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Speech Comprehension and Emotional/Behavioral Problems in Children with Specific Language Impairment (SLI)

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ABSTRACT

This research aims to investigate differences in speech comprehension between children with specific language impairment (SLI) and their developmentally normal peers, and the relationship between speech comprehension and emotional/behavioral problems on Achenbach's Child Behavior Checklist (CBCL) and Caregiver Teacher's Report Form (C-TRF) according to the DSM IV. The clinical sample comprised 97 preschool children with SLI, while the peer sample comprised 60 developmentally normal preschool children. Children with SLI had significant delays in speech comprehension and more emotional/behavioral problems than peers. In children with SLI, speech comprehension significantly correlated with scores on Attention Deficit/Hyperactivity Problems (CBCL and C-TRF), and Pervasive Developmental Problems scales (CBCL)($p<0.05$). In the peer sample, speech comprehension significantly correlated with scores on Affective Problems and Attention Deficit/Hyperactivity Problems (C-TRF) scales. Regression analysis showed that 12.8% of variance in speech comprehension is saturated with 5 CBCL variables, of which Attention Deficit/Hyperactivity ($\beta=-0.281$) and Pervasive Developmental Problems ($\beta=-0.280$) are statistically significant ($p<0.05$). In the reduced regression model Attention Deficit/Hyperactivity explains 7.3% of the variance in speech comprehension, ($\beta=-0.270$, $p<0.01$). It is possible that, to a certain degree, the same neurodevelopmental process lies in the background of problems with speech comprehension, problems with attention and hyperactivity, and pervasive developmental problems. This study confirms the importance of triage for behavioral problems and attention training in the rehabilitation of children with SLI and children with normal language development that exhibit ADHD symptoms.

Key words: *specific language impairment, SLI, speech comprehension, emotional and behavioral problems, preschool children, CBCL, C-TRF*

Introduction

SLI is diagnosed when a delay in language development is present in an otherwise developmentally normal child without an apparent cause[1]. Tomblin et al. estimate the prevalence of SLI to be around 7%[2]. The ICD 10 does not acknowledge SLI as a specific disorder, and the characteristic impairments can be found under the F80 heading, »Specific developmental disorders of speech and language«. As such, SLI is not diagnosed as a specific disorder in clinical practice. SLI is, however, a common category of disorder, and more fully described in scientific literature. Problems with speech comprehension, though not universally present, are important for establishing diagnosis[3]. Language development is usually normal, but children are characteristically slow to master language. Nonverbal skills are intact, while verbal development is delayed. Problems with pronunciation and fluency, understanding cause-effect, learning grammatical rules, and speech comprehension may be present in various combinations and with various severity. SLI is often associated with developmental deficits of motor skills[4].

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Although SLI is diagnosed when a language delay is present in developmentally normal children, children with SLI represent a heterogeneous category with diverse profiles of developmental problems. Children with SLI often have general developmental delay, i.e., IQ lower than average. Much research has sought to discover impairments in cognitive mechanisms that lie in the background of SLI, but a consensus has yet to be reached. Genetic theories have moved to the foreground of research endeavoring to discover the etiology of SLI; however, a complete picture has yet to be developed. Despite the discovery of a gene on chromosome 16 that links SLI with poor phonological working memory[5], debate exists over whether the overarching problem results from deficits in the perception of auditory input. Impairments in working memory have been implicated in the cognitive profile of SLI[3] and speech comprehension[6].

