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Early Academic Performance in Children with Cleft Lip and/or Palate.

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Early Academic Performance in Children with Cleft Lip and/or Palate

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by
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ABSTRACT

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Studies of preschool children have shown early speech and language deficits in children with cleft lip and/or palate (CLP). For some children, the deficits during kindergarten diminish as they begin school while some children continue to show delays. The purpose of this study was to determine if a relationship exists between speech and language skills and early reading skills of phonological awareness, letter identification, and rapid naming in children with and without CLP. The subjects, four kindergarten children with and four without CLP, were administered a battery of speech, language, early reading skills, and nonverbal cognition measures.

Two-way analysis of variance for groups and matched pairs and correlational analyses were performed. The results revealed that the cleft group performed poorer than the noncleft group on most of the speech, language, and early reading measures. Significant correlations were found between the speech and grammatical language measures and the early reading measures.

DEDICATION

This work is dedicated to my husband, Stevie Lowe, for his cherished and constant support of me throughout my graduate career. Thank you for your patience and understanding, your inspiration and support, and for always being there for me. Your love and presence in my life has given me strength and determination in such a way that only you would know. I couldn't have made it this far without you by my side.

I love you!!

"I thank God every time I remember you."

- Philippians 1:3

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Most of all, I humbly thank and praise my Lord and Saviour, Jesus Christ, for my life, my salvation, and all the blessings I have been given in my life, especially during the last two years. I will do my best to use the gifts you have given me to serve you.

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CHAPTER 1

INTRODUCTION

There is a considerable amount of literature documenting the speech deficits of children with cleft lip and/or palate. Recent research has documented early language deficits in children with cleft lip and/or palate that appear to improve during the preschool period. However, literature on school age children with clefts has shown conflicting findings concerning the presence of language impairments. Many of the studies have been challenged by methodological problems concerning subject selection and reliance on standardized test measures. However, there is a body of literature that has found language and reading deficits in children with clefts, particularly children with isolated clefts (ICP) (Richman, Eliason, & Lindgren, 1988). The persistence of language and speech problems beyond the preschool period is of great interest because of possible contributions to academic learning. There is considerable research available to suggest a link between language and speech deficits and early reading disabilities in other populations of children without clefts (Catts, 1993; Catts, Fey, Zhang, & Tomblin, 2001). However, the conflicting reports of reading disabilities in children with clefts suggest that there may be subgroups of children within the cleft group who may be at risk for academic problems. This study will examine the relationship among speech impairments, language disorders, and academic performance in children with cleft lip and/or palate.

Speech Characteristics of Children with Cleft Lip and/or Palate

An abundance of literature exists describing the speech characteristics of children with cleft lip and palate (Chapman, 1993; Chapman & Hardin, 1992; Kuehn & Moller, 2000; Scherer & D'Antonio, 1995; Sell, Harding, & Grunwell, 1994; Witzel, 1995). The majority of research

has focused on description of articulation errors, frequency and types of errors, and comparisons with normative data. The characteristics commonly found in speech of children with clefts include use of compensatory articulation, errors in placement and manner, and difficulties with resonance and phonation (Sell et al., 1994; Witzel, 1995).

Several studies that explored the speech abilities of young children with clefts have yielded inconsistent results. Chapman and Hardin (1992) found that there was no significant difference between two-year-olds with and without cleft palate regarding the sizes of consonant inventories. In a later study, however, Scherer and D'Antonio (1995) observed that children with clefts 18- to 30-months-old had significantly fewer consonants in their inventories than noncleft peers. Chapman and Hardin additionally reported that the subjects with clefts had significantly lower accuracy of production of nasals, liquids, and overall percent consonants correct when compared to noncleft peers.

Research has also generated conflicting results regarding the prevalence of speech disorders in preschool children with clefts. Morley (1966) reported that the number of preschool children with clefts who produced misarticulations decreased with age. Sixty percent of three- to four-year-old children with clefts were found to have imprecise articulation patterns, whereas only 25% of five- to six-year-olds with clefts produced misarticulations. In a later study by Philips and Harrison (1969a), two- to six-year-olds with clefts were compared to noncleft peers for intelligibility, consonant imitation, and articulation. Results of this study showed that the overall number of errors decreased with age for both groups of children, as Morley (1966) had documented. However, when compared to the children without clefts, the children with clefts consistently performed poorer than noncleft children in all areas measured across all ages.

Additionally, the five- to six-year-olds with clefts did not reach the articulation or intelligibility levels achieved by the three-year-olds without clefts.

Researchers have also begun to explore the use of phonological processes in the speech of children with clefts. Chapman and Hardin (1992) found that two-year-old children with clefts used many of the same phonological processes used by noncleft peers. However, the processes of nasal assimilation and backing were used significantly more frequently in the speech of the cleft group. Chapman (1993) found similar findings in a later study involving 60 three-, four-, and five-year-old children with and without clefts. The subjects with clefts employed many of the processes used by the noncleft participants. However, the cleft group used significantly more phonologic processes overall and for a longer period of time than their noncleft peers.

Despite the wide variability in the phonologies and articulation performance of children with clefts, there are certain deviant speech patterns which are commonly found in the speech production of children with clefts. Trost (1981) described several deviant speech characteristics and provided phonetic symbols for three types of compensatory articulation frequently used by speakers with clefts. Compensatory articulations are non-English consonant approximations produced by speakers with clefts (Harding & Grunwell, 1996). These approximations serve as substitutes and compensations for phonemes that are difficult for the speaker to produce due to the cleft. The compensatory articulations described by Trost include the glottal stop, pharyngeal fricative, velar fricative, pharyngeal stop, mid-dorsum palatal stop, and posterior nasal fricative. Each of these compensatory articulations may be produced in place of a target phoneme or simultaneously with a target phoneme.

While many researchers disagree on the type, severity, and progression of speech disorders seen in children with clefts, few would deny that the presence of speech disorders in

this population is almost certainly inevitable. In children without clefts, the presence of speech disorders increases the probability of a co-occurring language disorder (Shriberg, Tomblin, & McSweeny, 1999). Similarly, children with clefts are at risk for coexisting speech and language disorders. In addition to studying the speech characteristics, researchers have investigated and provided variable descriptions of the language abilities of children with clefts.

Language Characteristics of Children with Cleft Lip and/or Palate

Literature is also available describing the language characteristics of children with clefts (Broen, Devers, Doyle, Prouty, & Moller, 1998; Eliason & Richman, 1990; Kuehn & Moller, 2000; Scherer & D'Antonio, 1997; Scherer & D'Antonio, 1995; Scherer, D'Antonio, & Kalbfleisch, 1999; Witzel, 1995). The language characteristics commonly seen in children with clefts include early expressive vocabulary deficits and syntactic delays.

Patterns of early language development in young children with clefts have been of particular interest in the literature in recent years. Broen et al. (1998) studied 28 children with and 29 children without cleft palate at three-month intervals from 9 months until 30 months of age. During each visit, hearing and middle ear function screening was completed and a 20-minute language sample was collected. Parents reported vocabulary acquisition between twelve and 24 months. The Mental scale of the *Bayley Scales of Infant Development* (BSID; Bayley, 1969) was administered at 24 months of age and the *Minnesota Child Development Inventory* (MCDI; Ireton & Thwing, 1972) was completed by parents at 30 months. While the results showed that children with clefts in this study were not delayed according to norms on the BSID and MCDI, they did perform significantly poorer on verbal items than their age-matched

controls. The cleft subjects also had slower vocabulary acquisition than noncleft children. This suggests that children with clefts showed a slower onset and pace of language skills.

In another study of early language development, Jocelyn, Penko, and Rode (1996) found delays in most expressive and receptive language abilities in young children with cleft lip and palate (CLP) which increased from 12 to 24 months of age on the *Sequenced Inventory of Communication Development-Revised* (SICD-R; Hedrick, Prather, & Tobin, 1984). However, the subjects with CLP displayed mean length of utterance values and results from a parent questionnaire of language, the *Receptive-Expressive Emergent Language Scale* (REEL; Bzoch & League, 1971), that were similar to noncleft peers in the study.

