International Journal of Pediatric Otorhinolaryngology
54 (2000) 81–91

INTERNATIONAL JOURNAL OF Pediatric Oto Rhino Laryngology

www.elsevier.com/locate/ijporl

Linguistic development in cleft palate patients with and without compensatory articulation disorder

Ma. Carmen Pamplona, Antonio Ysunza *, Mara González, Elena Ramírez, Carmeluza Patiño

Phoniatrics Department, Hospital Gea González, 4800 Calzada de Tlalpan, 14000 Mexico D.F., Mexico

Received 20 December 1999; received in revised form 20 April 2000; accepted 25 April 2000

Abstract

Introduction: Cleft palate patients frequently show compensatory articulation disorder (CAD). CAD severely affects speech intelligibility and requires a prolonged period of speech intervention. CAD has been considered a phonologic disorder. Thus, it seems necessary to explore the relationship between CAD and language development. *Objective:* To study the relationship between language development and the presence of CAD in cleft palate patients. *Materials and Methods:* Cleft palate children with residual velopharyngeal insufficiency (VPI) after palatal closure, with and without CAD were studied. Only patients with an age ranging from 3 to 8 years were included in the study group. Twenty-nine cleft palate patients with residual VPI and CAD were included in the first group (active). The second group was assembled with 29 cleft palate patients with residual VPI without CAD, matched by age and sex (control). For evaluating language development, all patients were analyzed using the Situational–Discourse–Semantic (SDS) Model [13]. This Model is a valuable tool for conducting naturalistic observation and descriptive assessment of language development. The SDS Model provides a detailed description of three contexts (situational, discourse, and semantic) in ten levels of cognitive and linguistic organization. *Results:* In all contexts considered by the model of cognitive and linguistic organization used for this study, i.e. SDS, a Fischer exact test demonstrated that patients with CAD showed a significantly higher frequency of language delay as compared with patients without CAD. None of the patients present with CAD showed an adequate level of language development. The degree of language delay was greater in the situational context as compared to the semantic and discourse contexts. *Conclusions:* Cleft palate patients present with CAD, demonstrated a significantly higher frequency of delay in language development as compared with cleft palate patients present with VPI without CAD. From the results of this paper, it seems that a detailed evaluation of all aspects of cognitive and linguistic organization should be performed in cleft palate patients, especially in patients present with CAD. Moreover, it seems that speech intervention in cleft palate patients with CAD should address not only the articulation process, but also specific aspects of language development.

Keywords: Cleft palate; Language; Compensatory articulation disorder

* Corresponding author. Fax: +52-5-5685086.

PII: S0165-5876(00)00332-3

1. Introduction

Speech outcome in cleft palate patients depends on articulation and nasal resonance. Certain articulation disorders are generally regarded as compensatory behaviors secondary to velopharyngeal insufficiency (VPI). These articulation errors include dysfunction not only of the velopharyngeal sphincter but the entire vocal tract. For example, plosive sounds such as /p/ or /t/ might be attempted by substituting a glottal stop. These anomalous articulation patterns are usually referred as compensatory articulation disorder (CAD). This disorder severely affects speech intelligibility and requires a prolonged period of speech intervention.

Traditionally, CAD has been considered a phonetic disorder [2,10,17]. A phonetic disorder occurs when the movements of the articulators, such as the lips, tongue, palate, or resonating cavity are altered from a normal or typical production. A compensation such as glottal production would be considered phonetic, as the child with velopharyngeal insufficiency attempted to produce the sound in an alternative manner to compensate for the inability to establish intraoral air pressure because of the cleft [3]. Because the glottal production reflected an obvious and productive compensation, the problem was viewed as phonetic and articulation became the main topic in intervention. However, only a small or moderate percentage of children with repaired cleft palate exhibit CAD. Most patients, following the repair, produce the more typical pattern and no articulation delays or deviations are seen [14].

