7)	01	(3.3)
th /t/	Initial	29	(96.7)	01	(3.3)
	Medial	30	(100.0)	00	(0.0)
t /t̪/	Initial	30	(100.0)	00	(0.0)
	Medial	30	(100.0)	00	(0.0)
ch /c/	Initial	30	(100.0)	00	(0.0)
	Medial	30	(100.0)	00	(0.0)
k /k/	Initial	28	(93.3)	02	(6.7)
	Medial	30	(100.0)	00	(0.0)

b /b/	Initial	30	(100.0)	00	(0.0)
	Medial	27	(90.0)	03	(10.0)
dh /d/	Initial	30	(100.0)	00	(0.0)
	Medial	30	(100.0)	00	(0.0)
d /ḍ/	Initial	29	(96.7)	01	(3.3)
	Medial	29	(96.7)	01	(3.3)
j /j/	Initial	27	(90.0)	03	(10.0)
	Medial	26	(86.7)	04	(13.3)
g /g/	Initial	30	(100.0)	00	(0.0)
	Medial	26	(86.7)	04	(13.3)
y /j/	Initial	30	(100.0)	00	(0.0)
	Medial	29	(96.7)	01	(3.3)
r /r/	Initial	28	(93.3)	02	(6.7)
	Medial	24	(80.0)	06	(20.0)
l /l/	Initial	30	(100.0)	00	(0.0)
	Medial	30	(100.0)	00	(0.0)
w /w/	Initial	24	(80.0)	06	(20.0)
	Medial	30	(100.0)	00	(0.0)
s /s/	Initial	29	(96.7)	01	(3.3)
	Medial	21	(70.0)	09	(30.0)
h /h/	Initial	29	(96.7)	01	(3.3)
	Medial	23	(76.7)	07	(23.3)

m /m/	Initial	30	(100.0)	00	(0.0)
	Medial	30	(100.0)	00	(0.0)
n /n/	Initial	30	(100.0)	00	(0.0)
	Medial	30	(100.0)	00	(0.0)

Discussion

The noted 96 words were used to develop the word list. The words stated with bilabial stop, bilabial nasal and voice less velar stop sounds (words starting from sound /p, b, m, k/) are most frequent words out of those 96 words. According to *Grunwell, 1989* norms for English speaking children, in the age of 2.5 to 3.5 years, sounds /m, p, b, w, n, t, d n, k, g, h, ɳ, f, s, w, j/ are acquired and sound / l/ is developing. According to their norms, /ɵ, ð, ʧ, ʤ/ produced as fricatives and affricates and lately acquired. But in our study those sounds are produced as stop sounds and able to produced in this 2.5 to 3.0 age range (in Sinhala: ɵ= t, ð= d, ʧ= c, ʤ= ɟ). In our sample, all consonants were produced 75% or more than accurately except sound /s/ in word medial position. The production percentage for sound /s/ in word medial position is 70% of the sample population.

The discrepancies we report between observations in our sample and the English norms set by Grunwell (1989) may be due to the manner in

which the studies were conducted. Grunwell (1989) based his observations on phonemic acquisition skills whereas we used phonetic acquisition skills. Some sounds such as /s, ʈ, ɖ, r,/ which are believed to be acquired later in Sinhala speaking children. We observed that some children in our sample were able to produce them at the two repeat attempts. Our children had more difficulty in spontaneously producing /d, ɖ, ɟ, j, r, l, w/ sounds in word initial position and producing /ɖ, r, s/ sounds in word medial position as compared to other consonants.

Among 2.5 to 3.0 year old English speaking children, final consonant deletion, cluster reduction, stopping /v, ð, z, ʧ, ʤ/, /ɵ/ →/f/, fronting of /ʃ/→ /s/, gliding /r/→ /w/ and context sensitive voicing have been described as developmental phonological processes (Grunwell 1989). 23.3% of our Sinhala speaking 2.5-3.0 year old children produced /r/ as /l/ sound. Stopping of /f/ →/p/ (fricative simplification process) is the commonest developmental pattern (53.3 %) of this age group. 23.3% of the children produced /t/ for /s/ in word medial position. 23.3% of our children produced /samanalaja/as /samalaja/ and /nahaja/ as /na:ja/; other examples of weak syllable deletion included (/saruŋgalaja/--> /saruŋgaja/) and /walalla→/alalla/). We also observed consonant harmony (13.3%) and context sensitive voicing (6.7 %) in this age group. There is no significant difference between male and female sound production wasobserved.

Hutters and Henningsson (2004) reported that sounds that are produced may differ based on language background; hence, speakers of different language backgrounds require different speech material for speech assessment. We have highlighted here differences in sound production between English and Sinhala speaking 2.5 -3.0 year old children and the need to establish unique norms for children speaking different languages.