Scherer and D'Antonio (1997) evaluated four children with CLP and two children with isolated cleft palate (ICP) at 20, 24, and 30 months of age. The *Preschool Language Scale-3* (PLS-3; Zimmerman, Steiner, & Pond, 1992) was administered during the 20 and 30 month visits to assess receptive and expressive language abilities. Additionally, a 30-minute language sample was completed during each evaluation and analyzed using the Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 2001). The results were differentiated according to cleft type. The children with CLP displayed normal receptive language growth with delayed onset of vocabulary and mean length of utterance (MLU). However, ICP subjects demonstrated delays in both receptive and expressive language variables that persisted through 30 months of age despite receiving speech and language treatment. When comparing early speech and language development of normal children and children with CLP, ICP, and velocardiofacial syndrome (VCFS), Scherer, D'Antonio, and Kalbfleisch (1999) also found expressive and receptive language scores on the *SICD-R* to be lower in children with ICP and

CLP than in noncleft peers through 30 months of age. These results support findings regarding delays in early vocabulary and MLU through 30 months of age.

While recent research has focused on early language acquisition, school-aged language acquisition has received less attention. This may be due in part to the awareness that research findings on language abilities in school-age children with clefts have shown more contradictions than the research involving young children with clefts. Morris (1962) studied language abilities in 107 children with clefts aged 2 to 15 years old. The subjects were found to have significant impairments in both receptive and expressive language measures. Smith and McWilliams (1968) investigated psycholinguistic abilities in 136 children with clefts, ranging in age from three to eight years. The participants demonstrated general language weaknesses, particularly in the areas of vocal and gestural expression, across all age levels. These weaknesses also appeared to worsen with age. The next year, Philips and Harrison (1969b) found that 137 18- to 72-month-old children with clefts displayed significantly poorer vocabulary and receptive and expressive language skills than same-age peers. These deficits increased with age on some of the measures used. Four- to six-year-olds with clefts in a study by Eliason and Richman (1990) displayed normal vocabulary development, average verbal memory span, and were able to solve verbal analogies. The subjects did, however, exhibit deficits in tasks requiring verbal mediation, which is the use of the symbolic system of language in associative reasoning, memory, and categorization (Richman, 1980). In another study by Chapman, Graham, Gooch, and Visconti (1998), results showed that there were no significant differences on language measures between school-age (seven to nine years old) participants with and without cleft, suggesting that the language deficits in children with clefts resolved as they reach school age. The contradictory

findings of these various researchers reveal that more research on the language abilities of school-age children with clefts and its relation to academic performance is needed.

Cognitive and Academic Performance in Relation to Language

Several studies have documented cognitive and academic performance in school-age children with cleft lip and/or palate. In an early study examining cognition in children with clefts, Morris (1962) found that his subjects with clefts had normal mean IQs on the *Wechsler Intelligence Scale for Children* (Wechsler, 1949). A more recent study, however, reported very different findings. In a sample of 553 children with clefts ages four to 19 years old, Strauss and Broder (1993) discovered that 10% of the participants were found to have mental retardation. The rate of mental retardation in this study was approximately 10 times greater than that reported for the general population (American Psychiatric Association, 1987).

While the studies have documented the presence of cognitive impairments in some of the children with clefts, cognitive impairments were not present in the entire group. However, studies of academic achievement suggested that the rate of learning difficulties for children with clefts is significant. Studies have only begun to investigate the subject characteristics that are associated with presence or absence of academic learning difficulties and the exact nature of the problem. Broder, Richman, and Matheson (1998) examined the prevalence of learning disability, school achievement, and grade retention in 168 subjects with clefts aged six to 18 years old. Data were collected for each subject's IQ scores, standardized achievement test scores, and grade retention from the subjects' schools and craniofacial centers. Forty-six percent of all of the participants were identified as having a learning disability and nearly half of the subjects were functioning below their current grade level according to achievement test scores.

Additionally, the rate of grade retention was 25% higher among the subjects with clefts than in the general populations for their states. These findings highlight the urgent need for early screening, evaluations, and psychological assessments to be performed on young children with clefts for early detection of learning disabilities.

Richman and colleagues have investigated the possibility that these academic learning difficulties originated from language impairments. In 1976, Richman published a study involving 44 children with and 44 children without clefts in fourth through eighth grade. Richman found that the children in the cleft group were found to have significantly lower composite achievement scores than their noncleft peers. This finding led to another study by Richman (1980) that included 33 children with CLP and 24 with ICP, ages seven to nine. This study assessed a subgroup of children with clefts who had language deficits as evidenced by verbal scores 15 or more IQ points below performance scores on the *Wechsler Intelligence Scale for Children* and Performance IQ at or above 90. Five subtests from the *Hiskey-Nebraska* (Hiskey, 1966) that require verbal mediation skills and the *Wide Range Achievement Test* (WRAT; Jastak & Jastak, 1965) were administered to the subjects to place them into two groups based on verbal mediation ability. The first group of 31 subjects had poor verbal mediation skills and was categorized as having a General Language Disability (GLD), with deficits in both receptive and expressive language. The remaining 26 children fell into the second group, which showed higher levels of verbal mediation abilities and was labeled as having Verbal Expression Disability (VED) since they had difficulty primarily with expressive language only. Speech defectiveness ratings were then taken and studied for the subjects. Richman found that there were no significant differences between the GLD and VED groups for speech ratings or verbal IQ, performance IQ, or Full Scale IQ from the IQ and achievement tests. The VED group was

found to have significantly better verbal mediation skills on the *Hiskey-Nebraska* and significantly higher scores for reading and arithmetic on the WRAT. The groups also showed differences in cleft type, with significantly more children with ICP in the GLD group while children with CLP predominated in the VED group.

The results revealed that the primary cognitive construct distinguishing the GLD and the VED groups was abstract reasoning. The GLD group showed poorer categorization and associative reasoning skills in the subtest results. These results indicate that the VED group had intact verbal and symbolic mediation skills and deficits in verbal expression only. The GLD group, however, had deficits in both areas of verbal and symbolic, pointing to a symbolic language disorder and basic cognitive disabilities as the cause of their achievement differences. While Richman found receptive/expressive language impairments were associated with poor academic performance in math and reading, this study did not specify the nature of the language disability associated with these academic impairments.

In a later study, Richman, Eliason, and Lindgren (1988) examined the relationship of gender, age, and cleft type to reading problems. One hundred seventy-two children, ranging in age from 6- to 13-years-old, with CLP or ICP participated in the study. The children were divided into three groups: age 6 to 7 years, age 8 to 9 years, and age 10 to 13 years. Results of analyses revealed a significant effect for age on word recognition and for both age and cleft type on reading comprehension. Older children had better reading comprehension scores than younger children. Children with ICP had poorer reading comprehension scores, regardless of their age. There was no significant effect for gender on reading disability. Thirty-five percent of the subjects were found to have at least a moderate reading disability. The rate of reading disability was highest for the youngest children for both cleft types. The rate remained high as

age increased for children with ICP but decreased with age for children with CLP. This study shows that it is important to understand the mechanisms that contribute to this increased risk of learning disabilities in children with cleft lip and/or palate.

In summary, research has documented the presence of a range of speech and language deficits in young children with clefts. While speech impairments are nearly universal, some children with clefts displayed global language deficits involving receptive and expressive language and others had deficits in expressive language only. There is some suggestion these deficits were often distributed by cleft type. More children with ICP were found in the groups with global language deficits whereas children with CLP were more numerous for expressive language deficit groups. Further, language-related performance may interact with early academic learning as observed in other noncleft populations. Some studies have found that vocabulary and syntactic delays present in young children with clefts persist into school-age years. Other researchers report that vocabulary delays resolved by the time the subjects reached school age or were not present at all. These contradictory results are likely due to methodological differences in the studies including comparison of cleft subject's performances to test norms rather than to control subjects.

