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Zhengwei Lu, D.D.S., Lian Ma, Ph.D., M.D., Yi Luo, D.D.S., Paul Fletcher, M.Phil., Ph.D.

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Objective: **To investigate the effects of unrepaired cleft palate on the development of vocabulary comprehension and expression of Chinese children aged 8 to 15 months.**

Methods: **The parents or caregivers of 40 infants with unrepaired cleft palate were recruited from the Cleft Lip and Palate Center at the Stomatology School of Peking University. Vocabulary development was assessed using a parent report protocol, the Chinese Communicative Development Inventory: Infant, for Putonghua (PCDI: Infant). The scores for vocabulary comprehension and expression of infants with clefts were compared with typically developing infants in the same age group.**

Results: **All infants with unrepaired cleft palate performed below the typically developing infants in vocabulary comprehension, but there were no significant differences from 8 to 15 months of age. No significant differences were found from 8 to 13 months of age on the expressive vocabulary portion of the Chinese Communicative Development Inventory: Infant, for Putonghua. However, a significant difference appeared at 14 and 15 months, with infants with cleft palate performing at a significantly lower level than the typically developing infants.**

Conclusion: **The development of vocabulary comprehension in Chinese infants younger than 14 months with unrepaired cleft palate is not significantly delayed. At 14 and 15 months, however, the development of vocabulary expression is delayed. The reasons may be found in the specific phonetic characteristics of Putonghua.**

KEY WORDS: *cleft palate, early vocabulary development, infant, parent report*

Because the development of speech and vocabulary are closely interrelated, especially in the earliest stages of vocabulary development (Fletcher et al., 2005), the question arises whether cleft palate may affect vocabulary development as well as speech. There are indications in the literature that English-speaking children with cleft palate are at risk for early vocabulary delay (Kuehn and Moller, 2000). Jocelyn et al. (1996) found statistically significant differences in both receptive and expressive abilities between children with cleft lip and palate and noncleft peers at the ages of 12 and 24 months. Scherer and D'Antonio (1995) indicated that differences between the cleft and noncleft groups demonstrated evidence of delays in expressive vocabulary development in children 16 to 30 months with cleft lip and palate.

In contrast, other studies have not demonstrated a delay in vocabulary performance in children with cleft palate or cleft lip and palate in comparison with samples of typically developing (TD) children. Neiman and Savage (1997) did not find early expressive vocabulary delays in English-speaking children. They reported that toddlers with cleft palate did not exhibit at-risk or delayed expressive vocabulary development until 36 months of age. Broen et al. (1998) compared the early cognitive and linguistic development of toddlers with cleft palate with that of noncleft peers. Although small but statistically significant differences were found, linguistic and cognitive performance in the children with cleft were well within TD limits. Similarly, Chapman et al. (1998) did not find any significant group differences in conversational skills between children with unilateral cleft lip and palate (UCLP) and their noncleft peers. When the profiles of individual children were examined, however, 50% of the preschool children with UCLP appeared to exhibit low assertive conversational participation.

Assuming vocabulary delay does exist in some children with cleft palate, the etiology of the delay is not well understood. It has been suggested that early hearing loss may account for the vocabulary disabilities in children with clefts. These children are prone to middle ear effusion,

Dr. Lu is Lecturer, Dr. Ma is Professor, and Dr. Luo is Consultant, Cleft Lip and Palate Center, Peking University School of Stomatology, Beijing, China. Dr. Fletcher is Emeritus Professor, Speech and Hearing Sciences, University College, Cork, Ireland.

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Address correspondence to: Dr. Lian Ma, 22# South Avenue, Zhong Guancun, Weigongcun, Haidian Beijing 100081 China. E-mail Lamaiana@gmail.com.