The finding that a small percentage of patients continue to produce CAD despite the early and effective repair of the cleft suggests that some factor other than the inability to establish sufficient intraoral air pressure is contributing to the development and maintenance of this articulatory pattern. Most of the palatal repairs are completed between 12 and 18 months of age, or at the time when first words appear. The appearance of words suggests that by this age children are already establishing a phonological system, or a set of linguistic rules that map the phonetic patterns of speech to the sound and syllable patterns of meaningful language. Thus, what had been a compensatory strategy for approximating sounds heard in the environment during early stages of babbling for some patients becomes incorporated into the phonological rule system before the surgery is completed. Following surgery, when the child is quite capable of producing the plosive sounds or other speech patterns in a more typical manner, the child continues to produce the CAD form because it had become integrated with the language rules instead of the correct pattern. At this point, what began as a phonetic compensation had become a phonological rule. As a generative and productive rule, the articulatory production would not change until the rule changed, despite the change in the physical capability to produce the sound correctly.

Evidence for the contention that many of the speech problems of cleft palate children are phonological rather than phonetic can be found in two studies. Chapman in 1993 [3], compared articulation errors produced by children with cleft palate to age-matched and younger groups of typically developing children using a phonological analysis. A phonological analysis examines errors for patterns, such as deleting or modifying sound production patterns according to regularities or ‘rules’. Her findings indicated that children with cleft palate produced the same types of phonological process errors as the younger typically developing children, but they maintained these process errors longer than the age-matched peers. She also found that the children with cleft palate used the phonological process of backing with greater frequency and for more sounds than did the typically developing children. She concluded that these findings suggested the articulation errors of children with cleft palate were of the same phonological nature as the typically developing children, and that the high occurrence of backing indicated that compensatory gestures had become incorporated into the phonological rules of the subjects.

In the second study, Pamplona and Ysunza, in 1999 [14], treated children with CAD following surgery in either a phonetic or a phonological treatment approach. In the phonetic approach children were taught correct production of the error sounds through modeling and reinforcement, using repetitive drill for a single phoneme until it was mastered. In the phonological condition, multiple errors were targeted simultaneously by focusing on a process, such as producing phonemes in a more frontal position. Thus, three phonemes that had been produced as a glottal stop, such as /k/, /t/, and /p/ were treated simultaneously as sounds requiring more frontal posturing. The phonemes were taught and practiced in a meaningful language context such as storybook reading. Results indicated that while both groups improved their speech, the phonological group achieved normal speech production on average 1 year sooner than did the phonemic group, which required 2.5 years of therapy. Addressing the phonological rules resulted in faster learning of the target productions and more rapid incorporation into the language rules and thus more immediate carryover into conversational speech.

These findings suggest that many of the articulation problems in children with repaired cleft palate currently viewed as phonetic may actually be phonological as early as 1 year of age. It also implies that during speech assessment and intervention, some additional phonologic analysis and specific strategies should be employed.

Because the phonological system is integrated with the language system, and because faster progress was made when treatment for CAD was conducted in the meaningful language context of storybook reading, it is also suggested that the language of children with CAD should also be assessed. Hoffman in 1992 [8] stated that children's speech sound production and perception errors are related not only to phonological knowledge, but also to higher organizational levels of language processing. He also mentions some research findings indicating that children who have difficulty learning phonology also show similar difficulties for learning morphological, syntactic, and semantic regularities of language as well [1,5]. Hoffman and his colleagues in a series of studies showed that children with phonological disorders made greater progress in both articulation and in language measures such compared to children in treatment approaches that focused on phonological patterns practiced outside of a meaningful language context [8,13].

Other researchers have identified language problems in children with cleft palate, including syntax (i.e. grammar), morphology, and vocabulary [10,11,15,17]. These findings suggest that many of the language problems actually exhibited by children with CAD may be overlooked when the speech disorder is viewed from a phonetic rather than a phonological perspective. In many cases, there is an interaction between the phonological rules and other language rule systems, so that an articulation problem is really far more complex in nature than a phonetic analysis would suggest.

The purpose of this paper is to explore the possible relationship between CAD and the child's language system, including the ability to use semantic, syntactic, and discourse elements of language rules to express meaning. It is hypothesized that children with CAD will differ in their overall development of language, and not just speech productions, from children with repaired cleft palates that do not show the CAD speech patterns.