While there has been considerable research published on the presence of speech and language impairments in children with clefts, the findings of these studies are conflicting. Most researchers agree that children with clefts experience early speech and expressive language delays. However, the severity and persistence of these problems into the school years vary widely in research. Research indicates the existence of a relationship among language impairments, reading disabilities (Catts, 1993), and lower achievement test scores (Richman & Lindgren, 1980) in children without clefts. Research has also shown that children with clefts

have a high prevalence of learning disability, functioning below grade level, and grade retention (Broder, Richman, & Matheson, 1998). Nevertheless, there has been no research to investigate the link between speech and language impairments and academic performance in children with clefts.

The purpose of this study was to examine the relationship among speech impairments, language disorders, and early reading performance in children with cleft lip and/or palate. Two specific research questions were addressed in this study. First, are differences observed in the development of speech and language of kindergarteners with cleft lip and/or palate and noncleft children? Second, are differences in early readiness skills, such as phonological awareness, letter identification, and rapid naming that have been associated with early reading progress (Catts, Fey, Zhang, & Tomblin, 2001), observed in children with cleft lip and/or palate and noncleft children?

CHAPTER 2

METHODS

Participants

Two male and two female children with cleft lip and palate and four age-, gender-, and socioeconomic status- matched noncleft children participated in this study. Two of the children with clefts had bilateral cleft lip and palate (BCLP) and two children had unilateral cleft lip and palate (UCLP). Inclusion criteria for the children with clefts included: (a) five to seven years in age, (b) nonsyndromic cleft lip and/or palate, as determined by a geneticist, (c) absence of sensorineural hearing loss, and (d) currently enrolled in kindergarten. Inclusion criteria for the noncleft children included: (a) no identified speech, hearing, or language impairments, and (b) no significant medical impairments. Socioeconomic status of the participants was determined using the Hollingshead Scale (Hollingshead & Redlich, 1958). The participants were recruited from public schools and a current longitudinal study of children with cleft palate. Table 1 shows the age, gender, cleft type, hearing status and standard score on the *Test of Nonverbal Intelligence* (TONI) for each subject.

All the participants passed a hearing screening at 20 decibels at 500, 1000, 2000, and 4000 Hz. One child in the cleft and noncleft group passed the screening tympanogram in both ears. The remaining children in both groups had some indications of middle ear pathology. The *Test of Nonverbal Intelligence* (TONI; Brown, Sherbenou, & Johnsen, 1982) was administered to assess nonverbal cognitive abilities. This test examines nonverbal intelligence, competence, abstract reasoning, and problem solving. The TONI standard scores indicated that three of the

children in both the cleft and noncleft groups showed performance within the normal range, while one child in each group showed performance one standard deviation above the mean.

Table 1

Descriptive Data for the Comparison Subjects*

Subject	Age	Gender	Cleft type	Hearing screen	Tympanogram	TONI score
Cleft						
1A	5-3	Male	BCLP	Pass	Fail	92
2A	5-3	Female	BCLP	Pass	Fail	105
3A	5-7	Male	UCLP	Pass	Pass	121
4A	5-8	Female	UCLP	Pass	Fail	89
Normal						
1B	5-7	Male	NA	Pass	Fail	85
2B	5-3	Female	NA	Pass	Pass	109
3B	5-11	Male	NA	Pass	Fail	113
4B	6-1	Female	NA	Pass	Fail	124

Note. *NA = not applicable; BCLP = bilateral cleft lip and palate; UCLP = unilateral cleft lip and palate; Age = years and months of age; L = left ear; R = right ear

Procedures

A battery of tests was administered to each participant. This included two tests of language abilities, a measure of narrative abilities, a test of articulation performance, a measure of nonverbal cognitive abilities, measures of early reading skills and achievement, and a hearing and tympanometric screening. The test battery was administered in two to three sessions of one to two hours each.

Speech and Language Measures

Six subtests from the *Test of Language Development- Primary 3* (TOLD-P:3; Newcomer & Hammill, 1997) were administered. These included Picture Vocabulary, Relational

Vocabulary, Oral Vocabulary, Grammatical Understanding, Sentence Imitation, and Grammatical Completion. These subtests assessed the participants' receptive and expressive vocabulary and grammar abilities. The *Peabody Picture Vocabulary Test,* 3rd edition (PPVT-3; Dunn & Dunn, 1997) was also administered to further assess the children's receptive vocabulary skills. Standard scores are provided by each of these measures and were used in data analysis.

Narrative skills were elicited during a 10- to 15-minute language sample using three tasks. Research suggests that assessment of narratives should include a variety of elicitation tasks to give the child optimal opportunity to produce narratives (Hadley, 1998). The first task was an event retelling of a movie that the child had seen and with which the child was familiar. The child was asked to tell what happened in the movie. The second task elicited a story narrative using a wordless picture book, *Good Dog, Carl* (Day, 1985). The child looked through the book first, and then was asked to tell a story that went with the pictures. The third task elicited a familiar children's story, "Goldilocks and the Three Bears," using props. After the samples were collected and transcribed, they were analyzed using Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 2001). The variables that were examined using SALT included the number of different words, total words, type token ratio (TTR), mean length of utterance (MLU), and percent use of 14 grammatical morphemes.

Each child's articulation skills were assessed using the Sounds in Words subtest of the *Goldman-Fristoe Test of Articulation-2* (GFTA-2; Goldman & Fristoe, 2000). Words were transcribed as whole words using the International Phonetic Alphabet and compensatory articulation and nasal emission notations (Trost, 1981). GFTA-2 standard score was calculated from raw score and used in the analysis. The *Percentage of Consonants Correct* (PCC; Shriberg, Austin, Lewis, McSweeney, & Wilson, 1997) metric were calculated from the GFTA-2 single-

word samples to calculate the percentage of attempted consonant sounds that each child produced correctly. The metric provides severity classifications based on PCC. The percentages were included in the data analysis.

Perceptual nasality ratings were also collected. Each child was perceptually rated on nasality and nasal emission during their spontaneous language sample. They were rated using a 1 to 7 anchored scale with 1 corresponding to the absence of hypernasality and nasal emission and 7 representing severe hypernasality and nasal emission (Scherer, D'Antonio, & Kalbfleisch, 1999).

Phonological Awareness and Achievement Measures

Studies of kindergarten performance have found measures of rapid naming, phonological awareness, letter identification, and sentence imitation to be highly predictive of future reading abilities in a group of children with speech and language impairment (Catts, 1993; Catts et al., 2001). Two composites, the Rapid Naming and Phonological Awareness composites, from the *Comprehensive Test of Phonological Processing* (CTOPP; Wagner, Torgesen, & Rashotte, 1999) were administered. Each composite produces a standard score. The Rapid Naming composite consists of two subtests, Rapid Color Naming and Rapid Object Naming. These subtests measure the speed, in seconds, with which an individual can name a series of colors and objects. The Phonological Awareness composite is comprised of Elision, Blending Words, and Sound Matching subtests. The Elision subtest determines the ability of an individual to synthesize words from incomplete information. The Blending Words subtest measures the ability to form words from combining sounds. Sound Matching tests an individual's ability to match sounds within words. To assess early reading skills, the Letter Identification subtest of the *Woodcock*

Reading Mastery Tests- Revised (WRMT-R; Woodcock, 1998) was administered to document each child's ability to name upper and lower case letters of the alphabet. The WRMT-R also provides a standard score or a grade equivalent. The standard scores provided by each of these measures were used in data analysis.

Randomization

The measures were divided into two groups and administration of the groups was counterbalanced to prevent test bias from fatigue. The first group of tests included those requiring nonverbal responses and included the PPVT-III, WRMT-R, TONI, and hearing screen. Two of these measures were alternately administered first and last for each participant. The other group of measures included the TOLD-P:3, GFTA-2, CTOPP, and the language sample.

Reliability

Intrajudge and interjudge language and phonetic transcription reliability and nasality rating reliability were determined for 20 % of the SALT and GFTA-2 transcripts from the video recordings. For intrajudge reliability, 20% of the language samples and GFTA-2 responses were retranscribed one month after the initial transcription. Another graduate student, with transcription experience in compensatory errors, transcribed 20 % of each language sample and 20% of the GFTA-2 responses and perceptually rated each child's nasality from the language sample.