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TABLE 1 Dental-Alveolar and Palatal Initial Consonants in Putonghua

Unaspirated Affricates	*Aspirated Affricates*	*Fricatives*
ts	ts^h	s
tʂ	$tʂ^h$	ʂ
tɕ	$tɕ^h$	ɕ

which is often accompanied by mild to moderate hearing loss (Broen et al., 1996). Some studies have reported a relation between hearing loss associated with frequent otitis media with effusion and lower scores on vocabulary measures (Jocelyn et al., 1996; Schonweiler et al., 2000). Other authors state that vocabulary delays in children with cleft palate may be genetically determined and mediated by dysfunction in auditory short-term memory (Richman and Eliason, 1984; Ceponiene et al., 1999). A third possible reason for vocabulary delay in children with cleft palate may be found in interaction patterns between these children and their parents. Broen et al. (1998) hypothesize that children with better, more intelligible, age-appropriate speech may receive more accurate feedback. They suggest that vocabulary learning is aided by the ability to produce intelligible, age-appropriate speech. This does not mean that infants' pronunciations have to be accurate in terms of the target language, but the words children produce have to be identifiable by caregivers so they can provide responses that model these words in return. If caregivers cannot recognize a word a child attempts, the more limited is the scope for useful feedback. There is also some evidence that poor speech has a generally inhibiting effect on conversational interactions between children and caregivers (Frederickson et al., 2006). This would further limit the provision of accurate models for children with cleft lip and palate.

This interpretation of early vocabulary learning can be linked to features of early speech development in both TD children and children with cleft palate. The preference by TD children for some sounds over others (Fletcher et al., 2004) leads to homophony in the words they produce. For example, a preference in English for alveolar plosives over homorganic fricatives can lead to *tea* and *sea* having the same pronunciation, both being pronounced as *tea*. The more limited the child's phonetic repertoire, the greater the potential for homophony, for parental misunderstanding, and so the potential for the child to hear fewer accurate renditions of a word. If children with cleft palate persist longer than TD children with a restricted set of sounds, they would appear to be more at risk of less-than-optimal feedback from their caregivers. For Putonghua-speaking Chinese children with cleft palate, faced with learning a much more complex set of alveolar and palatal sounds than English-speaking children, the risk may be exacerbated because the simplification strategies they adopt may increase homophony. Table 1 shows that the sounds that form in the alveolar and palatal region in Putonghua, there are nine initial consonants out of a total of 21 (compared with five in English out of a similar total). Six of these are affricates and six are also retroflex—both features likely to contribute to articulation difficulty.

There is a further possible source of homophony in Chinese children with cleft lip and palate. There is evidence available from another Chinese vocabulary, Cantonese, that children with cleft palate are prone to the omission of initial consonants (Whitehill et al., 1995). Although Cantonese and Putonghua (Mandarin Chinese) are distinct languages and a speaker of one will not be able to understand a speaker of the other, they are typologically very alike in having contrastive tone and simple syllabic structures (maximally CVC), with a very restricted set of final consonants possible. If the initial consonant is omitted from a word in either of these Chinese vocabularies, a listener could rely on the syllable coda and the tone to identify it. But as the child's vocabulary expanded, initial consonant deletion would again tend to bring about massive homophony and so cause interpretation problems for interlocutors.

The assumption that the child's vocabulary development is related to the ability to produce recognizable, age-appropriate speech is then also the basis for the hypothesis in this study. In concurrence with the assumption that age-appropriate speech aids the child's vocabulary development by encouraging feedback from caregivers containing accurate models of the words the child is attempting, it was hypothesized that cleft palate will not affect receptive ability, even in children with unrepaired clefts, but will impact on vocabulary development in the early stages of the production of single words in Putonghua. This will be particularly apparent in children with unrepaired clefts because the potential for homophony increases with even moderate expansion of the child's stock of words.

Method

Participants

Forty nonsyndromic children ranging in age from 8 to 15 months with surgically unrepaired cleft palate were recruited from patients attending the Cleft Lip and Palate Center of the Peking University School of Stomatology. Written parental consent was obtained for all participants, in accordance with center ethical procedures. Intraoral examinations were performed on all children to ensure an accurate diagnosis. Table 2 provides a description of the participants in the cleft group. Criteria for exclusion included any evidence of a genetic syndrome; failures of universal newborn hearing screening, history of high-risk birth factors (other than clefting and prematurity defined as less than 36 weeks gestation); and family language not Putonghua.