2. Methods

Children with CAD and a matched group of subjects with repaired cleft palate but without CAD were compared for language abilities in the contexts of free play and story retelling. Language samples were analyzed for the semantic level of ideas expressed, discourse organization, and the level of situational displacement.

2.1. Subjects

The experimental subjects of this study were 29 children with repaired cleft palates who exhibited CAD. Subjects were between the ages of 3 and 8 years at the time of evaluation. A matched control group of 29 children with repaired cleft palate but without CAD was also identified. Both groups of subjects were recruited from patients who were evaluated in the cleft palate clinic of the Hospital Gea González at México City from June of 1997 to December of 1998. To qualify for the experimental group for this paper, the patients had to meet the following criteria:

1. Unilateral, complete cleft of primary, and secondary palate [9];
2. No known neurological or genetic syndromes;
3. No identified language disorders;
4. Cleft palate width had to be grades I or II [12];
5. Palatal repair of the UCLP performed according to the surgical routine of the Cleft Palate Clinic. This routine includes: surgical repair of the lip and primary palate between 1 and 3 months, and surgical repair of the secondary palate between 12 and 18 months with a minimal incision palatopharingoplasty [12];
6. VPI after palatal repair demonstrated by phoniatric assessment, videonasopharyngoscopy, and multi-view videofluoroscopy [6];
7. Compensatory articulation disorder in association with VPI demonstrated by phoniatric assessment during isolated and connected speech;
8. Absence of postoperative fistulae;
9. Chronological age between 3 and 8 years of age at the time of selection for the study;
10. Normal hearing demonstrated by conventional pure-tone audiometry.

Two types of CAD productions were exhibited by subjects in this study. The first, glottal stop, occurs when plosive sounds requiring intraoral air pressure are produced instead by stopping and releasing air pressure at the level of the glottis. The second, pharyngeal fricative, occurs when the placement of the frication is produced by the tongue and posterior pharyngeal wall instead of the oral cavity.

Twenty-nine children who met the criteria comprised the experimental group. A control group composed of children with cleft palate with VPI without CAD, matched for dimensions such as age, gender, age of repair of the secondary palate, age of tympanostomy tubes, and socio-economic status were selected from the clinical population. To determine if the groups were equivalent, Student t-tests were run for the variables chronological age, age of repair of the secondary palate (i.e. palatopharingoplasty), age of typanostomy tubes, and socio-economic status. Results indicated that no significant group differences were found for any of these variables.

2.2. Evaluation

To determine if there were differences in the language abilities between children with CAD and controls, language samples were elicited from both groups. The samples were obtained under two naturalistic conditions, play and story telling. The samples were collected during two different sessions within a 2-week period. All interactions were video recorded for later transcription and analysis.

2.3. Story telling

Each child met individually with one of the three trained examiners for approximately 30 min of story time. Stories were elicited from one of two sources. All subjects were shown an action picture showing a family engaged in everyday activities such as cooking, playing hide-and-seek, and doing laundry, selected from a picture set. Children were asked to look at the picture and tell a story. They were encouraged to tell more if they did not talk about many events in the picture, and were given question prompts to help elicit more complex information or details. Next, the examiner modeled a standard story about the picture that provided interpretations of the actions of the characters as they were called to dinner. This model included more complex ideas and better story organization than those produced spontaneously by the children. Subjects were then asked to retell the modeled story from the pictures. Both the spontaneous story and the retelling were analyzed.

In the case of the youngest subjects, this story was too difficult and failed to elicit sufficient language production for analysis. In this case, a second storytelling was elicited using an illustrated storybook about bathtime which told a boy getting ready for bed and taking a bath, but making a mess at every step of the process. Once again the procedure of eliciting a spontaneous telling, question prompts, and modeling followed by retelling was used.

2.4. Play

Each child met individually with the same examiner as in the storytelling condition for 30 min on a second day. A miniature play house with a wide array of people, furniture, food items, and other props was available. The child was first allowed to play spontaneously while the examiner asked questions about the actions. The examiner also modeled play actions when needed by the young children and then encouraged the child to try the action and talk to and for the characters.

