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Early Speech and Language Development: A Comparison of Typically Developing Children to Children with Cleft Palate.

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Early Speech and Language Development: A Comparison of Typically Developing Children with Children with Cleft Palate

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by

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ABSTRACT

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Previous research has shown that parent implemented intervention is effective in increasing the speech and language development of children with cleft lip and palate. To further determine the efficacy of this intervention, this study compared the speech and language development of children with CLP who received parent implemented intervention, with a group of younger, typically developing children, matched for vocabulary size. This study also evaluated the language differences between the mothers of both groups of children. Speech and language assessments were administered to the typically developing children and their mothers at two times to mirror the time of assessment for the children with clefts who received a three-month intervention in a prior study. The findings revealed that both groups of children demonstrated the same amount of speech and language growth as well as the cleft group exhibiting a decrease in compensatory articulation errors.

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CONTENTS

Page

ABSTRACT …….. 2

ACKNOWLEDGEMENTS …… 3

LIST OF TABLES ……..... 7

LIST OF FIGURES ……. 8

Chapter

1. INTRODUCTION …… 9

Etiology of Speech and Language Deficits in Children with Cleft Lip and Palate …….. 9

Speech and Language Development in Children with Clefts…… 10

Speech and Language Treatment for Children with CLP…… 16

Role of Language Development in Early Intervention…… 18

Parent Training Programs…… 19

Milieu Training…… 19

Dialogic Reading……. 20

Focused Stimulation…… 21

Purpose……. 24

2. METHODS…… 26

Participants…….. 26

Procedures…… 28

Test Protocol…….. 28

Reliability……. 30

Language Sample, Phonetic Transcription and Utterance Coding…… 30

Data Analysis…… 30

3. RESULTS……. 31

Children's Measures……. 31

Language Sample…… 31

Cleft/Noncleft Comparisons……... 32

Pretest-Posttest Comparisons…… 32

Tests of Language and Speech…… 35

Cleft/Noncleft Comparisons…….. 35

Pretest-Posttest Comparisons…… 36

Phonetic Inventories…….. 37

Cleft/Noncleft Comparisons…….. 38

Pretest-Posttest Comparisons…… 39

Mothers' Language Measures……. 41

Language Sample…….. 41

Cleft/Noncleft Comparisons……. 41

Pretest-Posttest Comparisons……... 42

Dyadic Vocabulary Growth……. 45

Summary…… 46

4. DISCUSSION……. 48

Comparison with Previous Research……... 48

Speech and Language Growth…… 48

Changes in Parent Language Addressed to Children……. 50

Limitations to the Study…… 53

Clinical Implications…… 53

Future Research……. 54

REFERENCES…… 55

APPENDICES……. 59

Appendix A: Case History Form…….. 59

Appendix B: Socioeconomic Status……. 63

VITA…… 64

LIST OF TABLES

Table Page

1. Age, Gender, Socioeconomic Status, and the Expressive Vocabulary Raw Score from the MacArthur Communicative Development Inventory (CDI; Fenson et al., 1993) for the Children with Cleft Palate…… 27

2. Age, Gender, Socioeconomic Status, and the Expressive Vocabulary Raw Score from the MacArthur Communicative Development Inventory (CDI; Fenson et al., 1993) for the Typically Developing Children…… 28

3. Study Group Comparisons for Children's SALT (Miller & Chapman, 2001) Measures…… 34

4. Study Group Comparisons for Children's Standardized Language and Phonetic Measures…….. 37

5. Phonetic Inventories of Children with Clefts and Noncleft Children Used At Least Twice in the Language Sample at Pretest and Posttest…….. 40

6. Study Group Comparisons for Mothers' SALT (Miller & Chapman, 2001) Measures…….. 43

LIST OF FIGURES

Figure Page

1. Percentage of Glottal Stops at Pretest and Posttest Produced by Children with Clefts…….. 36

2. Change in Responsive Labels and Commands/Requests from Pretest to Posttest for Mothers of Children with Clefts…… 44

3. Change in Responsive Labels and Commands/Requests from Pretest to Posttest for Mothers of Noncleft Children…… 44

4. Children with Clefts and Their Mothers Number of Different Words at Pretest and Posttest…….. 45

5. Noncleft Children and Their Mothers Number of Different Words at Pretest and Posttest…….. 45

CHAPTER 1

INTRODUCTION

Etiology of Speech and Language Disorders in Children with Cleft Lip and Palate

Speech and language deficits are well documented in children with cleft lip and palate (Broen, Devers, Prouty, & Moller, 1998; Chapman, Hardin-Jones, & Halter, in press; Estrem & Broen, 1989; Scherer, Williams, & Kalbfleisch, submitted). The etiology of these deficits has been attributed to issues relating to timing of surgery, extent of the cleft, or middle ear pathology (Broen et al.; O'Gara & Logemann, 1988). All of these sources of deficit stem from a view that the cause of the speech and language deficits in children with clefts is the "hole in the mouth". This view may be considered a peripheral view in that the cleft is an abnormality in a peripheral system. This view is in contrast to etiology of speech and language deficits in other speech and language impaired populations (Tomblin, 1989; Tomblin & Buckwalter, 1998). For these groups, the etiology of speech and language deficits are thought to be central in nature. However, until recently the central view has not been applied to clefting despite evidence to suggest that language, cognitive, and reading deficits occur in a substantial proportion of the cleft population (Eliason & Richman, 1990; Richman, 1980; Scherer & D'Antonio, 1997). From a dysmorphology perspective, this central view is well known. The development of the face and the brain are related in both normal and pathologic conditions. This development is so interwoven that dysmorphologists use the phrase "the face reflects the brain". However, until recently there has been little investigation of the relationships between the face and brain in individuals with clefts. Recently, a series of studies have been conducted by Nopoulus and colleagues that examined brain morphology of adults with clefts using MRI (Nopoulos, Berg,

Canady, Richman & Andreasen, 2002; Nopoulos, Berg, VanDemark, et al., 2002). These studies found significant differences in size and tissue composition of major brain structures between cleft and noncleft individuals. Most significant of these differences was an increase in the size of the frontal and parietal lobes and a decrease in the size of the temporal and occipital lobes of the cerebrum and cerebellum when compared to noncleft individuals. These size differences were accounted for by an increase in gray matter in the anterior lobes and decrease in white matter of the posterior lobes of the cerebrum and a decrease in gray matter in cerebellum. However, an important difference was a disproportionate reduction in the gray matter of the temporal lobe of the left hemisphere. These studies suggest that a central view of clefting should be examined. This view suggests that clefting may be a reflection of a larger complex of symptoms that may carry a risk for language and reading deficits.

Speech & Language Development in Children with Clefts

Numerous studies describe the speech deficits of children with cleft lip and palate (Broen et al., 1998; Chapman et al., in press; Estrem & Broen, 1989; Scherer et al., submitted). Recent studies have documented the presence of language deficits in addition to speech impairments, particularly at the beginning of language acquisition (Broen et al., 1998; Chapman et al., in press; Estrem & Broen, 1989; Scherer et al., submitted). Specifically, young children with clefts exhibit limited sound inventories and small vocabularies when compared to typically developing children of the same age (Broen et al., 1998; Chapman et al., in press; Estrem & Broen, 1989; Scherer et al., submitted). A study conducted by Estrem and Broen (1989) showed a relationship between lexical choice and phonological categories in children with cleft palate. The results indicated that children with clefts have smaller vocabularies at early stages of development and

the vocabulary words that they used contained predominately sounds within their phonetic inventories (Estrem & Broen). A later study that examined the linguistic development of young children with cleft palate revealed slower word acquisition for this group when compared to a noncleft group (Broen et al., 1998). The differences in language development for the children with clefts were attributed to the children's hearing status, velopharyngeal dysfunction, and resulting small sound inventories (Broen et al.). More recently, Chapman and colleagues (2002) compared the speech and lexical development of children with cleft lip and palate and typically developing children at 21 months of age. Children with clefts were found to be poorer than the noncleft children on most measures of speech and lexical development by exhibiting smaller consonant inventories and producing fewer words than noncleft peers. Furthermore, the children with CLP were less accurate than the noncleft children in their production of stop consonants. The results showed the percentage of true stop production to be the most consistent predictor for speech and lexical measures for the children with CLP. In contrast, the true canonical babbling ratio (number of true canonical syllables/total number of syllables) was the most consistent predictor for the noncleft children. These results indicate that the stop consonant category was used less for toddlers with clefts, which may be accounted for by fewer vocal attempts (Chapman et al., 2002). Scherer and colleagues examined vocalization rates of children with and without cleft palate at 6, 12, and 30 months of age. At 6 and 12 months of age the cleft group did not differ significantly from the noncleft group in the total number of vocalizations; however, the cleft group produced mainly nonspecific vocalizations and did not babble as much as the noncleft group. By 30 months of age the cleft group showed delays in speech sound accuracy, vocalization rates, and lexical development. Hearing status was not likely a cause of the delays exhibited because the children passed hearing screenings at six-month intervals and the children

who had ear infections were treated with early PE tube placement and regular follow-up. These results suggest that the cleft group was practicing less with sounds that were candidates for word use than the noncleft children (Scherer et al., submitted). Overall, young children with cleft lip and/or palate exhibit delayed speech and language development as shown by low vocalization rates, limited sound inventories, and delayed vocabulary development.