The TD children with whom the group of children with cleft palate were compared were those who constituted the

TABLE 2 Participants' Condition, N = 40

	Gender		*Cleft Type*	
Age Group, mo	*M*	*F*	*Cleft Lip and Palate*	*Isolated Cleft Palate*
8 to 9	5	5	5	5
10 to 11	7	3	5	5
12 to 13	3	7	5	5
14 to 15	7	3	4	6

normative sample of the Chinese Communicative Development Inventory: Infant, for Putonghua (PCDI: Infant). This group of 636 children between the ages of 8 and 16 months constituted a stratified random sample from the city of Beijing. All the children in the cleft group were from Beijing or from cities near Beijing such as Tianjin. There were no children in either group from a rural background. In common with more than 99% of the TD sample, the children in the cleft group had no siblings. The modal education level of the parents of the TD children was upper secondary (10 to 12 years of schooling), and this was the case for the parents of the children with cleft palate also.

Procedure

This study was facilitated by the recent availability of the PCDI (Tardif and Fletcher, 2008). The Chinese Communicative Development Inventory was developed on the model of the MacArthur Communicative Development Inventory (MCDI; Fenson et al., 2007) and standardized in Beijing on 1692 children between 8 and 30 months of age. This parent/caregiver approach to the measurement of children's vocabulary development now has been extended successfully to around 40 languages worldwide (Fenson et al., 2007). The PCDI is closely modeled on the original MacArthur-Bates CDI but adapted linguistically and culturally for Chinese children. Test-retest reliability for vocabulary comprehension on the PCDI is .98 and vocabulary expression, .93; its criterion validity is .62 (Tardif and Fletcher, 2008). Scherer and D'Antonio (1995) investigated the efficacy of the MCDI for screening early vocabulary development of English-speaking children with cleft lip and palate. Results indicated the MCDI showed concurrent validity with a comprehensive speech-vocabulary screen. The PCDI has versions for infants (8 to 16 months) and for toddlers (16 to 30 months). In this study we used only the PCDI: Infant, which is an instrument designed to elicit parent/caregiver reports on children's prelinguistic behaviors and on their comprehension and expression of vocabulary. Table 3 shows the categories and item numbers of the PCDI: Infant form. Here we report only on parent/caregiver responses to the Vocabulary Checklist, which contains 411 items in 20 different categories (e.g., action words, kinship terms, household items, animal names).

In line with the procedure outlined in the user's guide and manual for the Chinese Communicative Development Inventories (Tardif and Fletcher, 2008), using face-to-face interviews with the PCDI: Infant, parents of 40 children aged 8 to 15 months were asked to report their children's vocabulary skills. *t* tests were used to compare the mean scores of vocabulary comprehension and expression between the cleft children and TD children in the same age group. The scores of the TD children are those reported by Hao et al. (2005), which were derived, in turn, from Tardif and Fletcher (2008). Most vocabulary assessment instruments typically use the 10th to 15th percentile for demarcating the lower limits of typical development. Therefore, for purpose of this study, the criterion for vocabulary development delay was defined as performance at or below the 15th percentile.

TABLE 3 The Categories and Item Numbers of the PCDI: Infant Form*

Items	*Vocabulary Ability*	*Scores*
Part One: Early Vocabulary		
A. First Signs of Understanding	comprehension	3
B. Understand Phrases	comprehension	27
C. Starting to Talk	expression	4(8)
D. Vocabulary Checklist		
Understand	comprehension	411 (20 categories)
Can say	expression	
Part Two: Actions and Gestures		
A. Early communicative Gestures	expression	11(22)
B. Games and Routines	expression	5
C. Interactive Actions	expression	15
D. Pretend Play	expression	5
E. Imitate Adult Behaviors	expression	7

* Only numbers in the Vocabulary Checklist are included in this report.