2.5. Transcription

All videotaped interactions were transcribed verbatim, including the conversational turns of the examiner and the child. Three examiners transcribed the samples which were randomly assigned to an examiner. Each transcription was then checked against the videotape by a researcher that had not done the original transcription along with a second examiner for accuracy. If either of these two judges differed from the transcription, the videotape was rewatched until consensus was reached. All videotapes for all subjects were verified for accuracy in this manner.

2.6. Coding

Each sentence was coded for the level of meaning (semantics) expressed using the criteria established in the Situational–Discourse–Semantic (SDS) [13] Model. In this Model, the level of representation present in the activity is specified in the Situational context. If the child could interpret and talk about the pictures, this was scored as Level 4 = symbolic representation. If the child only played with the book but did not understand the picture symbols, a score of Level 3 = relational actions was assigned. This same criteria was applied to the play house activity. Level 4 represented symbolic play, meaning the child was able to make the characters perform actions and talk. Level 3 represented nonsymbolic actions such as holding the characters, stacking furniture pieces, or doing only single-actions such as rolling a car.

The Semantic context was scored for the level of meaning expressed during story telling or play. The samples were evaluated for the highest level of meaning expressed by the child. In the SDS model, the first 2 levels are nonverbal responses, and these were not scored. The lowest scored was Level 3, Labeling, which was assigned to a communicative turn when the child only named a toy or something in the picture (e.g. 'There is a car'. 'I see the dog'.) Level 4, Description, was assigned if the child talked about actions, as in 'Go to sleep now', or 'The boy is taking a bath'. Level 4, Attribution was assigned if the child described characteristics or emotions, such as 'My car is rolling fast' or 'The mother is sad'. Level 5, Interpretation, was scored if the child made a prediction or mentioned causality or similar insight, as in 'I think it is going to crash' or 'He is going to sleep because he is very tired'. The highest score assigned, Level 6 was given if the child made an inference that required combining personal experience or prior knowledge with the action, as in 'He is going to be in trouble because he is hiding instead of going upstairs to eat dinner'. The child was assigned the Semantic level equivalent to the highest produced that occurred with high frequency (i.e. more than five occurrences) during play and retelling.

The Discourse was scored according to the highest level of organization shown in the play and story telling. Level 1, a single discrete action with no continued interest was not seen by any of the subjects. Level 2 was assigned to a loose collection of actions or comments with no overall theme or topic shown. Level 3 was assigned to organization in list form, as in 'There is a mommy, and there is a dog, and he is taking a bath, and she is hiding' with no temporal connections. Level 4 was assigned if temporal connections were made between events, as in 'He is taking a bath and now he will dry off. Then the boy brushed his teeth'. Level 5 was assigned when causality was established between actions, as in 'Dad cooked dinner while mom did the laundry. Dad called everyone to dinner, but the boy did not come because he was hiding. Dad became very angry'. Levels 4 and 5 of Discourse required temporal or causal links across actions or events, and therefore required the child to play or tell a sequence of at least three related actions. The child was assigned the Discourse level equivalent to the highest produced during play and retelling.

The coding resulted in one number assigned for Situation, one for Discourse, and one for Semantics for each subject. The first coding was done by one of three randomly assigned examiners. A second researcher also coded the samples for all three measures. Intercoder agreement was 0.95.

Table 1
Situational–Discourse–Semantic (SDS) Model of linguistic development [13][a]

Patient no.	Group I (active)[b]	Group II (control)[c]
1	2	0
2	2	0
3	1	1
4	1	0
5	2	0
6	2	0
7	1	1
8	3	0
9	1	0
10	2	0
11	3	0
12	1	0
13	2	0
14	2	1
15	1	0
16	1	0
17	3	0
18	2	1
19	1	0
20	1	0
21	3	0
22	3	0
23	2	1
24	3	0
25	4	0
26	3	0
27	4	0
28	4	0
29	3	1

[a] Levels of delay, Situational context.
[b] 62% showed one or two levels of delay; 38% showed three or four levels of delay.
[c] 21% one level of delay; 79% within normal limits (WNL); $P > 0.05$.