In addition to limited sound repertoires and small vocabularies, children with cleft lip and/or palate also exhibit delays in play. Scherer and D'Antonio (1997) examined the relationship between play gesture performance and vocabulary development in children with cleft lip and/or palate at 20, 24, and 30 months of age. Results showed that the use of gestures correlated with lexical development from the use of single words to a mean length of utterance of 1.5, suggesting a relationship between the development of play gestures and the development of language. The children with cleft palate only (CPO) demonstrated slow play gesture and language development. In a larger study, Snyder and Scherer (in press) also evaluated symbolic play in young children with CLP and found that these children were slower to show gesture and language milestones than the noncleft children. These findings provide evidence of delays across verbal and nonverbal parameters of language in children with clefts (Scherer & D'Antonio; Synder & Scherer).

Further research shows that later speech and language performance for children with cleft lip and/or palate is still behind noncleft children at preschool ages. Chapman (1993) evaluated phonological processes in children with cleft palate at three, four, and five years of age. The children with clefts produced significantly more phonological processes than the noncleft children at three and four years of age, which indicates that children with cleft palate usually produce common phonological processes and produce them for a longer period of time than

typically developing children (Chapman, 1993). Research has not specifically evaluated language development at the preschool age; however, based on findings that show speech and language development to be commensurate before the preschool age suggests that children with clefts, as a group, are behind their peers in speech and language when they enter preschool.

Furthermore, these children are still delayed when they reach the critical period for developing literacy skills. While there are few recent studies of early literacy performance in children with clefts, the few studies available demonstrate a higher incidence of reading disabilities in early elementary school than typically developing children (Eliason & Richman, 1990; Richman, 1980). Richman found that reading disabilities were related to language impairments as shown in other language impaired populations (Tomblin, 1989). In 1980, Richman evaluated cognition and language, reading, and math skills in children with cleft lip and palate (CLP) and cleft palate only (CPO) aged seven to nine years. Two groups were formed based on cognitive measures: the General Language Disability (GLD) group and the Verbal Expression Disability (VED) group. Significantly more children with cleft palate only were placed in the GLD group and more children with cleft lip and palate were in the VED group. Abstract reasoning was the primary cognitive construct that distinguished the two groups with the GLD group scoring lower. These results suggest that the VED group had intact verbal comprehension skills and deficits only in verbal expression. The GLD group showed deficits in verbal and symbolic mediation skills, which suggests a symbolic language disorder and basic cognitive disabilities as the cause of their achievement differences. The findings of this study showed a correlation between receptive and expressive language impairments and poor academic performance in math and reading (Richman, 1980). Therefore, children with clefts who exhibit language impairments are likely to have difficulty with reading when they reach school age.

A later study by Eliason and Richman (1990) evaluated language development in early school age children with clefts. Sixty-five children with clefts (29-CLP, 36-CPO) aged four to six years old participated in the study. The results showed that the children with clefts had normal vocabulary development and average verbal memory span. Deficits were found in verbal mediation tasks, such as picture association tasks and rapid automatic naming (Eliason & Richman). Theses results show that children with CLP were behind their peers in tasks that required language processing.

Among the research discussed, most of the data have been interpreted from a peripheral perspective attributing the early delays in children with CLP to hearing status, timing of palatal surgery, and/or velopharyngeal dysfunction (Broen et al., 1998; Chapman et al., 2002). In contrast, several of the studies discussed view the deficits of children with clefts to be a result of a broad, central problem originating in the brain (Eliason & Richman, 1990; Richman, 1980; Scherer & D'Antonio, 1997; Scherer et al., submitted). The central perspective is supported by the studies that demonstrate deficits in areas of speech, language, and play, even into school age where both language and reading are poorer than noncleft children. It is difficult to explain these persistent speech, language, and reading problems long after the cleft has been repaired and points to the possibility that these deficits stem from a central origin. Further, studies of brain morphology suggest differences in brain structure that are typically associated with language and reading deficits.

To further support the perspective that cleft lip and/or palate originates from a central problem in the brain, research studies have evaluated cognition and the structure of the brain in adult males with cleft lip and plate and cleft palate only (Nopoulos et al.). In 2002, Nopoulus and colleagues examined cognition, language skills, visual perceptual skills, and motor skills in

50 male adults with non-syndromic cleft lip and palate or cleft palate only. The results showed the subjects with clefts to have significantly lower Full Scale Intelligence Quotients, Performance Intelligence Quotients, and Verbal Intelligence Quotients. Additionally, the scores were stratified by cleft type. The adults with bilateral CLP showed the lowest scores, followed by the unilateral CLP group, and the isolated cleft palate (ICP) group showed the highest scores of all the subjects with clefts. The scores for the cleft subjects were within normal range even though the scores were significantly below the matched controls. However, the subjects with clefts also exhibited significant and specific impairments in verbal fluency (Nopoulos et al.). Another study by Nopoulos and colleagues (et al.) provides even more compelling evidence of the relationship between development of the face and the brain. This study measured brain structure in adult males with non-syndromic cleft lip and/or palate using quantitative analysis of magnetic resonance images. Results showed significant anatomical differences between the brains of the subjects with clefts and the noncleft subjects. The subjects with clefts showed abnormally enlarged frontal and parietal lobes and significantly smaller temporal and occipital lobes in the cerebrum and in the cerebellum. In laterality measures no differences were found between the left and right hemispheres in the frontal lobe; however, the left hemisphere showed a decreased volume in the left temporal and occipital lobes. The left temporal lobe was the most affected region of the brain because it was the only area that had a decrease in volume of both gray and white matter. Furthermore, these abnormalities are correlated with cognitive dysfunction. The findings of these studies suggest that atypical craniofacial development may be linked to brain growth. This could suggest that the language and cognition differences observed in children with clefts may be a result of differences in brain morphology rather than a direct result of the cleft (Nopoulos, Berg, Canady, et al.).

In summary, young children with cleft lip and/or palate exhibit speech and language delays as evidenced by limited sound repertoires, vocalization rates, and small vocabulary. These early deficits persist through school age and are related to an increased incidence of reading disabilities. While the effects of palatal surgery and frequent otitis media may contribute to early delays, they do not fully explain the persistence of speech and language delays well into school age. Moreover, the fact that adults with cleft lip and/or palate perform below their peers in cognition and language strongly suggests the deficits to be a result of a central rather than a peripheral problem. Furthermore, the powerful evidence from the brain imaging studies show cleft lip and/or palate is associated with differences in brain morphology.

Speech and Language Treatment for Children with CLP

Children with cleft lip and/or palate show articulation, resonance, and language disorders. Historically, direct articulation therapy has been the most frequently used treatment for children over three years of age due to the structural anomalies of children with CLP. This treatment approach focuses on the place of articulation, specifically facilitating the anterior sound placement for children with CLP as well as eliminating compensatory errors and increasing the sound repertoire. According to Kuehn and Moller (2000), "Articulation treatment serves two purposes: maximizing articulation placement and clarifying velopharyngeal closure potential"(p. 31). Improving anterior sound placement can reveal adequate or inadequate velopharyngeal closure. Clinical reports have shown improvement of speech with this treatment however, the specific nature of the treatment and outcomes have not been documented (Kuehn & Moller). These methods may show positive results for children over three; however, they are not appropriate for children under three years of age. Research and clinical reports show that

efficacious treatments for children under three years involve facilitating language in naturalistic environments.

In addition to articulation errors, children with cleft lip and/or palate exhibit resonance disorders. Several resonance treatments are currently used to improve the speech of children with cleft lip and/or palate over the age of three. Biofeedback therapy is a treatment in which the client and the clinician can monitor visually the client's oral resonance while talking. The goal of the therapy is to teach oral/nasal contrast with visual biofeedback. There are several types of biofeedback therapy, including nasometry, nasal airflow, continuous positive airway pressure, and endoscopy. A drawback to this type of treatment is that use of most of the equipment requires visits to a hospital or clinic setting. Another limitation may be the invasiveness of some of the procedures, such as nasoendoscopy (Kuehn & Moller, 2000).

For children with cleft lip and/or palate under the age of three there has been an increased emphasis on early intervention. According to Golding-Kushner (2001) the goal of early intervention programs for children with CLP is to diagnose and treat speech and language problems as soon as possible in order to minimize the effects of delays and potentially prevent more significant disorders. Golding-Kushner suggests that parent training is a critical component of early intervention. The parents should be taught how to listen for sound errors, such as compensatory articulation errors, and use naturalistic intervention methods to facilitate sounds and words. Golding-Kushner suggests that the speech-language pathologist should demonstrate how to use toys and daily routines at home to elicit and stimulate desired responses, enabling the parent to make speech and language stimulation a daily, ongoing activity. While many of these methods are routinely used with children having speech and language disorders, their effectiveness has not been validated in children with cleft palate.

Role of Language Development in Early Intervention

Historically, intervention for children with cleft lip and/or palate has focused on treating the speech disorders to expand their consonant inventories and increase their intelligibility. Language delays usually accompany these speech disorders; however, much of the treatment has not emphasized language facilitation. In 1999, Scherer evaluated the speech and language of toddlers with cleft lip and/or palate following early vocabulary intervention. The children with clefts exhibited expressive language delays and small phonetic repertoires prior to the intervention. Milieu teaching was used as the intervention approach because it has been shown to be effective in facilitating language in noncleft children with speech and language delays. The treatment was a multiple baseline design across two conditions, vocabulary comprehended and vocabulary not comprehended. Results showed that milieu intervention was effective in increasing the vocabularies and phonetic inventories of children with cleft lip and/or palate. The target words that were comprehended showed a faster rate of acquisition to spontaneous production than the target words not comprehended. Furthermore, the children tended to respond better to target words containing consonants already in their consonant inventory than the target words not in the child's pretreatment inventory. In addition to the improvement in vocabulary, the study showed secondary improvement in consonant inventory and syllable structure without direct training. The findings indicate that language intervention can provide widespread changes in communicative behavior especially during the early stages of language development. Moreover, this study showed that language intervention is an efficient approach to early treatment for concurrent speech and language impairments (Scherer, 1999).