Results

From 8 to 15 months, the development of vocabulary comprehension in all infants with cleft palate is rapid, but the development of vocabulary expression is slow. Table 4 shows that although all infants with cleft palate performed below the noncleft infants in vocabulary comprehension, the differences between the groups are not significant at any of the age levels compared. Figure 1 provides a profile of the progression of both groups over time, relative to a criterion level at the 15th percentile below mean TD performance level. There is considerable variation in the vocabulary comprehension scores reported for the infants with cleft palate, but it should be noted that even taking this into account, reported comprehension scores are considerably in advance of expression scores.

Turning to Table 5 we see that infants with cleft palate had expressive vocabulary scores slightly in advance of the noncleft group at 8 to 13 months, but the difference is not significant. At 14 and 15 months, however, the reported vocabularies of infants with cleft palate are significantly lower than those of the noncleft group ($t = -6.345$, $df = 150$, $p < .000$). Figure 2 shows the trajectory of expressive scores of the infants with cleft leveling off after the 12- to

TABLE 4 Vocabulary Comprehension Scores (Mean ± SD)

Age Group, mo	Number		Vocabulary Comprehension Scores		t	p
	Cleft	Normal	Cleft	Normal		
8 to 9	10	141	81.5 ± 50.28	110.5 ± 13	−1.824	.101
10 to 11	10	141	163.7 ± 126.82	176.7 ± 12.8	−0.324	.753
12 to 13	10	142	214.6 ± 114.94	237.5 ± 12.9	−0.63	.544
14 to 15	10	142	286.4 ± 137.46	293.5 ± 12.8	−0.163	.874

13-month point and also indicates that at 14 to 15 months the mean score off the group is falling below the criterion for vocabulary delay.

Discussion

The period of infancy is critical for vocabulary development, and the early identification and treatment of vocabulary delay is important for patients. Decisions on both surgical treatment and speech and vocabulary intervention need to be based on culture-specific information. In China, the acquisition of valid and reliable information on the vital early stages of vocabulary development has not been straightforward. There are few reports on the vocabulary development of infants with cleft palate in the literature, and until recently no standardized assessment measures existed in China for young children speaking Putonghua. The availability of the PCDI now makes it possible to scrutinize in detail the period in which a child begins to speak in Putonghua-speaking children at a critical age. The advantage of the PCDI, in addition to the facility it provides for comparison with a standardization sample, is that as a parent report instrument it provides detailed, valid, and reliable information about the child's performance in everyday situations, as observed by the people who know the child best.

The development of vocabulary comprehension in Putonghua-speaking children with unrepaired cleft palate is in line with the trend in their TD peers. The early onset of comprehension vocabulary relative to expression, its linear acceleration over time, and its numerical advantage over expressive vocabulary is apparent in our data for both groups of children. Cleft palate does not appear to limit the comprehension of vocabulary in the early stages. This finding is similar to that found in English-speaking children with clefts, based on parent report (Scherer and D'Antonio, 1995). Vocabulary expression for the children with clefts showed no difference from the noncleft comparison group in the early stages of development, and the linear trend is similar. However, at 14 to 15 months of age the two groups begin to diverge, with the trajectory for the noncleft group flattening out. It is important to see this in the context of the future development of TD Putonghua-speaking children, as revealed by the PCDI. In the early stages of their language development, they dramatically outperform their Cantonese-speaking compatriots in Hong Kong. At 18 months of age, for example, the mean vocabulary score for Putonghua-speaking children is close to 200 words; whereas, for Cantonese-speaking children it is less than 100, which is in line with the figures for English-speaking children in the United States (Tardif and Fletcher, 2008). Two of the major factors contributing to this difference are the single-child status of the Putonghua-speaking children and the consistency of their linguistic input (Tardif et al., in press). Almost all the 1692 children in the Putonghua norming sample were the only child in their family, and everyone in the family spoke Putonghua. In Hong Kong, by contrast, the children in the normal sample often had several siblings and were exposed to a wider range of languages in the home. The rapid early development of the Putonghua vocabulary has to be taken into account in assessing the results reported here and their implications.