Research confirms the connection between language development and various behavioral problems. Children with SLI have a higher risk of developing psychiatric disorders than children with normal language development; the risk of developing psychiatric disorders is higher in girls[7]. The prevalence of various psychiatric disorders is higher in children with language impairments compared to children with speech impairments[8]. Longitudinal studies reveal that 5 year-old children with SLI have more emotional and behavioral problems than developmentally normal children, and 7 year-old children have more problems with social competence[9]. Children with multiple and persistent language impairments and a lower nonverbal IQ are found to have a higher risk of psychiatric disorders in adolescence[10]. Research shows that a significant percentage of children have ADHD symptoms[11] and ADHD symptoms are frequently seen in children with SLI[10]. Beitchman et al. propose that neurodevelopmental immaturity may lie in the background of both language impairments and psychiatric disorders[12]. Eisenmayer et al. find SLI to be a predictor of clinical symptoms in pervasive developmental disorders[13]. Barkley proposes four executive cognitive functions necessary for self-regulation: inner speech; working memory; synthesis (planning new patterns); and motivational assessment, all of which can be neutrally inhibited[14]. Disturbances in these functions are implicated in the neurobiology of ADHD, and may help explain problems with self-regulation in children with SLI. Because problems with speech comprehension are salient in children with SLI, and emotional/behavioral problems are seen more frequently, we intend to evaluate the following: 1.Differences in speech comprehension between children with SLI and children with normal language development. 2. Differences in emotional/behavioral problems (on CBCL and C-TRF scales according to DSM-IV criteria) between children with SLI and children with normal language development. 3. Potential relationships between speech comprehension and specific emotional/behavioral problems in children with SLI and children with normal language development.

Subjects and Methods

Subjects and procedure

Our research was conducted on 97 children attending a specialized kindergarten in Polyclinic SUVAG in Zagreb, Croatia. Polyclinic SUVAG rehabilitates preschool and school-age children with impairments in spoken-language development, and the specialized kindergarten rehabilitates children with SLI that require a more complex and intensive rehabilitative program. Children required a mandatory diagnostic assessment by a speech therapist, neurologist, and psychiatrist; hearing, speech and language status, and intellectual abilities were evaluated. The clinical sample comprised 74 boys (76.3%) and 23 (23.7%) girls ranging from 3 years and 9 months of age to 7 years and 3 months of age, with an average age of 5 years and 4 months. There were 109 children initially in the sample; children with hearing damage, intellectual disability, or multiple diagnoses that could impact speech development were excluded. The children's intelligence ranged from average to above average. The peer sample comprised 26 boys (43.3%) and 34 girls (56.7%) ranging from 3 years and 10 months to 7 years and 3 months of age, with an average age of 5 years and 8 months. The presence of intellectual disability was excluded by a child psychologist. Mothers completed CBCL scales prior to the onset of rehabilitation – according to both parents, mothers generally spent more time with their children, and were therefore chosen to complete the scales. Teachers and speech therapists completed C-TRF scales 2–3 months following the onset of rehabilitation so that children had adequate time to adjust to the rehabilitative process and speech therapists had adequate time to become familiar with the children.

Reynell's developmental scale of speech comprehension

Speech comprehension was evaluated by psychologists and speech therapists using Reynell's developmental scale of speech comprehension[15]. The scale allows the individual evaluation of speech comprehension and verbal expression. The scales are applied on children from 7 months of age to 7 years of age. The reliability coefficient is 0.87 to 0.97 for children 2 to 5.5 years of age, and falls for children greater than 5 years of age. Tasks on speech comprehension scales follow the development of speech comprehension itself and are arranged by degree of difficulty: from the earliest level of comprehension based on the selective recognition of verbal statements on an affective level, through the gradual increase in ability to interpret and understand various forms of speech, to the highest level when speech becomes the springboard of thought and associates with other intellectual functions[15].

Achenbach's CBCL and C-TRF questionnaires

Emotional/behavioral difficulties in preschool children were assessed using Achenbach's CBCL and C-TRF.

The scales were developed and standardized by Thomas M. Achenbach and Craig Eldebrock on a population of normal and clinical children in the United States, and revised norms have been published in the manual[16]. In one study, the CBCL showed a high reliability in a sample of Croatian children[17]. Items on the checklist are graded 0, 1, or 2, depending on the frequency of the described behavior. We used DSM-oriented versions of the CBCL and C-TRF that score problems across five subscales: Affective Problems, Anxiety Problems, Pervasive Developmental Problems, Attention Deficit/ Hyperactivity Problems, and Oppositional Defiant Problems.