Parent Training Programs

Considerable research is available on language based early intervention programs for children with delays and developmental disabilities (Alpert & Kaiser, 1992; Crain-Thoreson & Dale, 1999; Dale, Crain-Thoreson, Notari-Syverson, & Cole, 1996; Girolametto, Pearce, & Weitzman, 1996; Girolametto, Pearce, & Weitzman, 1997; Girolametto, Weitzman, & Clements-Baartman, 1998). These intervention programs have a parent-directed focus rather than a clinician-directed focus and emphasize training the parents in facilitation of language through direct interaction with their child. Efficacy data are available on three parent training programs that have been used to facilitate language. These programs are milieu training, dialogic reading, and focused stimulation.

Milieu Training

Milieu training is a naturalistic intervention procedure that applies behavioral teaching strategies in the context of everyday conversation (Alpert & Kaiser, 1992). This training facilitates language by focusing on the child's interest and arrangement of the environment. Six teaching strategies are included in this approach and any or all of the following strategies can be used: modeling, mand-model, time delay, incidental teaching, environmental arrangement, and responsive interaction strategies (Scherer, 1999). Alpert and Kaiser evaluated the effectiveness of milieu training as a parent training program for preschool children with expressive language delays. The mothers of the children attended four training sessions in which they were taught four of the six teaching strategies including: modeling, mand-model, time delay, and incidental teaching. The results showed that all the mothers implemented the four techniques effectively in that the mothers' use of the procedures appeared to be associated with increases in the children's

mean length of utterances, requesting, and total number of words and novel words produced. Furthermore, the children demonstrated generalization of their language gains across household settings and maintained the skills three months after treatment ended (Alpert & Kaiser).

Dialogic Reading

The Dialogic Reading Training Program was developed by Whitehurst and colleagues (1988) to provide a context for interactive dialogue between parent and child through shared book reading (Crain-Thoreson & Dale, 1999). The goal of the program is to promote active story telling while the mother is an active listener through prompting, expanding, and rewarding the child's responses. Originally this program was developed for two-year-old children; however, the program has been implemented with preschool children who exhibit language delays (Dale et al., 1996).

In 1996, Crain-Thoreson and colleagues compared the effectiveness of the shared book reading program to a conversational program in children with mild to moderate language delays. Results showed that the parents in the Dialogic Reading Training Program group increased their who/what questions, imitations, open-ended questions, and expansions, while the parents in the conversation language training program group only increased their use of expansions. The children in the reading program increased their mean length of utterance and number of different words produced; however, there was not a change in overall engagement or specific response to adult utterances except for an increase in responses to adult questions. The findings of this study suggest that children's language is more likely to change when the parents' language changes during training (Crain-Thoreson et al., 1996).

A similar study (Crain-Thoreson & Dale, 1999) compared a parent-implemented Dialogic

Reading program with two levels of staff-implemented intervention. One of the staff groups served as the control group and did not receive repeated exposure to dialogic reading and the other staff group did receive repeated exposure. The subjects were preschool children who exhibited mild to moderate language delays. The parents and staff receiving the training attended two, one and a half hour instructional sessions four weeks apart. All the strategies from the Dialogic Reading videotape were taught as well as one strategy to address the needs of children with language delays, which was to slow down and give their child time to respond. The Dialogic Reading between the parent and child or staff and child occurred at least four times per week. Positive results were shown in the parent and staff groups. The children responded with more frequent use of language and more elaborate expressive language during shared reading than before training. These results indicate that parents and staff respond similarly to the Dialogic Reading program and both provide facilitation for language use in children with language impairment (Crain-Thoreson & Dale).

Focused Stimulation

Focused stimulation is one version of the *interactive model of language intervention*, which suggests that simplified language input in a child centered environment will provide more opportunities for children with delays to learn language. Focused stimulation teaches parents to model pre-selected language targets while also following their child's lead. Focused stimulation differs from Milieu intervention in that focused stimulation emphasizes changing parental language use through increasing frequency of target word use. The parent follows the child's interest but does not respond to the child's language selectively with a variety of facilitation techniques as in Milieu training. Parental language stimulation does not depend on the child's

response as with Milieu training. Girolametto et al. (1996) evaluated the effects of focused stimulation parent training on toddlers with expressive vocabulary delays and their mothers. The parent training approach was the Hanen Program for Parents adapted to include three modifications consistent with the focused stimulation approach. The modifications included training the parents to incorporate target words into everyday activities, select new target words once their child demonstrated appropriate use of a word, and to model two-word combinations. The results showed that the mothers effectively implemented the intervention by reducing their mean length of utterance and rate of words per minute and increasing their labeling of target words. The children also used their target words more often. These results suggest that mothers' interaction styles can be optimized to facilitate language growth and accelerate vocabulary with language impaired children (Girolametto et al., 1996).

Girolametto et al. (1997) also examined the effects of focused stimulation on the vocabulary, language, and emerging phonological skills of children with language delays. Twenty-five toddlers with expressive language delays and their mothers were the subjects. This study was designed like the previous study with the mothers participating in the Hanen Program with focused stimulation adaptations. Results showed that the group who received vocabulary intervention made gains in two areas of phonological ability: syllable structure and consonant inventory. These findings suggest that phonology does not need to be targeted directly and that language treatment may indirectly facilitate gains in phonology (Girolametto et al., 1997). However, Fey and colleagues (1994) found that language intervention does not show indirect effects on the phonological development of preschool age children. Thus, this finding suggests that phonological impairments in preschool children should be addressed through direct intervention and that indirect phonological intervention may only be effective for children

younger than preschool age.

Furthermore, Girolametto (et al., 1998) investigated the effects of the focused stimulation parent training program on the vocabulary development in preschool children with Down Syndrome. Twelve children and their mothers participated in the study of parent training using the Hanen Program with focused stimulation modifications. Results demonstrated that the mothers who received the training used significantly more target labels and used more focused stimulation of target words. Additionally, the parents reported significant increases in the children's vocabulary by indicating an increased production of target words. The results of this study indicates that focused stimulation parent training is an effective intervention for children with concomitant cognitive and comprehension deficits in addition to expressive language and phonological impairments (Girolametto et al., 1998).

While there have been numerous studies of parent implemented treatments with noncleft children, there have been no studies to date for children with cleft lip and palate. These children have some similarities to those in the other studies but they also have some unique differences that set them apart. In particular, they may have structural abnormalities of the velopharynx and compensatory articulation errors not observed in these other populations. To determine how young children with cleft lip and/or palate might respond to parent implemented intervention, a recent study evaluated the effects of a parent implemented focused stimulation approach in these children and their mothers (Brothers, 2002). The four dyads that participated in the duration of the study received two interventions in a multiple baseline design. The interventions included the focused stimulation approach and a modified focused stimulation approach that included overaspiration of stop consonants in initial word position. Results showed positive changes in the mothers' language and the children's vocabulary in response to both treatments. The

children demonstrated language gains in treatment and in standardized language testing from both treatments. Furthermore, the children's phonetic inventories and percent consonants correct increased while their use of glottal stops decreased. Generalization was exhibited by the reduction of glottal stops in words other than the target words. These findings indicate that the focused stimulation treatment approach is efficient and effective in increasing expressive language and sound accuracy while decreasing glottal stop production in young child with cleft lip and/or palate (Brothers). This study was continued with seven more toddlers with cleft lip and/or palate and their mothers. The results continue to show similar findings to the original study. The children increased their vocabulary use and their sound inventories. Additionally, the use of glottal stops did not increase and for many children it decreased during treatment. The continuation of this study shows the efficacy of the focused stimulation parent training program for young children with cleft lip and/or palate (Scherer, 2003).

Purpose

To better determine the efficacy of the parent implemented focused stimulation approach for children with cleft lip and/or palate, the children's speech and language needs to be compared with typically developing children before and after intervention. Several reasons support the need for a comparison group of noncleft children. The children with clefts who participated in the focused stimulation parent training were in the critical period for language development, aged 18 to 36 months. While controls in multiple baseline designs do provide experimental manipulation of exposure to treatment conditions, they do not provide a comparison to typical development. This is particularly important because children are going through a phase of rapid vocabulary development. Comparing the children with cleft lip and/or palate to typically

developing children, who did not receive intervention, would assist in interpretation of the effects of parent training on the children with clefts.

The purpose of this study is to compare the speech and language development of children without clefts with a group of children with clefts who received a parent implemented focused stimulation intervention. Two specific questions will be addressed in this study. First, are the changes in speech and vocabulary growth different for children with clefts who received intervention from children without clefts who did not receive intervention? Second, are the mothers' use of language facilitation techniques different between the group who received intervention and the group who did not receive intervention?