2.7. Scoring

The samples were analyzed by comparing the child's assigned levels to those expected at age level. The SDS Model provides age norms for each level of development based on typically developing children in the US. To assure that these age norms were appropriate to the Mexican population, the researchers administered the play and story telling tasks to 25 typically developing children between 1 and 6 years of age in a day care center and in a preschool. The results indicated that the age levels described in the SDS Model corresponded with the performance of Mexican children.

The child's profile for the Situational, Discourse, and Semantic aspects of language were scored by subtracting the assigned level obtained from the assessment from the expected level established by the SDS age norms. This resulted in a number score, ranging from 0 to 4, that represented the number of levels of discrepancy or delay. For analysis, a score reflecting a delay (i.e. a discrepancy of one to four levels) was classified as 'delayed'. A score of zero levels of discrepancy represented typical performance, meaning the child performed at an age appropriate level. The Situational, Discourse, and Semantic aspects of language then were compared statistically for differences between the experimental and control groups.

3. Results

The three contexts of language were statistically compared between the experimental and control groups. Because the discrepancy scores between expected level of performance and actual level represented ordinal data (i.e. a limited range of 0–4), binary categories of performance were formed. The percentage of subjects categorized as typically developing versus delayed in development were compared.

Table 2
Situational–Discourse–Semantic (SDS) Model of linguistic development [13][a]

Patient no.	Group I (active)[b]	Group II (control)[c]
1	3	1
2	2	1
3	2	0
4	1	0
5	2	1
6	3	0
7	2	0
8	4	1
9	2	0
10	2	0
11	4	0
12	2	0
13	1	0
14	2	0
15	2	1
16	1	0
17	2	0
18	3	0
19	2	0
20	2	1
21	2	1
22	2	0
23	2	0
24	2	0
25	4	0
26	1	0
27	4	1
28	4	0
29	2	1

[a] Levels of delay, Discourse context.
[b] 14% showed one level of delay; 59% showed two levels of delay; 10% showed three levels of delay; 17% showed four levels of delay.
[c] 30% showed one level of delay; 70% within normal limits (WNL); $P > 0.05$.

Table 1 profiles the number and percentage of subjects in the experimental and control groups according to the number of levels of delay obtained for the Situational context. This table shows that while no children in the experimental condition showed typical development (i.e. a discrepancy score of 0), 23 of the control children (79%) scored at their age level. While the majority of the experimental children showed small delays, with 62% scoring either one or two levels below age norms, a large number of children (i.e. 37%) were far below expected levels with scores of three and four levels below age norms. In contrast, none of the control children scored more than one level below age norms, indicating any delays shown were small. To determine if these represented reliable group differences, a Fisher exact test was conducted with probability set at $P < 0.05$. Results indicated that the groups were significantly different for this measure ($P = 0.00001$).

Table 2 profiles the number and percentage of subjects in the experimental and control groups according to the number of levels of delay obtained for the Discourse context. This table shows that while no children in the experimental condition showed typical development (i.e. a discrepancy score of 0), 20 of the control children (70%) scored at their age level. While the majority of the experimental children showed small delays, with 73% scoring either one or two levels below age norms, a large number of children (i.e. 27%) were far below expected levels with scores of three and four levels below age norms. In contrast, none of the control children scored more than one level below age norms, indicating any delays shown were small. To determine if these represented reliable group differences, a Fisher exact test was conducted with probability set at $P < 0.05$. Results indicated that the groups were significantly different for this measure ($P = 0.00001$).

Table 3 profiles the number and percentage of subjects in the experimental and control groups according to the number of levels of delay obtained for the Semantic context. This table shows that while no children in the experimental condition showed typical development (i.e. a discrepancy score of 0), 20 of the control children (70%) scored at their age level. For this measure only 24% of the experimental children showed small delays. Fifty-five percent of the subjects performed three levels below age norms, and 21% of CAD children performed four levels below age expectation. In contrast, only 30% of the control subjects performed below age norms, all showing small delays (i.e. 24% one level, 6% two levels). To determine if these represented reliable group differences, a Fisher exact test was conducted with probability set at $P < 0.05$. Results indicated that the groups were significantly different for this measure ($P = 0.00001$).