Statistical analysis

Results on Achenbach's CBCL (mothers' assessments) and C-TRF (teachers' assessments) scales are expressed as standardized T values, and results on Reynell's scale of speech comprehension are expressed standard deviation of the mean (SD). The Kolmogorov-Smirnov test revealed that data from both groups on the Reynell's scale was normally distributed, as were total results from CBCL and C-TRF scales. The significance of differences in results on individual scales was tested using Students t-test. The relationship between speech comprehension (Reynell's test) and emotional/behavioral problems (CBCL and C-TRF) in both samples of children was calculated with Pearson's correlation using standardized values. Regression analysis and a reduced regression model were used to determine how much variance of speech comprehension could be explained by correlations obtained on CBCL scales.

Results

Speech comprehension

Scores on Reynell's scales in both samples of children, presented as standard deviation from the mean in a normative sample, are displayed in Table 1. Results from both samples are normally distributed, but the distribution in the clinical sample is negatively asymmetric, (figure 1) i.e., displaced toward lower values (M=–2.01). Although children with SLI can have normal speech comprehension (max SD=0.9), our results indicated greater problems with speech comprehension in the clinical sample (lowest results are 3 standard deviations below the

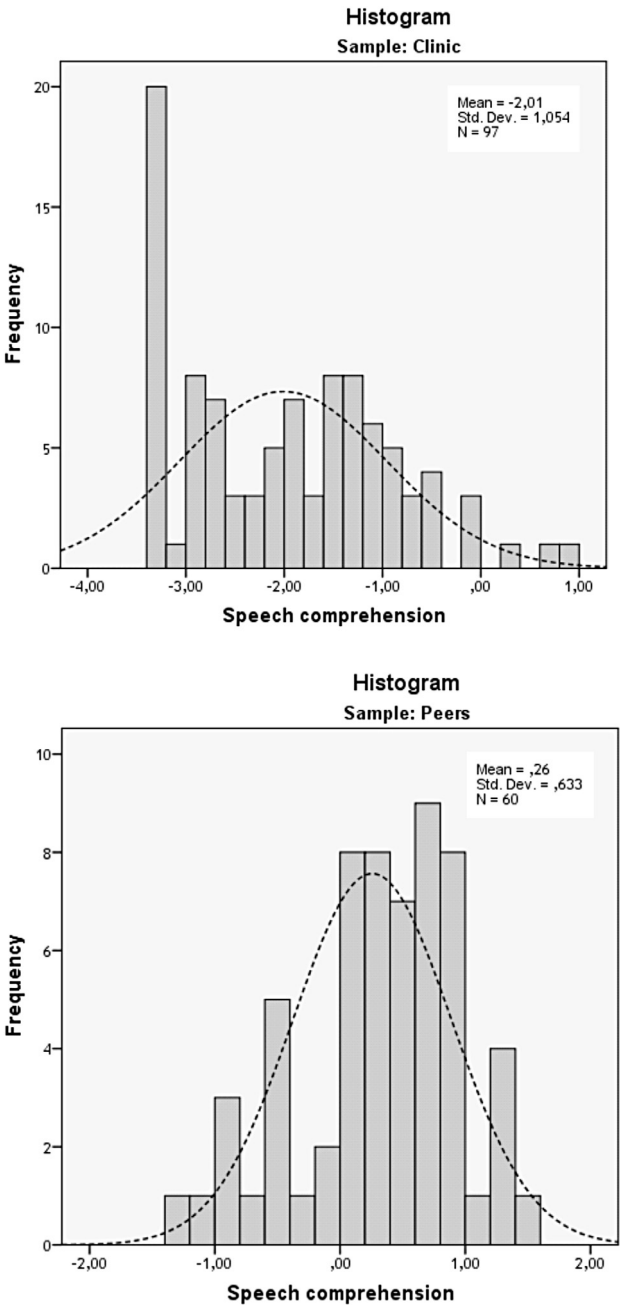

Fig. 1. Distribution of results on Reynell's test of speech comprehension in children with specific language impairments and peers.