CHAPTER 2

METHODS

Participants

This study included 10 typically developing children and their mothers. The children were matched with a group of children with clefts from a previous study on vocabulary production, age, gender, and socioeconomic status. The primary matching variable for all subjects was vocabulary production, while age, gender, and socioeconomic status were considered secondary matching variables. The vocabulary level was determined by the MacArthur Communication Development Inventory (CDI; Fenson et al., 1993). The children were matched as closely as possible to the children from the previous study. Children with clefts with a score of 50 or fewer words were matched to a typically developing child with 50 or fewer words. Children whose parents reported more than 50 words were likewise matched with a typically developing child with more than 50 words. The difference between CDI scores for the cleft and typical groups was not significantly different (t =0.73, df =16, p =0.477) indicating a good match between the groups. Tables 1 and 2 show the age, gender, socioeconomic status, and expressive vocabulary score from the CDI for the children with clefts and the typical children. The typical children ranged in ages from 14 to 30 (mean = 20.2) months of age, whereas the children with clefts ranged in age from 18 to 35 (mean = 27.4) months of age. The difference in age between the children with clefts and the noncleft children was significantly different (t=2.87, df=17, p=0.011). The children with clefts were evenly split between males and females while the typically developing group had six females and four males. Socioeconomic status was established from a case history form (Appendix A) completed by the parent that included

information on the parents' education background and type of employment. Socioeconomic status was determined by placing the family in one of five socioeconomic categories based on Eilers et al. (1993). Eight of the typical children's families were placed in category one, while the remaining two families were placed in category two or three. The difference between the two groups socioeconomic status was also found to be statistically significant *(t*=2.31, *p*=0.036, *df*=15).

The mother-child dyads were recruited from East Tennessee State University's Child Study Center and the community. Inclusionary criteria for the typically developing children included: (a) no identified speech, hearing, or language impairments reported by the child's parent or preschool teacher, (b) no significant medical, neurological impairments or preterm birth earlier than 36 weeks gestation as evidenced on the history form, and (c) passing a hearing screening consisting of pure tone acuity and tympanometry measures. Hearing screenings were interpreted as a pass if the acuity measures were passed. All 10 subjects passed the hearing screenings.

Table 1.
Age, Gender, Socioeconomic Status, and the Expressive Vocabulary Raw Score from the MacArthur Communicative Development Inventory (CDI; Fenson et al., 1993) for the Children with Cleft Palate

Child	Age (months)	Gender	Socioeconomic Status	CDI Score
1	30	F	2	59
2	24	M	4	11
3	28	M	2	1
4	35	F	2	222
5	35	M	1	324
6	18	M	1	9
7	21	F	2	52
8	27	M	2	10
9	31	F	4	36
10	25	F	2	123

Table 2.
Age, Gender, Socioeconomic Status, and the Expressive Vocabulary Raw Score from the MacArthur Communicative Development Inventory (CDI; Fenson et al., 1993) for the Typically Developing Children

Child	Age (months)	Gender	Socioeconomic Status	CDI Score
21	21	F	1	89
22	15	F	2	44
23	17	M	1	10
24	30	F	1	321
25	29	M	1	483
26	22	F	1	40
27	14	F	1	58
28	15	M	1	42
29	18	M	1	49
30	21	F	3	144

Procedures

The children participated in standardized and informal testing procedures at the initiation of the study and three months later to replicate the pre- and posttest timing in the intervention study that was previously conducted with children with cleft lip and palate and their mothers. These sessions took place in the child's home, preschool, or in the East Tennessee State University Speech and Hearing Clinic.

Test Protocol

The test measures for both testing sessions included the following procedures: (a) administration of the Sequenced Inventory of Communicative Development (SICD) (Hedrick, Prather, & Tobin, 2002) that provided a receptive and expressive language age score; and (b) collection of a 30-minute video and audio taped language sample involving mother-child

interaction during a book reading activity and free play with toys. The toys used to elicit the language sample included baby dolls, a bathtub, a chair, soap, blankets, food, eating utensils, a car, a ball, a book, *Farm Animals* (Greely, 1981), and a barn with animals.

A transcription of each language sample was generated from the video and audio tapes using the Systematic Analysis of Language Transcripts (SALT) (Miller & Chapman, 2001). From this analysis, measures from the mothers and the children were obtained. The maternal measures included (a) the total number of utterances; (b) number of total words; (c) number of different words; (d) the mean length of utterance; (e) the type token ratio; (f) the percent of responsive labels; (g) the percent of imitations; (h) the percent of extensions defined as adding semantic information to a child's utterance, such as, child: "doggy house". Adult: "He went inside"(Paul, 2001); (i) the percent of expansions defined as repeating a lexical item and generally maintaining the topic but either shift the central meaning or change the referential context, such as "Child: Get that! Adult: You want that over there." (Fey et al., 1999); (j) the percent of recasts defined as immediate responses to child utterances that repeat some of the child's words and modify or correct the syntactic or morphologic form of the child's utterances, while maintaining the central meaning of the child's production (Nelson et al., 1973) such as "Child: Phone ring. Adult: The phone is ringing"(Farrar, 1990); and (i) the percent of commands or requests (Girolametto et al., 1996).

The children's measures included (a) total number of utterances, (b) total number of words, (c) the number of different words, (d) the mean length of utterance, (e) the type token ratio, (f) the percent of glottal stops, (g) the percent of responses, (h) the percent of imitations, (i) the phonetic inventory, and (j) the percent of consonants in the inventory (PCI) (Shriberg, Austin, Lewis, McSweeny, & Wilson, 1997).

Reliability

Language Sample, Phonetic Transcription and Utterance Coding

Twenty percent of both the Systematic Analysis of Language Transcripts (SALT) (Miller & Chapman, 2001) and phonetic transcripts were randomly selected and re-transcribed by a second transcriber who was familiar with SALT transcription and phonetic transcription of speech disorders in children. The percentage agreement between the two transcribers for SALT transcription ranged from 75% to 100%. The percentage agreement between the two transcribers for phonetic transcription ranged from 85% to 100%. Additionally, 20% of the mothers' utterances were recoded for expansions, extensions, and recasts. Percentage agreement between the two transcribers for coding the mothers' utterances ranged from 80% to 100%. The calculations for the percent of consonants in the inventory (PCI) were calculated by a second transcriber and the percentage agreement was 100%.

Data Analysis

Measurements of both groups were entered into Excel to construct the initial database. For continuous data, the mean and standard deviation were used to summarize values for each study group. The difference between pre- and posttest scores were presented as a change score. Means were compared with the t-test (group one versus group two comparisons) or the paired t-test (pre- versus posttest comparisons within a group). A probability level of 0.05 or less was used to indicate statistical significance.

CHAPTER 3

RESULTS

The purpose of this study was to compare the speech and language development of a group of children without clefts matched for vocabulary size with a group of children with clefts who received a parent implemented intervention. The research questions include: (1) Are the changes in speech and vocabulary growth for children with clefts who received intervention different from children without clefts who were at a similar point in vocabulary acquisition and did not receive intervention? (2) Are the mothers' use of language facilitation techniques different between the group that received intervention and the group that did not receive intervention? The results of this study will be addressed by first presenting the children's performance, then the mothers' performance. The following data from the children and the mothers will be provided: (1) descriptive statistics including group means and standard deviations, (2) t-tests and p-levels at pretest, posttest, and for the amount of change that occurred from pretest to posttest and (3) paired t-tests and p-levels comparing pretest to posttest for both groups on each measure.

Children's Measures

Language Sample

Table 3 shows the group means and standard deviations for the total number of utterances, number of words, number of different words, mean length of utterance, type-token ratio, percentage of responses, and percentage of imitations obtained from the language sample at pretest, posttest, and for change between pretest and posttest. Between group t-test p-levels

are presented for pretest, posttest and change scores and within group pretest-posttest p-levels are presented for both cleft (Group 1) and noncleft groups (Group 2).

Cleft/ Noncleft Comparisons.

The children with clefts used significantly fewer total number of utterances at pretest (t=2.24, df=11, p=0.047) and posttest (t=2.99, df=17, p=0.008), than the matched noncleft children. Further, the children with clefts used significantly fewer number of words (t=2.23, df=9, p=0.053) at the pretest, than the noncleft children. However, at posttest there were no significant differences in the number of words used by the two groups (t=2.09, df=12, p=0.058) suggesting that the children with clefts had improved their vocabulary use following intervention. No other significant differences were observed between the groups on the SALT language sample measures. The results indicate that the children with clefts consistently performed below the younger, language matched noncleft children.

Pretest-Posttest Comparisons

The children with clefts showed significant increases in three measures from pretest to posttest: (a) number of words (t=3.14, p=0.012), (b) number of different words (t=5.79, p=0.000), and (c) mean length of utterance (t=3.43, p=0.007). The noncleft children showed significant increases in five measures from pretest to posttest: (a) number of words (t=4.35, p=0.002), (b) number of different words (t=5.82, p=0.000), (c) mean length of utterance (t=2.78, p=0.021), (d) percent of responses (t=2.37, p=0.042), and (e) total number of utterances

(t=3.46, p=0.007). While not different statistically, it is worth noting that the percent of imitation used by the children with cleft was higher than the noncleft group both at pretest and posttest. This may be related to their older chronological ages than the noncleft group. Additionally, there were no group differences in the change scores from pretest to posttest for any of the measures, suggesting that both groups were making progress in their language development at equivalent rates.