Interjudge language reliability was 83.5% for transcription of the language samples and 82.3% for consonant and vowels from phonetic transcription for cleft and noncleft subjects. Intrajudge reliability was 91.8% for the language sample transcriptions and 89.6% for

consonants and vowels from phonetic transcription for both cleft and noncleft subjects. Reliability measures indicate that acceptable agreement was obtained for the language and speech measures.

Data Analysis

Test measurements for each group were summarized by the mean. Two-way Analysis of Variance (ANOVA) was performed to compare cleft with noncleft (using matched subject pairs).

CHAPTER 3

RESULTS

Language Measures

Standardized Tests of Language

Performance of the children with clefts is compared with data from the noncleft group. Table 2 shows the standard scores on the *Test of Language Development- Primary 3* (*TOLD-P:*3) subtests and the PPVT-III by the cleft and noncleft group and by matched cleft and noncleft pairs. The cleft and noncleft pairs were matched by age, gender, and socioeconomic status. The group scores on the TOLD-P:3 Picture Vocabulary subtest and the PPVT-III were significantly lower for the cleft children than the noncleft children ($p < 0.05$). Paired subject comparisons revealed that the cleft subjects scored significantly lower than the noncleft subjects ($p < 0.05$) on the TOLD-P:3 Grammatical Understanding subtest and the PPVT-III. These results indicate a significant difference in performance on receptive vocabulary and grammatical language measures but not on expressive language measures. However, with the exception of two TOLD-P:3 subtests, the cleft group had clinically lower standard scores than the noncleft group. The four subtests that were at least one standard deviation below the mean were the TOLD-P:3 Picture Vocabulary, Relational Vocabulary, Sentence Imitation, and Grammatical Completion subtests and included both receptive and expressive subtests.

Table 2

Mean Standard Score and Statistical Comparison of the Children with Cleft and Noncleft Children on the *TOLD-P:3* subtests and the *PPVT-III* by Group and by Paired Subjects.

GROUP	TOLD-P:3-PV	TOLD-P:3-RV	TOLD-P:3-OV	TOLD-P:3-GU	TOLD-P:3-SI	TOLD-P:3-GC	PPVT-III
Cleft	7.75	7.3	10.5	10.25	7.0	6.75	94.8
Noncleft	11.5	11.5	10.5	11.25	10.5	10.75	105.0
	F = 15.70* P = 0.029	F = 5.59 P = 0.099	F = 0.02 P = 0.898	F = 2.00 P = 0.252	F = 8.65 P = 0.060	F = 8.73 P = 0.060	F = 29.49* P = 0.012
PAIRED SUBJECTS	F = 3.42 P = 0.170	F = 1.98 P = 0.294	F = 0.64 P = 0.639	F = 16.17* P = 0.023	F = 4.06 P = 0.140	F = 1.86 P = 0.311	F = 26.17* P = 0.012

Note. TOLD-P:3- PV = TOLD-P:3 Picture Vocabulary; TOLD-P:3- RV = TOLD-P:3 Relational Vocabulary; TOLD-P:3- OV = TOLD-P:3 Oral Vocabulary; TOLD-P:3- GU = TOLD-P:3 Grammatical Understanding; TOLD-P:3- SI = TOLD-P:3 Sentence Imitation; TOLD-P:3- GC = TOLD-P:3 Grammatical Completion; PPVT-III = *Peabody Picture Vocabulary Test- 3rd Edition*.

* = Statistically significant

Language Sample

Table 3 presents the SALT language sample variables for the cleft and noncleft group and by matched cleft and noncleft pairs. There were no statistically significant differences in comparisons of group averages or paired subjects for the SALT measures derived from the language samples. However, the cleft group performed poorer than the noncleft group on all of the SALT measures except the type token ratio (TTR). A comparison of the individual subjects' SALT measures with the SALT database revealed that all of the children in the cleft group were at least one standard deviation below the mean compared with the SALT norms for grammatical variables for: 1) at least one of the bound morphemes measured by SALT, 2) more omitted words and morphemes, and 3) fewer use of personal pronouns than the noncleft children. The

clinical significance of these results indicates that children in the cleft group showed more syntactically-based errors than the matched noncleft children.

Table 3

Mean Frequency and Statistical Comparison of the Children with Cleft and Noncleft Children on the Language Sample Measures by Group and by Paired Subjects.

GROUP	Number of different words	Number of total words	TTR	MLU	Number of bound morphemes
Cleft	147	480	0.325	5.45	26.0
Noncleft	167	554	0.312	5.90	44.8
	F = 0.30 P = 0.621	F = 0.18 P = 0.697	F = 0.10 P = 0.773	F = 0.45 P = 0.552	F = 2.61 P = 0.205
PAIRED SUBJECTS	F = 0.37 P = 0.785	F = 0.39 P = 0.772	F = 0.65 P = 0.634	F = 1.75 P = 0.329	F = 0.63 P = 0.645

Note. TTR = Type Token Ratio. MLU = mean length of utterance.

* = Statistically significant

Speech Production and Resonance

Table 4 shows the standard scores on the *Goldman Fristoe Test of Articulation-2* (*GFTA-2*), *Percentage of Consonants Correct* (PCC), and nasality and nasal emission ratings by the cleft and noncleft group and by matched cleft and noncleft pairs. When the mean GFTA-2 standard score for the cleft group (mean = 60.5) was compared to the mean for the noncleft group (mean = 108.3), the cleft group scored significantly lower than noncleft group ($p < 0.05$). The noncleft group's GFTA-2 errors were primarily developmental errors. However, the cleft group's GFTA-2 performance revealed errors included both developmental and phonological errors using compensatory articulations. The developmental errors displayed by the children with clefts

Table 4

Mean Standard Score and Statistical Comparison of the Children with Cleft and Noncleft Children on the GFTA-2 , Percent Consonant Correct (PCC) and Nasality Ratings by Group and by Subject Pairs.

GROUP	GFTA-2 standard score	PCC	Nasality rating	Nasal emission
Cleft	60.5	65%	4.50	1.50
Noncleft	108.3	97%	0.00	0.00
	F = 12.99* P = 0.037	F = 15.40* P = 0.029	F = 9.00* P = 0.058	F = 9.00* P = 0.058
PAIRED SUBJECTS	F = 0.33 P = 0.804	F = 0.85 P = 0.550	F = 1.00 P = 0.500	F = 1.00 P = 0.500

* = Statistically significant

consisted primarily of gliding the liquid consonants /l/ and /r/. Three of the four children in the cleft group used the phonological processes of backing and stopping in conjunction with some of the compensatory articulations (glottal stop for stopping and backing) (Trost, 1981). The compensatory articulation used by the children with clefts included velar fricatives by two children, pharyngeal stop by one child, mid dorsum palatal stops by one child, and glottal stops by two of the children. One of the children in the cleft group used no compensatory articulations. Two of the four cleft subjects showed moderately to severely restricted consonant inventories. The child with the most severely restricted consonant inventory substituted pharyngeal fricative or the glottal stop for all fricatives except /v/, both affricates, and several stops. The second most severely restricted consonant inventory was characterized by the use of mid dorsum palatal stops, velar fricatives, and glottal stops for /t/ and /d/, most fricatives, and both affricates. One child with CLP displayed a mildly restricted inventory that was characterized by the use of velar fricatives in the place of two fricatives and affricates. The cleft

group had significantly poorer PCC than the noncleft group. All of the children without clefts had PCCs that were above 95%, which would indicate normal phonology. In contrast, the children in the cleft group had PCCs ranging from 46% to 83%, indicating severe, moderate-severe, and mild-moderate impairments in speech sound accuracy.. Additionally, the cleft group received significantly poorer perceptual ratings of nasality and nasal emission than the noncleft group ($p < 0.05$). The ratings indicated moderately impaired nasal resonance. Paired subject comparison revealed no statistically significant differences between the groups.