Table 3
Situational–Discourse–Semantic (SDS) Model of linguistic development [13][a]

Patient no.	Group I (active)[b]	Group II (control)[c]
1	3	1
2	3	0
3	1	1
4	3	0
5	3	0
6	3	0
7	3	0
8	4	1
9	2	1
10	2	0
11	4	0
12	2	0
13	3	0
14	4	0
15	3	2
16	3	0
17	3	0
18	3	1
19	3	0
20	2	1
21	3	0
22	3	0
23	3	0
24	2	0
25	4	2
26	2	0
27	4	0
28	4	0
29	3	1

[a] Levels of delay, Semantic context.
[b] 3% showed one level of delay; 21% showed two levels of delay; 55% showed three levels of delay; 21% showed four levels of delay.
[c] 24% showed one level of delay; 6% showed two levels of delay; 70% within normal limits; $P > 0.05$.

4. Discussion

The purpose of this paper was to explore the relationship between children with cleft palate with CAD and the child's language abilities. It was hypothesized that children with CAD would differ in their overall development of language, and not just speech productions, from children with repaired cleft palates who do not show the CAD speech patterns. The results of this study supported this hypothesis. Children with CAD were significantly different from those without CAD on all three measures of language. Furthermore, all of the CAD subjects demonstrated at least one level of delay, while the majority of the subjects without CAD performed consistently with age norms. Only children in the CAD group scored more than two levels below age norms, with high percentages of CAD subjects showing these levels of delay.

Several authors have described the phonetic disorders in cleft palate patients due to the structural deviations associated with clefting [2,11,17]. However, only a few studies suggest that some of the speech sound problems present in cleft palate children are phonologic in nature [3,7,15].

Speech disorders in cleft palate patients, such as compensatory articulation disorder, may initially occur as a consequence of the cleft, producing a phonetic based disorder. Over time, these errors become incorporated into the child's developing rule system producing a phonologic disorder [3].

When intervention is based on the phonological principles, some implications for the assessment and management of children with cleft palate may be assumed, including analysis of phonologic processes in addition to phonetic analysis, and the use of facilitation strategies aimed to modify the phonologic system of each child.

Pamplona and Ysunza in 1999 [14], compared two modalities of speech intervention for treating CAD, phonologic approach versus articulatory approach. In this study, the total time of speech intervention necessary for correcting children compensatory articulation disorder associated with cleft palate was reduced when a phonological approach was used. The reduction in the total time of speech intervention necessary for complete correction of CAD using the phonological approach with cleft palate patients suggests that the study of the phonologic system in these patients is relevant.

Moreover, it is important to emphasize that in order to comprehend the linguistic system of each child one has to consider the speech sound production as an integral component of higher levels of language organization such as pragmatic, syntactic, and semantic knowledge.

It has been described that children's speech sound production and perception errors are related not only to phonological knowledge, but also to higher organizational levels of language processing [8].

The results from this study seem to support this statement. All patients with CAD showed linguistic organization below the expected level according to chronological age in all three contexts considered by the model used for assessing linguistic performance in this study, i.e. SDS. However, increased levels of delay were observed in the semantic context. A possible explanation can be that the semantic context explores the meaning expressed by individual sentences or sequences of sentences. In other words, the semantic context considers the relationship between the material and the language, ranging from a close relationship where language labels the material or object to a distanced relationship where perceptions must be evaluated, judged, and mentally manipulated to determine what may, might, could, or would happen to materials. As the distance between the material and language widens, the focus must change from recognition of the material to recognition of properties or information that can be abstracted from the material [13]. Children with linguistic organization problems have difficulty deriving meaning at more abstract semantic levels [4,5].