TABLE 1
COMPARISON OF THE MEAN SCORES ON REYNELL'S TEST OF SPEECH COMPREHENSION IN CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENTS AND PEERS

	SPEECH COMPREHENSION – Reynell test								
	Clinical Sample (N=97)				Peer Sample (N=60)				t-test
	$\bar{X}$	SD	Minimum	Maximum	$\bar{X}$	SD	Minimum	Maximum	(p)
SD values	–2.01	1.05	–3.3	0.9	0.26	0.63	–1.3	1.4	–16.843**

** p<0.01

mean with respect to average normative values). Adequate speech comprehension was seen in only 14.4% (scores around lower averages) of children in the clinical sample, while 93.4% of children in the peer sample had normal speech comprehension (Figure 2). The arithmetic mean in the peer sample was, as we expected, close to the mean in the normative sample (SD=0.26), with less scattering of results. In the peer sample, only 6.3% of children had mild impairments in speech comprehension.

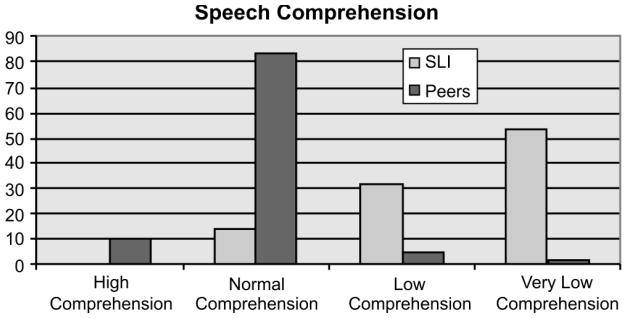

Fig. 2. Comparison of scores on Reynell's Speech Comprehension Scale for children with specific language impairments and peers.

Behavior

Five scales oriented to DSM-IV criteria were used to assess emotional/behavioral problems. Results on the majority of DSM-IV scales were within the normal range of T values in both samples of children. The Pervasive Developmental Problems scale was the only scale with clinically significant higher scores in the sample of children with SLI, with T values exceeding the critical value of 65.6= 13.48, ranging from 42.50 to 113.33.

According to assessments made by mothers, the clinical sample had significantly higher scores on Affective Problems, Pervasive Developmental Problems, Attention Deficit/Hyperactivity Problems, and Oppositional Defiant Problems scales; no difference was found on the Anxiety Problems scale. According assessments made by teachers, the clinical sample had significantly higher scores on Affective Problems, Anxiety Problems, Pervasive-Developmental Problems, and Attention Deficit/Hyperactivity Problems scales; no difference was found on the Oppositional Defiant Problems scale.

Speech comprehension and behavioral problems

In the clinical sample, Pearson's correlation showed (Table 3) that speech comprehension correlated negatively with scores on Pervasive Developmental Problems (r=–0.209) and Attention Deficit/Hyperactivity Problems scales (r=–0.270) according to mothers' assessments. Speech comprehension correlated negatively with scores on the Attention Deficit/Hyperactivity Problems scale according to teachers' assessments (r=–0.231). All correlations were statistically significant with a $p < 0.05$.

In the peer sample, speech comprehension correlated negatively with scores on Attention Deficit/Hyperactivity Problems and Affective Problems scales (C-TRF) according to teachers' assessments. All correlations were statistically significant with a $p<0.05$.