Table 3.
Study Group Comparisons for Children's SALT (Miller & Chapman, 2001) Measures

Measurement	Group	Pre Mean (SD)	Post Mean (SD)	Change Mean (SD)	P-Level Pre vs Post	*t*-Test Pre vs Post
T No. Utt	1	80.0 40.9	117.4 72.0	37.4 88.8	0.216	-1.33
	2	162.1 108.6	226.0 89.5	63.9 58.4	0.007*	-3.46
P-Level	1 vs 2	0.047*	0.008*	0.443		
t-test	1 vs 2	2.24	2.99	0.79		
No Word	1	44.9 66.7	162.0 163.8	117.1 117.8	0.012*	-3.14
	2	292 344	418 350	125.9 91.6	0.002*	-4.35
P-Level	1 vs 2	0.053*	0.058	0.854		
t-test	1 vs 2	2.23	2.09	0.19		
No Diff W	1	19.6 28.9	56.8 41.1	37.20 20.30	0.000*	-5.79
	2	64.8 65.6	97.4 74.7	32.60 17.70	0.000*	-5.82
P-Level	1 vs 2	0.069	0.156	0.596		
t-test	1 vs 2	1.99	1.51	0.54		
MLU	1	0.92 0.49	1.54 0.79	0.62 0.57	0.007*	-3.43
	2	1.41 0.98	1.65 0.93	0.24 0.27	0.021*	-2.78
P-Level	1 vs 2	0.182	0.777	0.081		
t-test	1 vs 2	1.41	0.29	1.91		
TTR	1	0.35 0.21	0.36 0.22	0.005 0.292	0.958	-0.05
	2	0.23 0.09	0.26 0.08	0.028 0.145	0.555	-0.61
P-Level	1 vs 2	0.131	0.235	0.827		
t-test	1 vs 2	1.62	1.26	0.22		
%Responses	1	28.70 17.64	33.07 12.01	4.37 17.75	0.456	-0.78
	2	40.04 10.63	30.62 11.13	9.42 12.58	0.042*	2.37
P-Level	1 vs 2	0.104	0.642	0.062		
t-test	1 vs 2	1.74	0.47	2.00		
%Imitations	1	10.97 10.16	8.65 7.10	2.33 4.47	0.134	1.65
	2	4.03 4.56	4.56 4.32	0.52 3.28	0.625	-0.51
P-Level	1 vs 2	0.072	0.142	0.123		
t-test	1 vs 2	1.97	1.56	1.63		

Note. Total No. Utt = total number of utterances; No. Word = number of words; No. Dif Word = number of different words; MLU = mean length utterance; TTR = type token ratio; %Responses = percentage of responses; %Imitation = percentage of imitations
* = statistical significance at $p<0.05$

Tests of Language and Speech

Table 4 presents the means and standard deviations for the percentage of glottal stops, phonetic inventory, percent of consonants in the inventory (PCI), SICD receptive age, and SICD expressive age for cleft and noncleft groups at pretest and posttest.

Cleft/Noncleft Comparisons

Two of the measures, phonetic inventory (pretest t=4.23, df=11, p=0.001; posttest t=6.42, df=14, p=0.000) and percent of consonants in the inventory (pretest t=2.81, df=15, p=0.013; posttest t=2.90, df=17, p=0.010), showed group differences at pretest and posttest, with the noncleft children always producing more consonants than the cleft children. Statistical differences between the groups for the percentage of glottal stops could not be calculated due to the zero values for the noncleft group; however, glottal stop use was a variable that differentiated the two groups. No significant differences were noted between the groups on the standardized language measures, the Sequenced Inventory of Communicative Development (SICD) receptive (pretest t=0.36, df=15, p=0.726; posttest t=0.88, df=17, p=0.393) and expressive language (pretest t=0.54, df=16, p=0.599; posttest t=0.26, df=15, p=0.797) scores. The similarity in the groups for language measures at pretest was expected given that the groups were matched for vocabulary level. Although, the children in the noncleft group were chronologically younger than the children in the cleft group, these results indicate that the matching criteria were successful in equating the groups for language at pretest. Furthermore, the children in the two

groups remained equivalent at posttest further suggesting that the children with clefts were maintaining progress commensurate with the language-matched noncleft children.

Pretest-Posttest Comparisons

The children with clefts showed significant increases in four measures from pretest to posttest: (a) phonetic inventory (t=3.24, p=0.010), (b) percent of consonants in the inventory (t=4.70, p=0.001), (c) SICD receptive language age (t=4.39, p=0.002), and (d) SICD expressive age (t=2.38, p=0.041). Additionally, the children with clefts displayed a significant decrease in the percentage of glottal stops from pretest to posttest (t=2.64, p=0.027) as shown in Figure 1. The noncleft children also showed significant increases on the same four measures from pretest to posttest: (a) phonetic inventory (t=3.91, p=0.004), (b) percent of consonants in the inventory (t=3.94, p=0.003), (c) SICD receptive age (t=3.67, p=0.005), and (d) SICD expressive age (t=3.60, p=0.006). No significant group differences in the change scores from pretest to posttest were observed for any of the language and speech variables. Both groups demonstrated similar growth rates for language and speech performance, although the scores for the children with clefts were always lower than the language matched noncleft children.

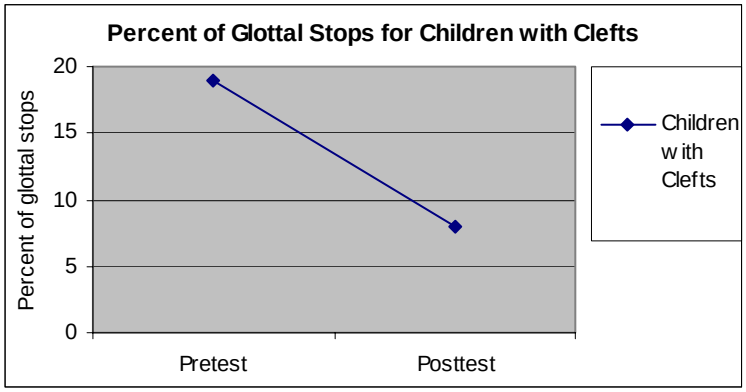

Figure 1. Percentage of Glottal Stops at Pretest and Posttest Produced by Children with Clefts

Table 4.
Study Group Comparison for Children's Standardized Language and Phonetic Measures

Measurement	Group	Pre Mean	Pre SD	Post Mean	Post SD	Change Mean	Change SD	P-Level Pre vs Post	*t*-Test Pre vs Post
% GS	1	18.89	20.61	8.04	16.61	10.85	12.99	0.027*	2.64
	2	0	0	0	0	0	0		
P-Level	1 vs 2								
t-test	1 vs 2								
PI	1	5.90	2.23	7.80	2.62	1.90	1.85	0.010*	-3.24
	2	14.95	6.38	18.25	4.43	3.30	2.67	0.004*	-3.91
P-Level	1 vs 2	0.001*		0.000*		0.192			
t-test	1 vs 2	4.23		6.42		1.36			
PCI	1	33.50	18.39	51.70	19.02	18.20	12.24	0.001*	-4.70
	2	62.30	26.68	76.10	18.56	13.80	11.06	0.003*	-3.94
P-Level	1 vs 2	0.013*		0.010*		0.411			
t-test	1 vs 2	2.81		2.90		0.84			
SICD-RA	1	23.0	7.50	29.20	6.55	6.20	4.47	0.002*	-4.39
	2	22.0	4.71	26.80	5.67	4.80	4.13	0.005*	-3.67
P-Level	1 vs 2	0.726		0.393		0.477			
t-test	1 vs 2	0.36		0.88		0.73			
SICD-EA	1	21.20	4.24	27.90	11.08	6.70	8.90	0.041*	-2.38
	2	20.0	5.66	26.80	7.32	6.80	5.98	0.006*	-3.60
P-Level	1 vs 2	0.599		0.797		0.977			
t-test	1 vs 2	0.54		0.26		0.03			

Note. % GS = percentage of glottal stops; PI = phonetic inventory; PCI; percent of consonants in the inventory; SICD-RA = receptive language age score on the Sequenced Inventory of Communicative Development; SICD-EA = expressive language score on the Sequenced Inventory of Communicative Development
* = statistical significance at $p<0.05$

Phonetic Inventories

The phonetic inventories for the children with cleft (upper panel) and the noncleft (lower panel) children at pretest and posttest are displayed in Table 5. The sounds are grouped by manner, or how the air stream is produced, in the following order: stops, fricatives, affricates,

glides, laterals, nasals, compensatory errors. Within each manner of production, the sounds are grouped by place of articulation from anterior to posterior place of production.

Cleft/Noncleft Comparisons

Children with clefts produced fewer consonants than the noncleft children at pretest and posttest. The stop consonant and fricative categories distinguished the cleft from the noncleft group. At pretest 50% or more of the children with cleft produced sounds in three of the manner categories: glides (/w/, /j/), laterals (/l/), and nasals (/m/, /n/). At pretest 50% or more of the noncleft children produced sounds from five of the manner categories: stops (/p/, /b/, /t/, /d/, /k/, /g/), fricatives (/f/, /s/, /z/, /ʃ/, /h/), glides (/w/, /j/), laterals (/l/), and nasals (/m/, /n/). The noncleft children produced stop consonants for all places of articulation (50% or more /p/, /b/, /t/, /d/, /k/, /g/). The children with clefts who produced stop consonants only produced one or two of the sounds either in bilabial or glottal position (/p/, /b/, /k/). The noncleft children also produced more fricatives in all places of articulation (/f/, /s/, /z/, /ʃ/, /h/). Three of the children with clefts produced one fricative (/f/, /s/). None of the children with clefts produced affricates; whereas four of the noncleft children produced affricates. Additionally, the children with clefts produced compensatory articulation errors. Both groups used glides, laterals, and nasal consonants. The differences between the children with clefts and the noncleft children at posttest were similar to the pretest differences. Again, the greatest differences were among the stops, fricatives, and affricates, with the noncleft children producing more phonemes across these three manners of production. The children with clefts also produced more compensatory articulation errors than the noncleft children. Production of the glides, laterals, and nasals continued to be similar between groups.