A second possibility is that children with CAD also exhibit central auditory processing disorders (CAPD). Children with CAPD have difficulty auditorily discriminating between phonemes and rapidly processing auditory information. Because the auditory modality is weak, categorical perception may be formed on the basis of production cues. Such children with CAD produce sounds requiring intraoral air pressure differently, their phonological rules match their own production cues rather than the auditory input from the speech of others. This effect is seen in other populations of children. Children with CAPD but without cleft palate often demonstrate phonological errors in early childhood, and inconsistent patterns of errors at school age.

Other characteristics of CAPD include poor auditory memory, or holding auditory information in short term memory long enough to be completely processed. As a result of only partially processed speech, children with CAPD typically show delays in syntax, morphology, semantics, and discourse. In this explanation, children who exhibit CAD are those with central auditory process disorders concomitant with cleft palate. These children would have had speech and language problems even without cleft palate. The CAD errors and the language delays are both an outcome of the auditory processing deficits.

A third possibility is an interaction between CAD and higher levels of language organization. Children learn language in the context of events such as eating or bathing routines [13]. As they learn the rules, actions and objects associated with the events, they map words to the visual event. These words would include many levels and descriptions of the ongoing actions and related objects.

Once the words are integrated with the event, they serve to add complexity and abstraction to the internal event structure. Caregivers use language to help the child understand the sequence of the event, as in 'we have to wash your hair first. Now lets rinse the soap out. Then we will get dry'. These temporal words have no visual referent. Rather, they are learned by first perceiving a word that has no known meaning to the child. This process of acquiring meaning through context results in the acquisition of abstract language such as interpretations and inferences. It also leads to greater complexity in discourse structures, as the child uses the words to discover temporal and causal links between actions within an event.

In this model, speech productions have an origin independent of the event structure, involving auditory and motor input and output. During infancy, the child's productions increasingly approximate the sounds of the language heard by the child [4]. During this phase, children with cleft palate would use compensatory strategies to best match the output to the input they heard. Children with better developed event structures would make the transition from prelinguistic sounds productions such as babbling and jargon faster and more efficiently than children with fewer or more impoverished event structures [1]. That is, the event structures have to be present to provide a context for mapping or learning language. These children would map the standard speech produced by others with event. The phonological rule system thus would develop consistent with this adult input. Once children had surgical repair of the palate, their speech productions would change to better match the accurate perceptions and phonological rules.

Children with fewer or more impoverished event structures would continue with prelinguistic sound productions longer. Further, without event structures they would have no context for mapping the speech produced by others with meaning. The compensatory productions would lack a meaningful context for change and therefore would become overlearned motor patterns. As event structures and the concomitant language were acquired, these learned productions would be incorporated into the phonological rule system. That is, the child would continue to match his established speech productions to the adult model. This would result in misperceptions of words and interfere with the processing of higher levels of language, or words learned within the event and linguistic context. CAD should thus contribute to maintaining the language delay. At the same time, the language delay and the incorporations of compensatory productions in to the phonological rule system would serve to maintain CAD long after these speech modifications were physiologically necessary.

In fact, the children with CAD in this study did demonstrate difficulty with both the event structures and the concomitant language. Situationally, many of the children could neither play productively with the toys nor interpret more than the most familiar early events (i.e. bathing) from pictures. Similarly, they did not demonstrate elaborated knowledge of events structures in the discourse analysis, marking neither temporal or causal sequences of actions. Without the development of elaborated and complex event structures, a context for learning the language of interpretations and inferences would not be available. The data revealed that the semantic context was the most delayed in children with CAD.

Future studies will need to be conducted to explore the relationships between CAD and language delays. For example, children with cleft palate with and without CAD may be compared for the presence of central auditory processing disorders. Longitudinal studies of children with cleft palate may be conducted to determine if those who are slower to develop event structures or delayed in mapping language to existing structures are the children who later exhibit CAD. Studies comparing children with or without CAD on measures such as IQ can be examined for correlations.

While the relationship between CAD and language disorders remains unknown, this study clearly shows that children with CAD are also at risk for overall language developmental delay. These findings along with the treatment study conducted by Pamplona and colleagues [14] showing far more rapid change occurring under conditions of phonologically (i.e. language) based treatment than phonetic (i.e. motor) approaches suggest that CAD is, at least in part, a phonological disorder.