Regression analysis was used to determine how much variance can be explained by correlations obtained on CBCL scales. The dependent variable (y) was speech

TABLE 2
COMPARISON OF MEAN SCORES ON CBCL AND C-TRF SCALES IN CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENTS AND PEERS

	SAMPLES								Significance of Difference
	Clinical Sample (N=97)				Peer Sample(N=60)				
DSM-oriented scales	$\bar{X}$	SD	Min.	Max.	$\bar{X}$	SD	Min.	Max.	t-test
CBCL Affective Problems	52.59	11.98	39.50	114.50	48.35	10.85	39.50	104.50	2.202*
CBCL Anxiety Problems	50.59	12.33	36.40	108.40	48.33	11.37	36.40	88.40	1.128
CBCL Pervasive Developmental Problems	65.09	13.49	42.50	113.33	49.67	11.21	38.33	109.17	7.717**
CBCL Attention Deficit/Hyperactivity Problems	54.31	11.12	35.71	92.86	46.25	9.32	32.14	64.29	4.802**
CBCL Oppositional Defiant Problems	52.18	9.80	35.60	83.60	47.08	8.72	35.60	67.60	3.281**
C-TRF Affective Problems	58.14	14.01	43.68	96.32	50.76	11.39	43.68	96.32	3.546**
C-TRF Anxiety Problems	57.62	16.35	43.13	111.88	51.08	10.48	43.13	86.88	2.988**
C-TRF Pervasive Developmental Problems	59.77	13.31	43.13	108.00	49.25	10.12	40.00	94.67	5.529**
C-TRF Attention Deficit/Hyperactivity Problems	54.55	11.81	40.00	88.57	49.04	8.54	40.00	76.33	3.304**
C-TRF Oppositional Defiant Problems	51.08	10.89	43.00	95.56	49.00	7.32	43.00	73.33	1.357

* $p<0.05$; ** $p<0.01$

TABLE 3
CORRELATIONS BETWEEN SPEECH COMPREHENSION AND EMOTIONAL/BEHAVIORAL PROBLEMS ASSESSED BY MOTHERS (CBCL) AND SPEECH THERAPISTS (C-TRF)

Clinical Sample, N= 97		Peer Sample N=60	
Mothers' evaluations on CBCL and speech comprehension			
Affective Problems	–.055 p=.596	Affective Problems	.029 p=.824
Anxiety Problems	–.036 p=.729	Anxiety Problems	.166 p=.206
Pervasive Developmental Problems	–.209* p=.040	Pervasive Developmental Problems	.150 p=.254
Attention Deficit/Hyperactivity Problems	–.270** p=.008	Attention Deficit/Hyperactivity Problems	.083 p=.526
Oppositional Defiant Problems	–152 p=.137	Oppositional Defiant Problems	.216 p=.097
Speech therapists' evaluations on C-TRF and speech comperhension			
Affective Problems	–.033 p=.374	Affective Problems	–.226* p=.042
Anxiety Problems	.152 p=.069	Anxiety Problems	–.041 p=.378
Pervasive Developmental Problems	.018 p=.429	Pervasive Developmental Problems	–.051 p=.350
Attention Deficit/Hyperactivity Problems	–.231* p=.011	Attention Deficit/Hyperactivity Problems	–.248* p=.028
Oppositional Defiant Problems	–.121 p=.119	Oppositional Defiant Problems	–.119 p=.138

* $p<0.05$; ** $p<0.01$

comprehension and the independent variables were Affective Problems, Anxiety Problems, Attention Deficit/Hyperactivity Problems, Pervasive Developmental Problems, and Oppositional Defiant Problems. Regression analysis shows that 12.8% of variance is saturated with these 5 variables, of which Attention Deficit/Hyperactivity Problems ($\beta=-0.281$) and Pervasive Developmental Problems ($\beta=-0.280$) are statistically significant ($p<0.05$). In turn, we applied a reduced regression model using only the statistically significant independent variables to determine whether there was a significant difference between models. Both regression models described the variability of the y variable equally well and there was no significant difference between models ($p=0.303$, $F=1.232$, with 3.91 degrees of freedom). In the reduced model, the only significant variable was Attention Deficit/Hyperactivity Problems, so the model was further reduced to include only this independent variable. This model did not significantly differ from the initial model with 5 independent variables ($p=0.226$, $F=1.445$ with 4.91 degrees of freedom).