What we are seeing in the data for the TD group is the beginning of a rapid acceleration of vocabulary development, facilitated in part by an expanding phonetic repertoire. By contrast, the children with unrepaired cleft palate, as a result of reduced intelligibility as their vocabulary expands, are either using fewer words or having fewer of the words they attempt recognized by caregivers and so are facing reduced feedback as to the accuracy of their productions. This is due to the limitations their cleft

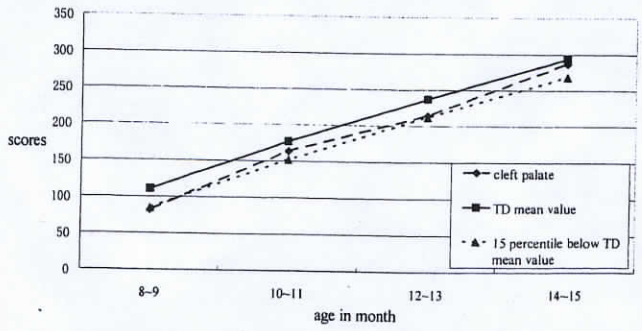

FIGURE 1 Vocabulary comprehension scores comparison of TD children and children with cleft palate. (The criterion line, representing the 15th percentile in TD children, is the conventional level at which language delay is identified.)

TABLE 5 Vocabulary Expression Scores (Mean ± SD)

Age Group, mo	Number		Vocabulary Expression Scores		t	p
	Cleft	Normal	Cleft	Normal		
8 to 9	10	141	13 ± 8.01	10.6 ± 0.9	0.947	.368
10 to 11	10	141	18.7 ± 9.15	17.5 ± 1.3	0.415	.688
12 to 13	10	142	33.6 ± 8.33	30.9 ± 3.2	1.025	.332
14 to 15	10	142	43.3 ± 11.86	67.1 ± 7.8	−6.345	.000

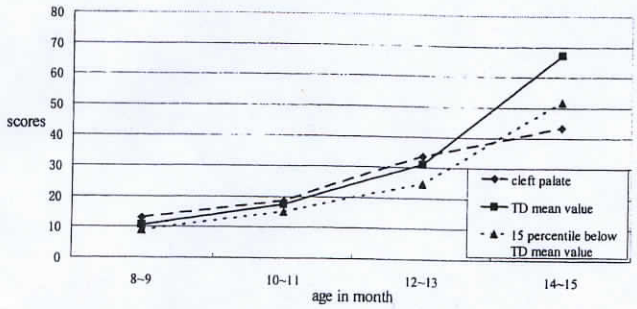

FIGURE 2 Expressive vocabulary scores comparison of TD children and children with cleft palate. (The criterion line, representing the 15th percentile in TD children, is the conventional level at which language delay is identified.)

status imposes on their phonetic inventory in the alveolar and palatal areas and the resulting homophony of the words they attempt. In addition, if they behave similarly to Cantonese-speaking children with cleft palate and resolve their articulation difficulties by resorting to initial consonant deletion, this may play a role in limiting recognition of their speech by caregivers.

The only previous study of early vocabulary development of children with cleft palate using CDI parent report, that of Scherer and D'Antonio (1995) for English, found that lower scores in vocabulary production are maintained in children with cleft palate from 16 to 30 months of age. Although we need to be aware that the results reported here are specific to Putonghua, the data reported suggest that the slower pace of vocabulary progress in children with cleft palate may start earlier. Due to the particularly rapid expansion of vocabulary in Putonghua in the second year of life, early delays in vocabulary development are likely to disadvantage Putonghua-speaking children even more than those speaking other languages and would warrant early surgical intervention As Priester and Goorhuis-Brouwer (2008) demonstrated for Dutch-speaking children, such intervention can lead to successful articulation outcomes at 24 months of age.

The most plausible explanation for the falling-off in expressive vocabulary development, given parity in the comprehension scores of the two groups, rests with the limitations on speech development resulting from an unrepaired cleft palate.

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