Pretest-Posttest Comparisons

Table 5 shows the increases in phonetic inventories from pretest to posttest. The children with clefts demonstrated the most growth in stop consonants from pretest to posttest (/p/, /b/, /k/ produced by 50% or more). The noncleft children also exhibited increases in their production of stops but additionally showed much growth within the fricative category (/p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /θ/, /h/ produced by 50% or more).

Table 5.
Phonetic Inventories of Children with Clefts and Noncleft Children Used At Least Twice in the Language Sample at Pretest and Posttest.

	PHONEMES																									
	STOPS						FRICATIVES									AFFRICATES		GLIDES		LATERALS		NASALS			COMPENSATORY ERRORS
SUBJECT	p	b	t	d	k	g	f	v	s	z	ʃ	ʒ	ð	θ	h	ʧ	ʤ	w	j	l	r	m	n	ŋ	ʔ
Cleft Group pre-test 1																		○	○			○	○		○
2	○				○		○											○	○	○		○	○		
3																						○	○		
4		○																○	○	○	○	○	○		○
5		○																○	○			○	○		○
6	○				○				○									○	○		○	○	○		○
7	○	○					○											○	○	○	○	○	○		
8																		○	○	○		○	○		○
9						○												○				○	○		○
10		○																○	○	○	○	○	○		○
Non-Cleft Group pre-test 1	○	○	○	○	○	○			○	○	○				○			○		○		○	○		
2		○	○	○					○						○		○	○	○	○		○	○		
3				○																					
4	○	○	○	○	○	○	○		○	○	○		○	○	○			○	○	○	○	○	○	○	
5	○	○	○	○	○	○	○		○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	
6		○		○	○	○									○			○	○	○		○	○		
7	○	○	○	○	○	○					○				○					○		○	○		
8	○	○	○	○		○	○								○		○		○	○		○	○		
9	○	○	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○		
10	○	○	○	○	○	○	○		○	○	○		○		○			○	○	○		○	○	○	
Cleft Group post-test 1	○	○																○	○			○	○		○
2	○		○		○		○											○	○	○		○	○		
3																						○	○		
4	○	○	○		○				○									○	○	○	○	○	○		○
5	○	○			○													○	○			○	○		
6	○	○			○				○									○	○		○	○	○		○
7	○	○					○											○	○	○	○	○	○		
8	○																	○	○	○		○	○		○
9	○	○			○		○		○									○	○	○		○	○		
10		○	○		○													○	○	○	○	○	○		○
Non-Cleft Group post-test 1	○	○	○	○	○	○	○		○	○	○				○			○		○		○	○		
2	○	○	○	○	○	○	○	○	○		○				○			○		○		○	○		
3				○		○			○		○				○							○	○		
4	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	
5	○	○	○	○	○	○	○	○	○		○		○	○	○	○	○	○	○	○	○	○	○	○	
6	○	○	○	○	○	○	○		○	○				○	○			○	○	○		○	○		
7	○	○	○	○	○	○			○	○	○			○	○	○	○	○	○	○	○	○	○	○	
8	○	○	○	○	○	○			○	○				○	○			○		○	○	○	○		
9	○	○	○	○	○	○	○	○	○		○		○		○	○		○		○	○	○	○	○	
10	○	○	○	○	○	○	○	○	○		○		○	○	○			○	○	○	○	○	○		

Mothers' Language Measures

Language Sample

Table 6 shows the mothers' total number of utterances, number of words, number of different words, mean length of utterance, type-token ratio, percentage of responsive labels, percentage of imitations, percentage of extensions, percentage of expansions, and percentage of commands/requests taken from the language sample for both groups at pretest and posttest.

Cleft/ Noncleft Comparisons

Significant differences between the cleft and noncleft groups were noted on several measures. The mothers in the noncleft group scored higher on pretest and posttest for the total number of utterances, number of words, number of different words, and mean length of utterance. The mothers of the noncleft children always talked more and used larger vocabularies than the mothers of the children with clefts. The mothers of the children with clefts scored higher on type-token ratio (t=3.90, df=9, p=0.004) at pretest. None of the other SALT language sample measures demonstrated significant differences between the groups at pretest.

The mothers of the children with clefts exhibited greater use of language facilitation techniques characterized by using more responsive labels (t=2.89, df=11, p=0.015), extensions (t=3.15, df=9, p=0.012), expansions (t=3.47, df=9, p=0.007), greater vocabulary diversity (type-token ratio, t=4.68, df=10, p=0.001) and fewer commands/requests (t=2.43, df=15, p=0.028) at the posttest than the mothers of the noncleft children. No significant difference was noted for the percentage of imitations (t=1.47, df=16, p=0.161) at posttest.

Change scores indicated that the number of different words showed significant differences from pretest to posttest (t=4.05, df=16, p=0.001), with the mothers of the children

with clefts changing more by increasing their number of different words used. Significant change scores were also observed for percentage of responsive labels (t=3.70, df=17, p=0.002) with the mothers of the children with clefts increasing their use and the mothers of noncleft children decreasing their production of responsive labels. None of the other measures showed significant change from pretest to posttest between groups.

Pretest-Posttest Comparisons

The mothers of the children with clefts exhibited significant increases from pretest to posttest on three measures: (a) number of words (t=2.40, p=0.040), (b) number of different words (t=6.14, p=0.000), and (c) percentage of expansions (t=2.64, p=0.027). The mothers of the noncleft children significantly decreased their percentage of responsive labels (t=4.31, p=0.002) from pretest to posttest and significantly increased their percentage of expansions (t=4.05, p=0.003) from pretest to posttest. To further examine the language of the mothers of the noncleft children, the percentage of recasts used by these mothers at pretest and posttest were analyzed. These mothers demonstrated a significant increase in their percentage of recasts from pretest to posttest (t=3.00, p=0.015). Figure 3 shows the decrease in percentage of responsive labels as well as the small increase in percentage of commands/requests from pre to posttest for the noncleft mothers. These findings were in contrast to the mothers of the cleft children who reduced their use of commands/requests and increased their use of responsive labels as seen in Figure 2. No other significant changes were noted on the measures from pretest to posttest.

Table 6.
Study Group Comparisons for Mothers' SALT (Miller & Chapman, 2001) Measures

Measurement	Group	Pre M SD	Post M SD	Change M SD	P-Level Pre vs Post	*t*-test Pre vs Post
Total No. Utt	1	124.6 106.9	141.8 105.3	17.2 96.3	0.586	-0.57
	2	371.8 121.7	331.3 120.6	40.5 83.5	0.159	1.53
P-Level	1 vs 2	0.000*	0.002*	0.170		
t-test	1 vs 2	4.83	3.74	1.43		
No. Word	1	108.5 51.2	155.3 73.9	46.8 61.5	0.040*	-2.40
	2	1483 530	1349 485	134 324	0.224	1.31
P-Level	1vs 2	0.000*	0.000*	0.117		
t-test	1 vs 2	8.17	7.69	1.73		
No. Dif Word	1	45.5 24.2	92.6 37.8	47.10 24.25	0.000*	-6.14
	2	244.3 50.4	252.1 49.9	7.80 18.77	0.221	-1.31
P-Level	1 vs 2	0.000*	0.000*	0.001*		
t-test	1 vs 2	11.24	8.06	4.05		
MLU	1	3.43 0.70	3.81 0.85	0.38 0.94	0.226	-1.30
	2	4.27 0.58	4.45 0.27	0.18 0.52	0.304	-1.09
P-Level	1 vs 2	0.009*	0.046*	0.552		
t-test	1 vs 2	2.94	2.27	0.61		
TTR	1	0.38 0.16	0.40 0.13	0.02 0.11	0.622	-0.51
	2	0.17 0.03	0.20 0.04	0.03 0.04	0.062	-2.13
P-Level	1 vs 2	0.004*	0.001*	0.854		
t-test	1 vs 2	3.90	4.68	-0.19		
% Resp Label	1	8.04 7.47	10.14 8.08	2.09 9.74	0.514	-0.68
	2	17.57 12.46	2.25 3.02	15.32 11.25	0.002*	4.31
P-Level	1 vs 2	0.057	0.015*	0.002*		
t-test	1 vs 2	2.07	2.89	3.70		
% Imitation	1	4.55 5.36	6.32 4.22	1.78 6.90	0.437	-0.81
	2	3.08 2.20	3.89 3.11	0.80 1.93	0.220	-1.32
P-Level	1 vs 2	0.442	0.161	0.677		
t-test	1 vs 2	0.80	1.47	0.43		
% Extensions	1	5.65 7.52	7.31 6.53	1.66 5.09	0.330	-1.03
	2	0.58 0.75	0.77 0.71	0.18 1.00	0.576	-0.58
P-Level	1 vs 2	0.063	0.012*	0.392		
t-test	1 vs 2	2.12	3.15	0.90		
% Expansions P-Level *t*-test	1	5.96 7.78	14.00 9.75	8.04 9.64	0.027*	-2.64
	2	1.48 1.59	3.05 2.11	1.57 1.23	0.003*	-4.05
	1 vs 2	0.108	0.007*	0.065		
	1 vs 2	1.79	3.47	2.10		

% Com/Req	1	33.76 17.00	23.31 14.50	10.45 16.39	0.074	2.02
	2	37.29 6.53	36.80 9.87	0.49 7.44	0.839	0.21
P-Level	1 vs 2	0.553	0.028*	0.106		
t-test	1 vs 2	0.61	2.43	-1.75		