Attention Deficit/Hyperactivity Problems was statistically significant in the further reduced regression model, with a standardized coefficient of $\beta=-0.270$, and $p<0.01$. Attention Deficit/Hyperactivity Problems explain 7.3% of the variance in speech comprehension, while 92.7% of the variance is accounted for by the action of factors not investigated in this study.

Discussion

Problems with speech comprehension are important for establishing diagnosis of SLI[18], but children with SLI are also affected by other problems: behavioral problems, e.g., problems with attention deficit/hyperactivity; impairments of motor abilities; delayed development of verbal cognitive abilities; and a general delay in cognitive development.

Our research has confirmed that children with SLI have significantly impaired speech comprehension, 2.01 standard deviations lower than the peer sample. We saw a greater scattering of results in children with SLI, which was expected in this group. A certain percentage of children had normal speech comprehension, although results were below average.

The arithmetic mean of results on Reynell's test in the peer sample was very near the arithmetic mean for the population of children on which results were standardized (English norms), which justifies the use of translated versions of the test and English norms. The test requires children to understand commands, and regardless of the language of administration, all children, English and Croatian, are subject to the same developmental process of speech comprehension.

Prior to inclusion in the peer sample, 6.7% of children were found to have mild deficits in speech comprehension. This finding evokes Tomblin's 7% prevalence estimate of SLI[2]. One would expect equal representation of

males and females in the clinical sample, but 76% of our clinical sample were males, which reflected the overall ratio of boys to girls in rehabilitation. It appears that boys are an at risk group for SLI. There was equal representation of males and females in the peer sample.

Our research confirmed the increased frequency of behavioral problems, measured by Achenbach's CBCL and C-TRF scales, in the children with SLI. It has to be emphasized that scores on DSM-oriented CBCL and C-TRF scales are not equivalent to a DSM diagnosis, but do identify children with a higher likelihood of being diagnosed by DSM-IV criteria.

Specific differences in assessments between mothers and speech therapists were seen. According to mothers, children in the clinical sample had more affective problems, pervasive developmental problems, attention deficit/hyperactivity, and defiance; they did not have more anxiety. According to speech therapists and teachers, children with SLI had more affective problems, anxiety, pervasive developmental problems, attention deficit/hyperactivity; they were not more defiant.

Differences in mothers' and teachers' assessments may be explained in various ways. Children with SLI were assessed as more anxious by speech therapists, but not by mothers. Children may experience more anxiety in the rehabilitative environment due to the inherent demands and intensity of the therapeutic process. There was no difference in teachers' assessments of defiance in clinical and peer samples; however, mothers assessed children with SLI as more defiant. Children may react defiantly to situations at home when parents insist they practice exercises learned in rehabilitation, and are not always prepared to let parents assume the role of speech therapists. This could be one reason that defiance manifests more frequently at home with parents than at kindergarten.

In the clinical sample, 23.7% of children were evaluated by a psychiatrist due to clinically documented manifestations of behavioral problems. Problems were exposed by a lack of cooperativity in therapy, difficulty establishing contact due to attention deficits, and other perceived difficulties with communication. The arithmetic mean in the clinical sample for the Pervasive Developmental Problems Scale was borderline for this behavior (T>65) according to Achenbach's manual.

This research confirms an association between problems with speech comprehension and attention deficit/hyperactivity problems (in both samples), and pervasive developmental problems (in the clinical sample). Although the correlations were not high, all correlations were significant with a p value <0.05.

There was a correlation between poor speech comprehension and increased affective problems in the peer sample. Prior to our research, problems with speech comprehension were not identified in any children attending regular kindergarten; however, during the course of our research we identified problems in a small percentage of these children. We suggest that affective problems result when impairments in speech comprehension are overlooked. If children are unable to fully understand instructions and are expected to communicate and participate regularly in daily activities, we can expect to see an increase in affective problems. Therefore, the systematic education of teachers and parents can help prevent problems with speech comprehension going undetected in kindergarten and at home. Regression analysis reveals that attention deficit/hyperactivity contributes to 7.3% of problems with speech comprehension, or receptive speech. This finding was to be expected. Although we did not measure auditory attention, rehabilitation and psychological examinations indicate that attention problems manifest through all sensory channels: auditory, visual, and kinesthetic.