Phonological Awareness and Reading

Table 5 presents the standard scores on the *Comprehensive Test of Phonological Processing* (CTOPP) subtests and the *Woodcock Reading Mastery Tests-Revised* (WRMT-R) Letter Identification subtest by the cleft and noncleft group and by matched cleft and noncleft pairs. Statistical comparison of the two groups revealed that there were no significant differences found between the cleft and noncleft groups for six of the seven CTOPP subtests and composites. The cleft group was found to score significantly lower on the Rapid Color Naming subtest of the CTOPP than the noncleft group. However, clinically significant differences (> 1 SD) were observed for the group means on the CTOPP Phonological Awareness Composite and Sound Matching subtests. Additionally, the cleft group consistently scored below than the noncleft group on all of the phonological awareness measures except the CTOPP Rapid Object Naming subtest.

There were no significant differences between the two groups for performance on the WRMT-R. The means for both cleft and noncleft groups were above average (standard score, 113 and 131 respectively) on the Letter Identification subtest of the WRMT-R. However, the

difference between the two groups was greater than one standard deviation (SD = 15), which indicates a clinically significant difference between the groups.

Table 5

Mean Standard Score and Statistical Comparison of the Children with Cleft and Noncleft Children on the CTOPP subtests and the Letter Identification subtest of the WRMT-R by Group and by Subject Pairs.

GROUP	CTOPP-PAC	CTOPP-E	CTOPP-BW	CTOPP-SM	CTOPP-RNC	CTOPP-RCN	CTOPP-RON	WRMT-R
Cleft	90.3	8.3	8.8	8.5	94.8	8.00	10.25	113
Noncleft	107.8	10.5	11.5	11.5	100.8	10.75	9.50	131
	F = 3.07 P = 0.178	F = 1.85 P = 0.266	F = 1.86 P = 0.266	F = 3.60 P = 0.154	F = 2.67 P = 0.201	F =13.44* P = 0.035	F = 2.45 P = 0.215	F = 0.34 P = 0.599
PAIRED SUBJECTS	F = 0.89 P = 0.538	F = 1.92 P = 0.303	F = 0.55 P = 0.683	F = 0.33 P = 0.804	F = 0.50 P = 0.708	F = 2.19 P = 0.269	F = 1.73 P = 0.332	F = 0.23 P = 0.872

Note. CTOPP-PAC = CTOPP Phonological Awareness Composite; CTOPP-E = CTOPP Elision; CTOPP-BW = CTOPP Blending Words; CTOPP-SM = CTOPP Sound Matching; CTOPP-RNC = CTOPP Rapid Naming Composite; CTOPP-RCN = CTOPP Rapid Color Naming; CTOPP-RON = CTOPP Rapid Object Naming; WRMT-R = Woodcock Reading Mastery Tests- Revised Letter Identification.

* = Statistically significant

Relationship between Language, Speech, and Reading

Language and Early Reading

Tables 6 and 7 display the significant correlations between the language measures and the measures of early reading performance. Table 6 shows the reading measures associated with measures of grammar. Table 7 displays reading measures associated with vocabulary skills. The complete correlational matrices for all measures are provided in Appendix D.

Twenty-five significant correlations were found for the cleft group. Most of the significant correlations for cleft and noncleft groups showed a relationship between grammatical and sentence imitation language subtests, MLU and rapid naming, elision, sound matching, and letter identification. Vocabulary measures were, for the most part, negatively correlated with reading measures for the cleft group. The early reading measures that were most highly related to grammatical language were measures that required the ability to retrieve information from long-term memory as in the rapid naming subtests of the CTOPP and the ability to identify and manipulate the phonological structure of words seen in the elision and sound matching subtests of the CTOPP and letter identification on the WRMT-R. For the noncleft group, grammatical measures and vocabulary measures were primarily positively correlated with the reading measures. The cleft and noncleft groups differed in the pattern of correlations with respect to vocabulary measures. The children with clefts showed a discontinuity between vocabulary and early reading measures while the noncleft children showed a relationship between vocabulary and early reading measures. This finding may suggest that children with clefts do not have the same vocabulary foundation for early reading as typically developing children.

Table 6

Pearson Correlation Comparisons for Grammar Measures and Early Reading Measures by Group

Group	Grammar measure	Correlates with
Both		
	TOLD-P:3-GU	CTOPP-E*, WRMT-R***
	TOLD-P:3-SI	CTOPP-E*, CTOPP-SM*
	TOLD-P:3-GC	CTOPP-RON***
	SALT- MLU	CTOPP-RON*
Cleft		
	TOLD-P:3-GU	CTOPP-SM*
	TOLD-P:3-SI	WMRT-R*
	TOLD-P:3-GC	CTOPP-SM*, WRMT-R*
	SALT-MLU	CTOPP-SM*
	SALT-Morphemes	CTOPP-RON**
Noncleft		
	TOLD-P:3-GU	CTOPP-RCN*, CTOPP-RON*
	TOLD-P:3-SI	CTOPP-BW*, CTOPP-RON*
	TOLD-P:3-GC	CTOPP-E*, CTOPP-BW*
	SALT-MLU	CTOPP-E*
	SALT-Morphemes	CTOPP-SM*, CTOPP-RCN**, WRMT-R*

Note. The exact "p" values for the correlations presented in this table can be found in Appendix D.

TOLD-P:3-GU = TOLD-P:3 Grammatical Understanding; TOLD-P:3-SI = TOLD-P:3 Sentence Imitation; TOLD-P:3-GC = TOLD-P:3 Grammatical Completion; MLU = mean length of utterance; CTOPP-E = CTOPP Elision; CTOPP-BW = CTOPP Blending Words; CTOPP-SM = CTOPP Sound Matching; CTOPP-RCN = CTOPP Rapid Color Naming; CTOPP-RON = CTOPP Rapid Object Naming; WRMT-R = *Woodcock Reading Mastery Tests-Revised* Letter Identification.

* = Positively correlated. ** = Negatively correlated. *** = Mixed positive/negative between groups

Table 7

Pearson Correlation Comparisons for Vocabulary Measures and Early Reading Measures by Group

Group	Vocabulary measure	Correlates with
Both		
	TOLD-P:3-PV	CTOPP-RCN**, CTOPP-RON*
	TOLD-P:3-RV	CTOPP-RCN***
	TOLD-P:3-OV	CTOPP-RON***
	PPVT-III	CTOPP-E*
Cleft		
	TOLD-P:3-PV	CTOPP-BW**
	TOLD-P:3-RV	CTOPP-BW**
	PPVT-III	CTOPP-SM*, CTOPP-RCN**, WRMT-R*
	SALT-Diff.Wrds	CTOPP-RON**
	SALT-Tot.Wrds	CTOPP-SM*, CTOPP-RON**
	SALT-TTR	CTOPP-SM**, CTOPP-RON*
Noncleft		
	TOLD-P:3-PV	CTOPP-E*, WRMT-R*
	TOLD-P:3-RV	CTOPP-E*, CTOPP-RON*, WRMT-R**
	TOLD-P:3-OV	CTOPP-E*, CTOPP-BW*, CTOPP-SM*, CTOPP-RCN**, WRMT-R*
	PPVT-III	CTOPP-BW*, CTOPP-RON*
	SALT-Diff.Wrds	CTOPP-SM*, CTOPP-RCN**, WRMT-R*
	SALT-Tot.Wrds	CTOPP-RCN**, WRMT-R*
	SALT-TTR	CTOPP-RCN*, WRMT-R**

Note. The exact "p" values for the correlations presented in this table can be found in Appendix D.
TOLD-P:3-PV = TOLD-P:3 Picture Vocabulary; TOLD-P:3-RV = TOLD-P:3 Relational Vocabulary; TOLD-P:3-OV = TOLD-P:3 Oral Vocabulary; PPVT-III = *Peabody Picture Vocabulary Test- 3rd Edition*; SALT-Diff.Wrds = SALT Different Words; CTOPP-E = CTOPP Elision; CTOPP-BW = CTOPP Blending Words; CTOPP-SM = CTOPP Sound Matching; CTOPP-RCN = CTOPP Rapid Color Naming; CTOPP-RON = CTOPP Rapid Object Naming; WRMT-R = *Woodcock Reading Mastery Tests- Revised* Letter Identification.
* = Positively correlated. ** = Negatively correlated. *** = Mixed positive/negative between groups

Speech and Early Reading

Table 8 displays the significant correlations between the speech production measures and the measures of early reading performance. The complete correlational matrix for all measures is provided in Appendix E. Pearson correlations showed significant correlations between the GFTA-2 measure and the early reading measures of rapid naming, sound matching, blending words and letter identification. While the group differences between nasality measures could not be analyzed between the noncleft group and the cleft because the noncleft children had absence of these attributes. However, for the children with clefts the nasality and nasal emission measures were correlated with early reading measures. These correlations are likely secondary to primary articulation differences in the children with clefts.