Note. Total No. Utt = total number of utterances; No. Word= number of words; No. Dif Word= number of different words; MLU = mean length utterance; TTR = type token ratio; % Resp Label = percentage of responsive labels; % Imitation = percentage of imitations; % Extensions = percentage of extensions; % Expansions = percentage of expansions; % Com/Req = percentage of commands/requests
*=statistical significance $p<0.05$

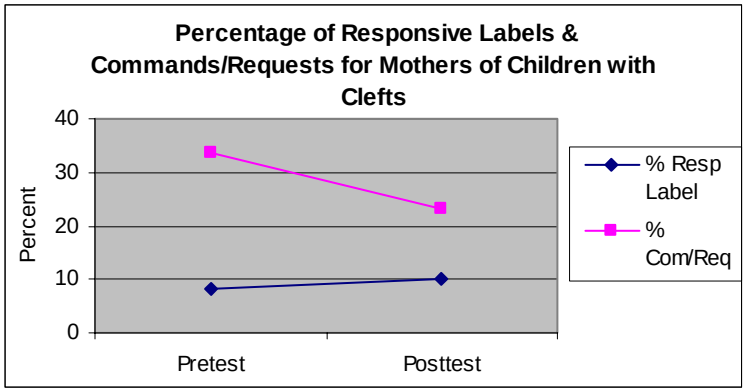

Figure 2. Change in Responsive Labels and Commands/Requests from Pretest to Posttest for Mothers of Children with Clefts

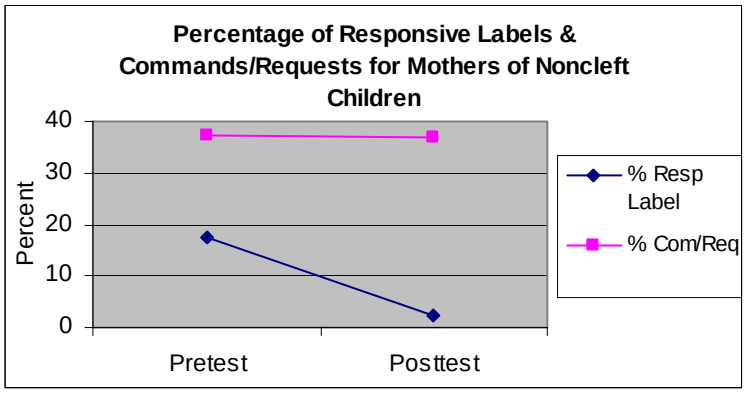

Figure 3. Change in Responsive Labels and Commands/Requests from Pretest to Posttest for Mothers of Noncleft Children

Dyadic Vocabulary Growth

Figure 4 shows the number of different words at pretest and posttest for the children with clefts and their mothers. The increases in the use of different words from pretest to posttest are very similar for the children and their mothers, with the mothers always producing more different words than their children. Figure 5 shows the mean number of different words at pretest and posttest for the noncleft children and their mothers. The mothers and noncleft children showed large differences in their vocabulary diversity while the cleft mother-child pairs were more equally balanced for vocabulary diversity.

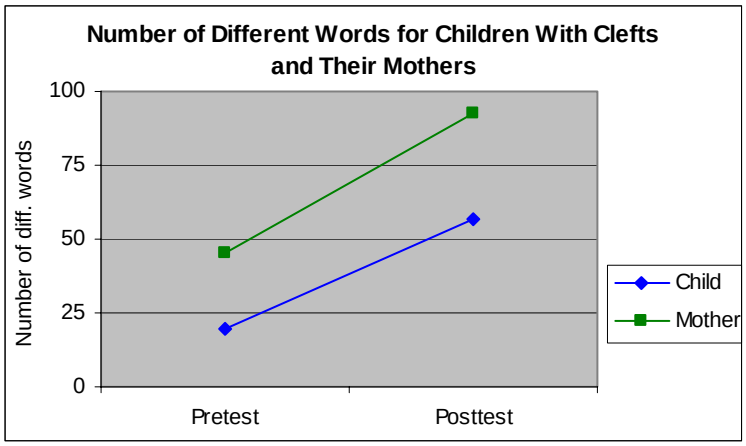

Figure 4. Children with Clefts and Their Mothers Number of Different Words at Pretest and Posttest

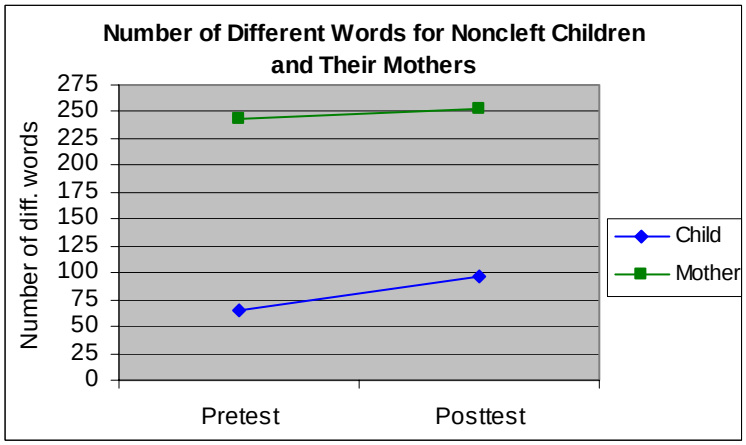

Figure 5. Noncleft Children and Their Mothers Number of Different Words at Pretest and Posttest

Summary

The first question proposed in this study was: Are the changes in speech and vocabulary growth different for children with clefts who received intervention from children without clefts who were at a similar point in vocabulary acquisition and did not receive intervention? The results showed that the changes in growth were not different between the children with clefts and the children without clefts. The scores that measured the amount of change from pretest to posttest were not significantly different on any measure between the two groups. The children with clefts made similar gains on vocabulary measures (number of words, number of different words) and speech measures (phonetic inventory, percent of consonants in the inventory) as the younger noncleft children who did not receive intervention. While the children with clefts did not exceed the growth rate of the younger, language matched children, these results indicate that speech and vocabulary were growing at a rate similar to the younger noncleft children. The percentage of glottal stops was the one measure that did show a reduction from pretest to posttest for the children with clefts.

The second question addressed in this study was: Are the mothers' use of language facilitation techniques different between the group that received intervention and the group that did not receive intervention? The results show that there are differences between the mothers of the children with clefts, who received intervention, and the mothers of the noncleft children at pretest and posttest. Five of the measures (total number of utterances, number of words, number of different words, mean length of utterance, type-token ratio) showed large differences at pretest and posttest, which was due to the mothers of the noncleft children talking more and using larger vocabularies than the mothers of the children with clefts. However, the mothers of the children with clefts showed changes from pretest to posttest that indicated that they were using many

positive language facilitation techniques including balanced turns, diverse vocabulary, responsive labels, expansions, and reduced commands/requests.

CHAPTER 4

DISCUSSION

The purpose of the present study was to compare the speech and language development of a group of children with cleft lip and palate who received a parent implemented intervention to a group of children without clefts matched for vocabulary size. The study also examined the differences between the mothers' use of language facilitation techniques for the group who received intervention and the group that did not receive intervention. The results indicated that there were significant increases in speech and vocabulary growth for both the children with clefts and the younger, noncleft children, although the children with clefts who received intervention did not make faster growth than the noncleft children. One measure, percentage of glottal stops, showed a significant reduction following intervention for the children with clefts. The mothers' use of language facilitation techniques demonstrated significant differences between the group who received intervention and the group that did not receive intervention. The mothers' of children with clefts showed a significant increase in vocabulary diversity and expansions and a reduction in the use of commands and requests when compared to the noncleft mothers. This chapter will discuss the results of this study in relation to previous research, clinical implications, and future research.

Comparison with Previous Research

Speech and language growth

The speech and language measures showed that the children with clefts and the noncleft children progressed in their speech and language growth at equivalent rates. The children with

clefts did not catch up or exceed the growth rate of the younger, typically developing children; however, the fact that these children demonstrated the same rate of growth as the noncleft children is very positive when compared to other studies. Data from a longitudinal study of children with clefts who did not receive this intensive vocabulary intervention indicated that children with clefts demonstrated delays in vocabulary from the onset of words to four and a half years of age (Scherer, 2003; Scherer, D'Antonio, & Kalbfleisch, 1999). Results from the present study suggest that early intervention can impact early language development, although the long-term effects are not known.

The primary result pertaining to the children's speech production was the reduction of glottal stop use in the children with clefts following intervention. The other speech measures, including PCI and consonant inventory, showed improvement from pretest to posttest at a rate commensurate with the younger, language matched noncleft children. Longitudinal data from the Scherer et al. (1999, 2003) studies indicate that children with clefts show persistent deficits in speech production through four and a half years of age despite being enrolled in speech therapy programs in the schools from three years of age. The results of the present study suggest that early intervention should be viewed as a viable means of enhancing language and speech development in children under three years of age with clefts.

The impact of early intervention on compensatory articulation use observed in the present study was also exciting. Hardin-Jones and Jones (2003) recently found that 25% of preschool children with cleft palate exhibit glottal stops in their speech. Clinical reports indicate the difficulty with which these errors are remediated, but little data are available to substantiate these reports. Van Demark and Hardin (1986) evaluated the effectiveness of intensive articulation therapy on the speech errors of school-aged children with clefts. While they had only one child

with significant glottal stop use in their study, this child did reduce his use of glottal stops during intervention but did not maintain those gains at follow-up nine months after the conclusion of intervention. A case study that evaluated the effects of a parent implemented intervention for a 3-year-old child using a high frequency of glottal stops (40%), reported no change in glottal stop use after intervention despite improvement in other speech errors (Broen, Doyle, & Bacon, 1993). These data suggest that glottal stop production is often difficult to eliminate once established. The data from the present study provide evidence to suggest that glottal stops can be reduced in early development; however, as yet we do not have follow-up data regarding the maintenance of this change after intervention. The reduction in glottal stop use suggests that that production of glottal stops can be prevented from occurring or being established when parents are trained to implement early intervention with a speech component such as over-aspiration of stop consonants.