It appears that the maturation of certain developmental areas in children with SLI are hindered, and as children develop in social environments, one can expect problems with interaction to follow. Some problems are developmental and can be expected at certain ages, while other suggest psychopathology or are psychopathology. Often the border between developmental deficits and psychopathology is indistinct. When SLI is diagnosed, a triage for other problems associated with SLI is necessary. This allows the rehabilitative process to be specifically catered to the needs of each child and their developmental stage. With well-targeted rehabilitation, we can use the period of brain plasticity to our advantage and support the maturation of developmental processes[19].

Our research lacks assessments by fathers of children in clinical and peers samples. In further research on the mechanisms responsible for problems with speech comprehension, it would be interesting to apply questionnaires that are constructed to measure attention and hyperactivity, investigate the relationship between speech comprehension and other aspects of cognitive development, and study the effect of environmental factors.

Conclusion

Our results showed that problems with speech comprehension correlated significantly with attention deficit/hyperactivity problems, and pervasive-developmental problems, which suggests that the same neurodevelopmental process or poor maturation may lie in the background of these disorders. Attention deficit/hyperactivity contributes 7.3% of the variance in speech comprehension, and likely interferes with the input of spoken language. The relationship between impaired speech comprehension and pervasive-developmental problems is in agreement with previous research that finds SLI to be a predictor of pervasive developmental disorders. Our findings emphasize the need to enhance attention during speech therapy, and the importance of triage for emotional/behavioral problems in children with SLI and in children without language impairments in an effort to prevent the development of psychopathology.

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RAZUMIJEVANJE GOVORA I PROBLEMI EMOCIJA/PONAŠANJA PREDŠKOLSKE DJECE S POSEBNIM JEZIČNIM TEŠKOĆAMA

SAŽETAK

Cilj ove studije je bio istražiti razlike u razumijevanju govora djece s jezičnim teškoćama (PJT) i djece normalnog razvoja, te ga usporediti s emocionalnim teškoćama i teškoćama ponašanja na Achenbachovim ljestvicama prema DSM IV kriteriju (engl. Child Behavior Checklist (CBCL) i Caregiver Teacher's Report Form (C-TRF). Klinički uzorak je obuhvaćao 97 predškolske djece sa PJT i 60 djece iz redovnog vrtića. Djeca s PJT su pokazala značajno kašnjenje u jezičnom razumijevanju i emocionalnim, odnosno teškoćama ponašanja. U uzorku djece s PJT, jezično razumijevanje je značajno povezano s teškoćama pažnje/ hiperaktivnošću (na CBCL i C-TRF) i pervazivnim razvojnim teškoćama (CBCL), uz $p<0,05$. U usporednom uzorku, razumijevanje govora je značajno negativno povezano s afektivnim teškoćama i teškoćama pažnje/ hiperaktivnošću (C-TRF). Regresijska analiza je pokazala da je 12,8% varijance u varijabli razumijevanje govora djece s PJT saturirano s varijablama: teškoće pažnje/hiperaktivnosti ($\beta=-0,281$) i pervazivnim razvojnim teškoćama ($\beta=-0,280$) uz $p<0,05$. U reduciranom modelu teškoće pažnje/hiperaktivnosti objašnjavaju 7,3% varijance razumijevanja govora ($\beta=-0,270$, $p<0,01$). Prema rezultatima, može se zaključiti da u određenoj mjeri isti neurorazvojni procesi maturacije leže u pozadini teškoća pažnje/hiperaktivnosti i pervazivnih razvojnih teškoća. Ova studija potvrđuje važnost trijaže emocionalnih i teškoća ponašanja i potrebe treninga pažnje u rehabilitaciji kako djece sa PJT, tako i djece urednog jezičnog razvoja, ali s ADHD simptomima.