Table 8

Pearson Correlation Comparisons for Speech Production Measures and Early Reading Measures by Group

Group	Speech measure	Correlates with
Both		
	GFTA-2	CTOPP-RCN*
Cleft		
	GFTA-2	CTOPP-BW*, CTOPP-RON*, WRMT-R**
	Nasality Rating	CTOPP-E*, CTOPP-BW*, CTOPP-SM*, CTOPP-RCN*, CTOPP-RON**, WRMT-R*
	Nasal Emission Rating	CTOPP-BW*, CTOPP-RCN*
Noncleft		
	GFTA-2	CTOPP-SM**

Note. GFTA-2 = *Goldman-Fristoe Test of Articulation-2*; CTOPP-BW = CTOPP Blending Words; CTOPP-SM = CTOPP Sound Matching; CTOPP-RCN = CTOPP Rapid Color Naming; CTOPP-RON = CTOPP Rapid Object Naming; WRMT-R = *Woodcock Reading Mastery Tests- Revised* Letter Identification.

* = Positively correlated. ** = Negatively correlated. *** = Mixed positive/negative between groups

CHAPTER 4

DISCUSSION

One purpose of this study was to provide a description of the speech and language differences between kindergartners with and without cleft lip and/or palate (CLP). Results from speech measures revealed statistically and clinically significant differences in the speech production and resonance characteristics of kindergarteners with clefts when compared to noncleft age, gender, and socioeconomic status matched peers. Speech production for the children with clefts was characterized by compensatory and phonological errors. The group of cleft children also demonstrated poorer sound accuracy as determined by *Percentage of Consonants Correct* (PCC) when compared to the noncleft group. These findings support those of previous studies that report lower PCCs, smaller consonant inventories, and compensatory errors in children with CLP (Chapman & Hardin, 1992; Philips & Harrison, 1969a; Scherer & D'Antonio, 1995; Trost, 1981).

Previous research also indicates that the presence of speech impairments increases the probability of a coexisting language disorder in children without clefts (Shriberg, Tomblin, & McSweeny, 1999). This finding was also true for the children with CLP in this study. The children with CLP demonstrated statistically significant deficits in receptive grammar and vocabulary skills when compared to noncleft age, gender, and SES matched peers. Additionally, clinically significant differences were found between the cleft and noncleft groups on measures of receptive and expressive vocabulary and grammatical language. Scherer and D'Antonio (1997) and Scherer, D'Antonio, and Kalbfleisch (1999) found delays in the vocabulary of

preschoolers with clefts. The present study indicated that vocabulary delays, as well as delays in grammatical language, persist into school-age for children with clefts.

The second purpose of this study was to identify the possible relationships between speech, language, and early reading skills in the cleft and noncleft group. Data revealed that the cleft group showed significant correlations between grammatical language and early reading measures of phonological awareness, letter identification, and rapid naming while the noncleft group showed significant correlations between vocabulary, grammatical language and phonological awareness, letter identification, and rapid naming. In addition, the speech production of the cleft group was found to be correlated with performance on many of the early reading measures.

Similar findings have been reported in other studies involving groups of children without clefts. Catts (1986) found that a group of 12- to 15-year-olds with reading disabilities had poorer speech production than children without reading impairments. Based on these results, Catts suggested that their difficulties with reading may be associated with expressive phonological abilities. Additionally, in a review of previous research, Hodson (1994) found a number of studies of receptive and expressive phonological abilities report that children with phonological impairments performed poorer on tasks of phonological awareness than children without phonological impairments. This finding has been contradicted by other studies that have found that articulation and phonological impairments are not predictive of future reading abilities. After administering speech-language, phonological awareness, and rapid naming measures to kindergarten children with and without speech-language impairments, Catts (1993) reported that articulation abilities were not related to reading abilities in the first or second grades. Bishop and Adams (1990) studied groups of children with either phonological disorders or impairments in

phonology and language. Neither the presence of an isolated phonological impairment nor the severity of phonological impairment was found to predict reading outcome. Further, they found that children with expressive language deficits only had mild reading problems that resolved with age, while children with receptive delays had the most impaired reading performance. The group of children with CLP in this study also presented a specific relationship between language performance and early reading skills. The children with clefts had grammatical language abilities that were more predictive of their early reading skills than vocabulary development. In contrast, the children without CLP displayed correlations between early reading measures and both grammatical language and vocabulary measures. These results are similar to findings of studies that have found impairments in early reading tasks to be co-occurring with impairments in speech and language in noncleft language-impaired children (Catts, 1993; Catts et al., 2001; Magnusson & Nauclér, 1990).

Previous studies of early reading abilities by Catts (1993) and Catts et al. (2001) reported that receptive language skills are associated with early reading performance in groups of children with language impairments. In the present study, grammatical language skills were associated with early reading performance for both groups. The results from the present study suggest that children with clefts have specific language and speech deficits that may impact their early reading performance as indicated in the studies of Richman (1980). Richman identified a subgroup of children with clefts who showed receptive and expressive language deficits. These children performed poorer on reading tasks than those with only expressive language impairments. The study found that receptive language abilities were strongly associated with performance in early reading. The present study expands upon the findings of Richman (1980),

Richman et al. (1988), and Catts et al. (2001) by specifying the aspect of receptive language, grammatical language, which appeared to be most strongly related to later reading performance.

Of the early reading skills assessed in this study, the phonological awareness measures had the greatest relationship to language skills. Magnusson and Nauclér (1990), who studied 115 children with and without language impairments before and after entering school, reported that noncleft children with language impairments had poorer phonological awareness skills than children with normal language abilities. Magnusson and Nauclér also stated that, based on their results, children with intact phonological awareness skills are more likely to succeed at reading than children who do not possess these skills. In another study of noncleft children, Bishop and Adams (1990) assessed preschool children with early language delays. One group of children, whose language delays resolved by 5 ½ years of age, showed no reading difficulties. However, the children who continued to have language delays exhibited poor reading performance. In summary, it appears that the results of the present study pertaining to the relationship of early reading performance to receptive language deficits, specifically the grammatical components of language, are supported in the literature with noncleft, language-impaired children. Further, the results of the present study pertaining to the association of phonological impairments to early reading performance are supported in the literature from noncleft children. Finally, while studies of reading impairments in children with CLP have supported the link to receptive language deficits, the present study offers additional data to support the importance of grammatical development in early reading acquisition.

Clinical Implications

The findings of this study support those of previous studies that have found children with CLP to have poorer speech and language abilities than noncleft children as they enter school. The findings of this study also show that children with CLP perform poorer on tasks of phonological awareness, rapid naming, and letter identification and may, therefore, be at increased risk for future reading disabilities (Bishop & Adams, 1990; Catts, 1993; Catts et al., 2001; Magnusson & Nauclér, 1990). Many children with CLP receive early intervention that targets speech production. However, the results of this study suggest that children with CLP should also receive early intervention that targets deficits in language skills, particularly vocabulary, syntax, and phonological awareness skills. There is a body of research available that supports phonological awareness facilitation as a means of improving present and future reading abilities in noncleft children, and this study suggests that children with clefts may benefit from these same phonological awareness intervention strategies (Ball & Blachman, 1988; Cunningham, 1990; Lundberg, Frost, & Peterson, 1988; Williams, 1980; Yopp, 1982).

Additionally, due to difficulties with vocabulary and grammatical comprehension, children with CLP may benefit from early reading programs that emphasize vocabulary development, such as whole language or literature based programs. These programs stress the language components that appear problematic for children with clefts. Further, these programs have been successful in promoting reading performance for noncleft children with language deficits similar to those described in this study. However, future research would be necessary to assess the effectiveness of such language-literacy programs and phonological awareness for children with CLP.