Changes in Parent Language Addressed to Children

At pretest, the mothers of the two groups of children in the present study differed predominantly in how much they talked to their children. The two groups of mothers showed significant differences on several measures that were related to how much the mothers talked and how many vocabulary words they used with their children. The mothers of the noncleft children produced more utterances, words, different words, and a longer length of utterance than the mothers of the children with clefts. After the intervention, the groups continued to show differences in their language, with the mothers of the noncleft children still producing more utterances, words, different words, and longer utterances than the mothers of the children with clefts. However, when the balance between mother and child utterances were examined, the

cleft dyads had more equally balanced number of turns while the noncleft dyads favored mother utterances at a rate of 1 child utterance to 14 utterances from the mother. The degree of difference in the mothers' talkativeness is not likely explained by the differences in the ages because one would expect that mothers of younger children to be using less complex language when interacting with their child. It may be the mothers of the noncleft children did not perceive the need to simplify their language for their typically developing children. In fact the mothers were using techniques associated with more advanced child language use such as frequent use of recasts and expansions but few responsive labels, which may demonstrate that these mothers are adapting their language to their children's upcoming language development.

The mothers' difference in talkativeness could be explained by the significant difference in socioeconomic status observed between the cleft and noncleft groups. The mothers of the noncleft children scored significantly higher than the mothers of the children with clefts on socioeconomic status, particularly higher levels of education. It is likely that mothers with higher levels of education are more talkative and use larger vocabularies with their children than mothers with less education. Additionally, the difference in the mothers' talkativeness may be related to the talkativeness of their children. The typically developing children were more talkative than the children with clefts even though they were younger. Previous research has found differences between mothers of typically developing children and mothers of children with specific language impairment whose children differed in talkativeness. In one study, Nova and Recorla (as cited in Rescorla & Ratner, 1996) discovered that the mothers of the typically developing children were more talkative than the mothers of the children with specific language impairment. Additionally, the mothers of typical children requested fewer labels and imitated

less than mothers of language impaired children. This was similar to the mothers in the present study.

Chapman and Hardin (1991) examined mothers' language use presented to their young children with clefts. She found that the mothers of children with clefts were not significantly different from the mothers of noncleft children on talkativeness. It appears that the balance between utterances observed for the mothers and children with clefts in this study should be interpreted as a positive finding in that they indicate that the mothers were using language that was more equally balanced between communicative partners and responsive to their children's language use, giving them increased opportunities to respond.

An important finding of this study is that the mothers of the children with cleft palate learned to modify their language use to facilitate growth in their children's speech and language in a short period of time (three months), which suggests that mothers of children with cleft palate are capable of implementing intervention when they are trained by a clinician. This finding corresponds to previous studies that have evaluated the effectiveness of parent training with populations other than cleft palate, such as children with language delays and developmental delays. Kaiser (Hancock & Hester, 1998) and Hammeter (Ostrosky, Alpert, & Hancock, 1995) found parent training using naturalistic language teaching procedures to be effective in changing the parents' interaction skills and the relationship between the child and the parent. However, changes in the children's language use did not reach significance until a six-month follow-up. Girolametto and colleagues (1996) found that focused stimulation parent training was effective in changing mothers' language use and increasing the children's language development for children with language delays. Focused stimulation parent training has also been effective in changing mothers' language use and increasing children's vocabulary for children with

concomitant cognitive, language, and phonological impairments (Girolametto et al., 1998). The present study used a focused stimulation parent training model that included both language and a specific phonological component and extended the support for use of this model to parents of children with organic conditions.

Limitations to the Study

Some important limitations to this study should be noted. First, the intervention provided to the children and their mothers occurred for three months, which is a short period of time. Longer interventions or a combination of follow-up and booster sessions to maintain parental language changes may provide greater impact on child language measures (Kaiser et al., 1995). Another limitation is that both groups (n=10) are small and larger numbers of participants may provide stronger evidence for the efficacy of the intervention. Also, this study examined a nonsyndromic group of children with clefts and generalization of the results to other groups of children with clefts having syndromes may require additional studies. A final limitation is that the group that received intervention was not followed or reassessed after the posttest. Therefore, it is not possible to determine if the treatment effects were maintained. A subsequent follow-up study would be appropriate to address this limitation.

Clinical Implications

The results of this study provide several clinical implications regarding speech and language intervention for young children with cleft palate. First, this study demonstrated that mothers of children with cleft lip and/or palate can be taught to facilitate their children's speech and language development by using language facilitation techniques at home after a short

training. The fact that the children in this study made gains in vocabulary and speech production suggests that training parents is a cost effective approach to facilitating speech and language growth.

Another important finding from this study is that glottal stop production can be reduced or prevented in children with cleft lip and/or palate when parents are taught to implement the intervention. This finding is especially noteworthy given that compensatory articulation errors present a considerable clinical challenge for children with CLP. The data from the present study suggest that early intervention models may assist some children in reducing glottal stop use before it becomes habituated.

Future Research

Future research is needed to assess the children with clefts who received parent training intervention six months after the posttest to determine if the treatment effect was maintained. Also, other controls should be added in future studies such as the typically developing children receiving treatment or another cleft group receiving a more neutral or different intervention from the one under investigation. Another study should address the rate of glottal stopping in young children with clefts to provide comparison data for intervention studies. Additionally, components of the parent training models should be examined that may reduce training demands and increase efficiency of training.

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APPENDICES

Appendix A: Case History Form

Case History

Child's Name: _____ Birth date: _____

Parents/Guardians: _____

Home Address: _____
Street City Zip

Telephone: (home) _____
(work) _____

Teacher: _____

I. Birth and Early Development

Mother's health during pregnancy:

Any unusual problems at birth (Caesarian, breech birth, etc.):

Any problems immediately following birth or during the first two weeks of the infant's life (swallowing, feeding, sleeping, other):

At what ages did the following occur:
Sat alone unsupported _____ Crawled _____
Stood alone _____ Walked Alone _____
Fed self with spoon _____

Is your child's coordination good _____ fair _____ poor _____

How would you describe your child's overall development?

III. Speech/Language Development

When did your child say his/her first words? _____
First sentences? _____

How does your child make his/her needs known: sentences _____

phrases _____ one or two words _____ sounds _____ gestures _____

How well is your child understood in his/her first language by:
(estimate in %) parents _____ other adults _____ brother and sisters _____
friends _____

How well is your child understood in English by: (estimate in %)
Parents _____ other adults _____ brothers and sisters _____ friends _____

How well does your child understand what is said to him/her in his/her first language?

How well does your child understand what is said to him/her in English?

What is the primary language spoken in the home? _____

Please add any additional information you feel will be helpful in understanding your child's speech?

III. General Health

Has your child had any of the following:

	Age	Duration	Hospitalized?
Tonsillitis			
Sinusitis			
Frequent colds			
Earaches			
Draining ears			
High fever			
Allergies			

Does your child have tubes in his/her ears? _____ Date: _____
Does you child have any vision problems? _____
Does you child have any physical handicaps? _____

How would you describe your child's general health?

IV. Family

Brothers and Sisters:

Name	Age	Grade	Speech/Hearing Problem?

Are there any hearing, speech, language, or developmental problems in the family (grandparents, parents, relatives)?

Education

Mother
What is the highest grade that you completed? _____
How many years of college or technical school did you complete? 1 2 3 4
How many years of graduate or professional school did you complete? _____

Father
What is the highest grade that you completed? _____
How many years of college or technical school did you complete? 1 2 3 4
How many years of graduate or professional school did you complete? _____

Employment

Mother
Are you presently employed? Yes No
If yes, what is your job title? _____
What are your job duties? _____
_____
_____
What type of industry do you work in, that is, what does your company produce or what services does your company provide? _____
_____
_____

Father
Are you presently employed? Yes No
If yes, what is your job title? _____
What are your job duties? _____
_____
_____

What type of industry do you work in, that is, what does your company produce or what services does your company provide? _____

_____

Appendix B: Socioeconomic Status Scale

Level 1: both parents completed college, professional or high-level management employment, stable two-parent homes

Level 2: at least one parent completed college, white collar, middle management, teachers, nurses, mid-sclae proprietors, two-parent homes

Level 3: some college but no completed degrees, transitional white collar non-management employment

Level 4: no college, one parent with high school diploma, blue collar employment

Level 5: no completion of high school, unskilled workers, single parent, and highly unstable families

VITA

HOLLY J. MCGAHEY

Personal Data:	Date of Birth: Decemeber 24, 1979 Place of Birth: Atlanta, Georgia Marital Status: Single
Education:	The University of Georgia, Athens, Georgia; Communication Sciences and Disorders, B.S.Ed., 2002 East Tennessee State University, Johnson City, Tennessee; Speech-language Pathology, M.S., 2004
Professional Experience:	Tuition Scholar, East Tennessee State University, Department of Communicative Disorders, 2002 - 2004
Honors:	Tuition Scholarship, East Tennessee State University, 2002 – 2004 Hope Scholarship, The University of Georgia, 1998 – 2002 Golden Key National Honor Society Phi Kappa Phi Honor Society