Conclusion

Except sound /s/ in word medial position all the other sounds can be described as correctly produced sounds for the aged 2.5 to 3.0 years. This result concluded that the word list which used to assess those sounds is a suitable word list to assess articulation skills in aged 2.5 years to 3.0 years and can be used to develop articulation assessment.

Recommendation

The Developed wordlist should be validated with CLP children. In this study, the suitability of the word list was checked with typically developing children as a preliminary process of developing an assessment. After the validation, this word list can be developed as an Articulation assessment for Sinhala speaking children with CLP aged between 2.5 years to 3.0 years and manual and a guide could be develop for the clinician to follow when administrating the tool.

References

Amaratunga, AN; A.Chandrasekera (1989) Incidence of cleft lip and palate in Sri Lanka. *Journal of oral maxillofacial surgery,* 1989 Jun. Vol. 47. No 6, pp. 559-61.

Dodd, B; A. Holm, Z. Hua and S. Crosbie. 2003. Phonological development: a normative study of British-English speaking children. *Journal of clinical linguistics and phonetics*. Vol.17, No 8, pp.617-643.

Giddings, M and C. Halverson, (1981) Young children's use of toys in home environment. *Family relations*. Vol 30, No 1, pp.69-74.

Grunwell, P. (1987) *Clinical phonology*, 2nd edition. Croom Helm, London and Sydney. pp.114-116,Chapter1. Chapter 5.Chapter 14.

Grunwell, P; A.C.H. Watson; D.A. Sell. (2001) Management of cleft lip and palate, Whurr publishers Ltd, chapter 5, chapter 14

Henninigsson, G; D.P.Quehn; D.Sell; T.Sweeney; Judith. E. Trost-Cardamone; L. Whitehill.(2008) Universal parameters for reporting speech outcomes in individuals with cleft palate. The cleft palate craniofacial Journal. Vol. 45, n. 1,pp. 1-17.

Hettiarachchi,S; M. Ranaweere; R. Rassool. (2001) 'Universal' and ' language specific' features of Sinhala and Sri Lankan Tamil reflected in trajectory of phonetic and phonology development in children. 5th Research Conference,.March 30th – 31st 2011. The Royal Asiatic Society of Sri Lanka. Book of Abstracts, p112

Hutters, B; G. Henningsson. (2004) Speech outcome following treatment in cross-linguistic cleft palate studies: Methodological implications. The cleft palate-craniofacial journal. Vol. 41. No. 5. pp. 544-549.

Kumara, KH ; N. Dias; H.Sirisena (2007) Automatic segmentation of given Sinhala text in to syllables for speech synthesis. *Journal of Science*, University of Kelaniya. Vol. 3. pp.53-62.

Lohmander, A. and M. Olsson. (2004). Methodology for perceptual assessment of speech in patients with cleft palate: a critical review of the literature. *The cleft palate-craniofacial Journal*. Vol. 41, No. 1, pp. 64-70.

Lohmander, A and A.E. Soderpalm. (1993) Evaluation of speech after complete later closure of the hard palate. *Folia phoniatrica*. Vol 45, pp.25-30.

Prather, E; D. Hedrik; Caroline A. Kern.(1990) Articulation development in children aged two to four years. *National Speech Language Hearing student Association Journal*. Vol 18. pp.96- 102.

Reynell, K; P. Gruber.(1971) New scales for the assessment of language development in young children. *Journal of learning disability*. Vol. 4, No 10. pp. 549- 557.

Sell, D; A. Harding; P. Grunwell. (1994) A screening assessment of cleft palate speec (Great Ormond Street Speech Assessment). *European*

Journal of Disorders of Communication. The college of speech and language therapists, London,Vol. 29,pp. 1-15.

Sell, D. (2004) Issues in perceptual speech analysis in cleft palate and related disorders: a review. Received 27 April 2004. Accepted September 2004. *International Journal of Language and communication disorders*.. Vol. 40, No. 2, pp. 103–121.

Sell, D; A. John; A. Harding- Bell; T. Sweeney; A. Harding- Bell; A. Williams. (2006). The cleft audit protocol for speech—augmented: a validatedand reliable measure for auditing cleft speech. *cleft palate craniofacial journal*. 2006 May. Vol 43. No 3. pp.272-288.

Sell, D; A. John; A. Harding- Bell; T. Sweeney; F. Hegarty and J. Freeman (2003). cleft audit protocol for speech (CAPS-A):A comprehensive training package for speech analysis, *International journal of speech & communication disorders*.. Vol. 44, No. 4, pp.529-548