Future Research

This study found a number of statistically significant findings and some trends that appeared to be clinically significant but did not achieve statistical significance. It is possible that, with additional subjects, these trends would achieve significance. Additionally, it is important to extend data collection to second grade in order to evaluate how these language and early reading measures predict later reading difficulties. There is some precedence for this methodology. Catts et al (2001) assessed early reading skills at kindergarten and then again at second grade. They found that many of the reading measures identified as highly correlated with language performance were also predictive of later reading performance. Further assessment of the predictive nature of early reading and language performance would assist in identifying which children with clefts are at highest risk for reading failure. This knowledge then could be helpful in obtaining early intervention for reading risk.

REFERENCES

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., revised). Washington, DC: Author.

Ball, E., & Blachman, B. (1988). Phoneme segmentation training: Effect on reading readiness. *Annals of Dyslexia, 38,* 208-225.

Bayley, N. (1969). *Bayley scales of infant development.* San Antonio, TX: Psychological.

Bishop, D. V. M., & Adams, C. (1990). A prospective study of the relationship between specific language impairment, phonological disorders, and reading retardation. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 31,* 1027-1050.

Broder, H. L., Richman, L. C., & Matheson, P. B. (1998). Learning disability, school achievement, and grade retention among children with cleft: A two-center study. *Cleft Palate-Craniofacial Journal, 35,* 127-131.

Broen, P. A., Devers, M. C., Doyle, S. S., Prouty, J. M., & Moller, K. T. (1998). Acquisition of linguistic and cognitive skills by children with cleft palate. *Journal of Speech, Language, and Hearing Research, 41,* 676-687.

Brown, L., Sherbenou, R. J., & Johnsen, S. K. (1982). *Test of nonverbal intelligence*. Austin, TX: PRO-ED.

Bzoch, K. R., & League, R. (1971). *Receptive-expressive emergent language scale.* Austin, TX: PRO-ED.

Catts, H. W. (1986). Speech production/phonological deficits in reading-disordered children. *Journal of Learning Disabilities, 19,* 504-508.

Catts, H. W. (1993). The relationship between speech-language impairments and reading disabilities. *Journal of Speech and Hearing Research, 36,* 948-958.

Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (2001). Estimating the risk of future reading difficulties in kindergarten children: A research-based model and its clinical implementation. *Language, Speech, and Hearing Services in Schools, 32,* 38-50.

Chapman, K. L. (1993). Phonological processes in children with cleft palate. *Cleft Plate-Craniofacial Journal, 30,* 64-67.

Chapman, K. L., Graham, K. T., Gooch, J., & Visconti, C. (1998). Conversational skills of preschoolers and school-aged children with cleft lip and palate. *Cleft Palate-Craniofacial Journal, 35,* 503-516.

Chapman, K. L., & Hardin, M. A. (1992). Phonetic and phonologic skills of two-year-olds with cleft palate. *Cleft Palate-Craniofacial Journal, 29,* 435-441.

Cunningham, A. (1990). Explicit vs. implicit instruction in phonological awareness. *Journal of Experimental Child Psychology, 50,* 429-444.

Day, A. (1985). *Good dog, Carl*. La Jolla, CA: Green Tiger Press.

Dunn, L. M., & Dunn, L. M. (1997). *Peabody picture vocabulary test* (3rd ed.). Circle Pines, MN: American Guidance Service.

Eliason, M. J., & Richman, L. C. (1990). Language development in preschoolers with cleft. *Developmental Neuropsychology, 6,* 173-182.

Goldman, R., & Fristoe, M. (2000). *Goldman-Fristoe test of articulation-2*. Circle Pines, MN: American Guidance Service, Incorporated.

Hadley, P. A. (1998). Language sampling protocols for eliciting text-level discourse. *Language, Speech, and Hearing Services in Schools, 29,* 132-147.

Harding, A., & Grunwell, P. (1996). Characteristics of cleft palate speech. *European Journal of Disorders of Communication, 31,* 331-357.

Hedrick, D. L., Prather, E. M., & Tobin, A. R. (1984). *Sequenced inventory of communication development- Revised.* Seattle: University of Washington Press.

Hiskey, M. S. (1966). *Hiskey-Nebraska test of learning aptitude.* Lincoln, NE: Union College Press.

Hodson, B. W. (1994). Helping individuals become intelligible, literate, and articulate: The role of phonology. *Topics in Language Disorders, 14,* 1-16.

Hollingshead, A., & Redlich, F. (1958). *Social class and mental illness.* New York: Wiley.

Ireton, H., & Thwing, E. (1972). *Minnesota child development inventory.* Minneapolis: Behavior Science Systems.

Jastak, J. F., & Jastak, S. R. (1965). *The wide range achievement test.* Wilmington: Guidance Associates.

Jocelyn, L. J., Penko, M. A., & Rode, H. L. (1996). Cognition, communication, and hearing in young children with cleft lip and palate and in control children: A longitudinal study. *Pediatrics, 97,* 529-534.

Kirk, S. A., McCarthy, J. J., & Kirk, W. D. (1968). *Illinois test of psycholinguistic ability.* Urbana, IL: University of Illinois.

Kuehn, D. P., & Moller, K. T. (2000). Speech and language issues in the cleft palate population: The state of the art. *Cleft Palate-Craniofacial Journal, 37,* 348.

Lundberg, I., Frost, J., & Peterson, O. (1988). Effects of an extensive program of stimulating phonological awareness in preschool children. *Reading Research Quarterly, 26,* 263-284.

Magnusson, E., & Nauclér, K. (1990). Can preschool data predict language-disordered children's reading and spelling at school? *Folia Phoniatrica, 42*, 227-282.

McCraken, R. (1966). *The standard reading inventory.* Klamath Falls, OR: Klamath.

Miller, J., & Chapman, R. (2001). *Systematic analysis of language transcripts (SALT).* Language Analysis Laboratory, Waisman Center, University of Wisconsin-Madison.

Morley, M. E. (1966). *Cleft palate and speech*. Baltimore: Williams & Wilkins.

Morris, H. L. (1962). Communication skills of children with cleft lips and palate. *Journal of Speech and Hearing Research, 50,* 79-90.

Newcomer, P. L., & Hammill, D. D. (1997). *Test of language development- Primary 3*. Austin, TX: PRO-ED.

Philips, B. J., & Harrison, R. J. (1969a). Articulation patterns of preschool cleft palate children. *Cleft Palate Journal, 6,* 245-253.

Philips, B. J., & Harrison, R. J. (1969b). Language skills in preschool cleft palate children. *Cleft Palate Journal, 6,* 108-119.

Richman, L. C. (1980). Cognitive patterns and learning disabilities in cleft palate children with verbal defects. *Journal of Speech and Hearing Research, 23,* 447-456.

Richman, L. C., Eliason, M. J., & Lindgren, S. D. (1988). Reading disability in children with clefts. *Cleft Palate Journal, 25,* 21-25.

Richman, L. C., & Lindgren, S. D. (1978). *The color span test.* Iowa City, IA: Department of Pediatrics, University of Iowa Hospitals and Clinics.

Richman, L. C., & Lindgren, S. D. (1980). Patterns of intellectual ability in children with verbal defects. *Journal of Abnormal Child Psychology, 8,* 65-81.

Scherer, N. J., & D'Antonio, L. D. (1995). Parent questionnaire for screening early language development in children with cleft palate. *Cleft Palate-Craniofacial Journal, 32,* 7-13.

Scherer, N. J., & D'Antonio, L. D. (1997). Language and play development in toddlers with cleft lip and/or palate. *American Journal of Speech-Language Pathology, 6,* 48-54.

Scherer, N. J., D'Antonio, L. D., & Kalbfleisch, J. H. (1999). Early speech and language development in children with Velocardiofacial Syndrome. *American Journal of Medical Genetics, 88,* 714-723.

Sell, D., Harding, A., & Grunwell, P. (1994). A screening assessment of cleft palate speech (Great Ormond Street Speech Assessment). *European Journal of Disorders of Communication, 29,* 1-15.