This finding suggests that children with CAD are better served using a phonologically based treatment approach than the phonetic treatment currently viewed as standard treatment for this population. By modifying the child's internalized rules governing production, the child's speech changes to match this revised category. Because the phonological rule is integrated with other aspects of language, occurrence of correct sounds in spontaneous production is more rapid. The sound does not first have to be learned as a motor production and then generalized to language and spontaneous speech.

Furthermore, if children with CAD present significant language delays, as this study suggests, then intervention needs to address these needs as well as the speech production. With limited time and resources, intervention that simultaneously addresses both the CAD and the language delay promises greater efficacy. This is particularly important in a center like the Hospital Gea González in Mexico City, where most of the patients show severe social and educational limitations.

Although this study addressed a relatively small group of subjects selected from a homogeneous population in a single clinical setting [16], the results are so robust that is advisable that all children exhibiting CAD be further evaluated for language delays. Naturalistic contexts such as play or story telling that allow for event structures and related language to be examined for semantic context, discourse organization and situational representation are recommended.

References

[1] N. Andrews, M. Fey, Analysis of the speech of phonologically impaired children in two sampling conditions, Lang. Speech Hear. Serv. Sch. 17 (1986) 187–198.

[2] K.R. Bzoch, Articulation proficiency and error patterns of preschool cleft palate and normal children, Cleft Palate J. 2 (1965) 340–349.

[3] K. Chapman, Phonologic processes in children with cleft palate, Cleft Palate Craniofac. J. 30 (1993) 64–71.

[4] J. Damico, Systematic observation of communicative interaction: a valid and practical descriptive assessment technique, in: W.A. Secord, J.S. Damico (Eds.), Best Practices in School Speech-Language Pathology, Psychological Corp, San Antonio, TX, 1992, pp. 133–144.

[5] E. Dubois, J. Berenthal, A comparison of three methods of obtaining articulatory responses, J. Speech Hear. Disord. 43 (1978) 295–305.

[6] K. Golding-Kushner, R. Shprintzen, A. Ysunza, et al., Standardization for the reporting of videonasopharyngoscopy and multi-view fluoroscopy. A report from an interanational working group, Cleft Palate J. 27 (1990) 337–347.

[7] B. Hodson, E. Paden, Targeting Intelligible Speech, College Hill Press, San Diego, CA, 1993.

[8] P. Hoffman, Clinical forum: phonological assessment and treatment. Synergistic development of phonetic skill, Lang. Speech Hear. Serv. Sch. 23 (1992) 254–260.

[9] D.A. Kernahan, R.B. Stark, A new classification for cleft lip and palate, Plast. Reconstr. Surg. 22 (1958) 435–443.

[10] B. McWilliams, R. Musgrave, Diagnosis of speech problems in patients with cleft palate, J. Commun. Dis. Spring 26 (1979) 241–274.

[11] B. McWilliams, H. Morris, R. Shelton, Cleft Palate Speech, 2nd edition, BC Decker, Philadelphia, 1990, pp. 5–19.

[12] M. Mendoza, C. Azzolini, F. Molina, A. Ysunza, Minimal incision palatopharyngoplasty, Scand. J. Plast. Reconstr. Hans. Surg. 28 (1994) 199–205.

[13] J. Norris, P. Hoffman, Whole Language Intervention for School-Age Children, Singular, San Diego, CA, 1993, pp. 29–105.

[14] M.C. Pamplona, A. Ysunza, A Comparative trial of two modalities of speech intervention for compensatory articulation in cleft palate children, phonologic approach versus articulatory approach, Int. J. Pediatr. Otorhinolaryngol. 49 (1999) 21–26.

[15] G. Powers, et al., Speech analysis of four children with repaired cleft palate, J. Speech Hear. Disord. 55 (1990) 542–550.

[16] R.J. Shprintzen, Fallibility of clinical research, Cleft Palate Craniofac. J. 28 (1991) 136–140.

[17] D. Van Demark, et al., Patterns of articulation abilities in speakers with cleft palate, Cleft Palate J. 16 (1979) 230–239.