Shriberg, L. D., Austin, D., Lewis, B. A., McSweeney, J. L., & Wilson, D. L. (1997). The percentage of consonants correct metric: Extensions and reliability data. *Journal of Speech, Language, and Hearing Research, 40,* 708-722.

Shriberg, L. D., Tomblin, J. B., & McSweeny, J. L. (1999). Prevalence of speech delay in 6-year-old children and comorbidity with language impairment. *Journal of Speech, Language, and Hearing Research, 42,* 1461-1481.

Smith, R. M., & McWilliams, B. J. (1968). Psycholinguistic abilities of children with clefts. *Cleft Palate Journal, 5,* 238-249.

Strauss, R. P., & Broder, H. (1993). Children with cleft lip/palate and mental retardation: A subpopulation of cleft craniofacial team patients. *Cleft Palate-Craniofacial Journal, 30,* 548-556.

Trost, J. E. (1981). Articulation additions to the classical descriptions of the speech of persons with cleft palate. *Cleft Palate Journal, 18,* 193-202.

Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (1999). *Comprehensive test of phonological processing*. Austin, TX; PRO-ED.

Wechsler, D. (1949). *Manual for wechsler intelligence scale for children.* New York: Psychological.

Wechsler, D. (1969). *Wechsler preschool and primary scale of intelligence.* New York; Psychological.

Williams, J. (1980). Teaching decoding with an emphasis on phoneme analysis and phoneme blending. *Journal of Educational Psychology, 72,* 1-15.

Witzel, M. A. (1995). Communicative impairment associated with clefting. In Shprintzen, R. J., & Bardach, J. (Eds). *Cleft Palate Speech Management: A Multidisciplinary Approach*.

Woodcock, R. G. (1998). *Woodcock reading mastery tests- Revised/NU examiner's manual*. Minnesota: American Guidance Service.

Yopp, H. (1992). Developing phonological awareness in young children. *The Reading Teacher, 45,* 696-703.

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (1992). *Preschool language scale-3*. San Antonio, TX: Psychological.

APPENDICES

APPENDIX A

NASALITY RATING FORM

1. Is there velopharyngeal closure for speech when expected?
   _____ Yes
   _____ No
   _____ Variable

2. HYPERNASALITY
   _____ Yes
   _____ No
   _____ Variable

   HYPONASALITY
   _____ Yes
   _____ No
   _____ Variable

   When hypernasality occurs, rate severity:

   _____
   1 2 3 4 5 6 7
   (mild) (severe)

3. NASAL EMISSION
   _____ Yes
   _____ No
   _____ Variable

   When nasal emission occurs, rate severity:

   _____
   1 2 3 4 5 6 7
   (mild) (severe)

APPENDIX B

DATA COLLECTION SHEET

Group											
Subject ID											
Age											
Gender											
Cleft Type											
TOLD- PV											
TOLD- RV											
TOLD-OV											
TOLD- GU											
TOLD- SI											
TOLD- GC											
PPVT-III											
SALT-dif wds											
SALT- tot wds											
SALT- TTR											
SALT- MLU											
SALT- morph											
GFTA-2											
TONI											
CTOPP- RNC											
CTOPP- RCN											
CTOPP- RON											
CTOPP-PAC											
CTOPP- E											
CTOPP- BW											
CTOPP- SM											
WRMT- ID											
Nasality											
Nasal Emission											

APPENDIX C

VARIABLES LIST

Age	Years-months
Gender	Male, Female
Cleft Type	ICP, CLP, NCP
TOLD-P:3- Picture Vocabulary	Standard score
TOLD-P:3- Relational Vocabulary	Standard score
TOLD-P:3- Oral Vocabulary	Standard score
TOLD-P:3- Grammatical Understanding	Standard score
TOLD-P:3- Sentence Imitation	Standard score
TOLD-P:3- Grammatical Completion	Standard score
PPVT	Standard score
SALT- # of different words	Frequency
SALT- Total words	Frequency
SALT- Type Token Ratio (TTR)	Ratio
SALT- Mean Length of Utterance (MLU)	Score
SALT- # of bound morphemes	Frequency
GFTA-2	Standard score
TONI	Standard score
CTOPP- Rapid Naming Composite	Standard score
CTOPP- Rapid Color Naming	Standard score
CTOPP- Rapid Object Naming	Standard score
CTOPP- Phonological Awareness Composite	Standard score
CTOPP- Elision	Standard score
CTOPP- Blending Words	Standard score
CTOPP- Sound Matching	Standard score
WRMT-R Letter Identification	Standard score

APPENDIX D

Pearson Correlation Comparisons for Language Measures and Early Reading Measures.

Language Measures	Reading Measures					
	CTOPP-Elision	CTOPP-Blending Words	CTOPP-Sound Matching	CTOPP-Rapid Color Naming	CTOPP-Rapid Object Naming	WRMT-R
TOLD-P:3 Picture Vocabulary	-0.157 0.577*	-0.627* 0.348	-0.304 0.348	-0.736* -0.503*	0.676* 0.577*	-0.039 0.591*
TOLD-P:3 Relational Vocabulary	0.055 0.577*	-0.904* 0.348	0.024 -0.302	-0.911* 0.704*	-0.372 0.577*	0.300 -0.549*
TOLD-P:3 Oral Vocabulary	0.265 0.873*	-0.213 0.892*	0.371 0.818*	-0.131 -0.636*	-0.965* 0.870*	0.375 0.776*
TOLD-P:3 Grammatical Understanding	0.901* 0.570*	0.103 0.401	0.932* -0.232	0.000 0.695*	-0.469 0.570*	0.939* -0.543*
TOLD-P:3 Sentence Imitation	0.922* 0.801*	0.084 0.966*	0.852* 0.753*	-0.129 -0.251	0.211 0.801*	0.935* 0.398
TOLD-P:3 Grammatical Completion	0.478 0.927*	-0.288 0.759*	0.548* 0.208	-0.273 0.208	-0.837* 0.927*	0.610* -0.010
PPVT-III	0.751* 0.819*	-0.374 0.538*	0.712* -0.061	-0.512* 0.366	-0.230 0.819*	0.891* -0.182
SALT- Number of different words	0.314 0.168	0.274 0.185	0.454 0.564*	0.367 -0.905*	-0.908* 0.168	0.302 0.890*
SALT- Number of total words	0.449 0.108	0.348 0.046	0.580* 0.387	0.408 -0.800*	-0.849* 0.108	0.422 0.778*
SALT- TTR	-0.470 0.195	-0.297 0.271	-0.597* -0.143	-0.352 0.672*	0.862* 0.195	-0.457 -0.597*
SALT- MLU	0.405 0.593*	0.063 0.256	0.525* 0.023	0.129 -0.177	-0.935* 0.593*	0.451 0.286
SALT- Morphemes	-0.232 0.424	0.269 0.389	-0.078 0.617*	0.457 -0.852*	-0.814* 0.424	-0.273 0.891*

Note: Table entries are "r" values for Pearson Correlation Coefficients. Upper entries are always the cleft group's "r" values. Lower entries are always the noncleft group's "r" values.

TTR = Type Token Ratio. MLU = mean length of utterance.

* = Statistically significant (-/+ 0.5-1.0)

APPENDIX E

Table

Pearson Correlation Comparisons for Speech Measures and Reading Measures.

Speech Measures	Reading Measures					
	CTOPP-Elision	CTOPP-Blending Words	CTOPP-Sound Matching	CTOPP-Rapid Color Naming	CTOPP-Rapid Object Naming	WRMT-R
GFTA-2	-0.331 0.382	0.640* -0.044	-0.350 -0.536*	0.645* 0.506*	0.654* 0.382	-0.536* -0.402
Nasality Rating	0.739* N/A	0.574* N/A	0.834* N/A	0.544* N/A	-0.556* N/A	0.657* N/A
Nasal Emission Rating	-0.317 N/A	0.662* N/A	-0.192 N/A	0.816* N/A	-0.333 N/A	-0.482 N/A

Note: Table entries are "r" values for Pearson Correlation Coefficients. Upper entries are always the cleft group's "r" values. Lower entries are always the noncleft group's "r" values.

* = Statistically significant (-/+ 0.5-1.0)

VITA

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