
PHONOLOGICAL PERFORMANCE IN READING AND WRITING IN PEOPLE WITH CONGENITAL CEREBRAL PALSY

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ABSTRACT

The objective of the present study is to characterize and compare the phonological performance in subjects with Hemiparetic Cerebral Palsy and its correlation with learning and writing abilities. Sixteen (16) children between 7 and 13 years old, with Hemiparetic Cerebral Palsy, all of them going to elementary public schools, participated in this study. The individuals were divided into 2 groups: GSd (group of individuals with right hemiparetic cerebral palsy) and GSe (group of individuals with left hemiparetic cerebral palsy). All the subjects were affected by learning disabilities because of their language developmental retard and its relation with phonological, writing and reading disorders, besides disorders in the phonological codification, that causes disturbs in the use and representation of phonetics in the working memory. We concluded that the GSe group showed better results than the GSd group concerning to the emission and reception of written language.

Received on: April 8, 2004.
Accepted on: October 26, 2004.

KEY WORDS: learning; cerebral palsy; learning disorder

INTRODUCTION

Cerebral palsy (CP) is a persistent, non fixed, movement and postural disorder that occur in the first years of life by interference of the development of the Central Nervous System (CNS) due to a non-progressive cerebral disorder (SCHWARTZMANN, 1992).

In what regards language, some studies indicate that children and adolescents with CP show alteration in at least on aspect of language, such as in phonology and syntax and preservation of semantic and pragmatic. A study with 5 year-old preterm children with and without CP showed that CP preterm children scored lower in the sub-test for phrase completion and grammar in the Psycholinguistic Abilities Illinois Test (LARGO, 1996).

The congenital alterations of speech interfere in the phonologic process resulting in difficulties in the acquisition of oral code and reading (LIEBERMANN, 1977). Studies suggest that the difficulties with written language in individuals with speech disturbances can be a result of a previous deficit in phonologic conscience (KAMHI; CATTs, 1986; CATTs, 1991). However, on the other hand, the development of phonologic conscience seems to be relatively dependent on speech since the study of Brady (1983) showed that dysarthric individuals can have a good performance in task for analysis and manipulation of phonologic information and analysis.

Limitations in the phonologic or linguistical process can trigger reading and writing problems. Episodes of this process can cause alteration in the developmental process of reading and writing, alteration in the phonemic segmentation, difficulties in the elaboration of phonological specification in the short run memory during the process of lexical acquisition (vocabulary), alteration in the discrimination and differentiation between words and sentences and deficit of short run phonological memory (KAMH; CATTs, 1986).

The objective of the present study is to characterize and compare the phonological performance and the reading and writing performance in individuals with hemiparetic cerebral palsy involving the right and left side.

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MATERIALS AND METHODS

Subjects

The study includes 16 individuals with hemiparetic cerebral palsy with age ranging from 7 to 13 years old, education level ranging from the 1st to the 6th grade. They were allocated in two groups:

I – Group Sd (GSd): with 8 individuals (4 males and 4 females) with hemiparetic cerebral involving the right side, with age ranging from 7 to 13 years old and education level ranging from 1st to 6th grades.

II – Group Se (GSe): with 8 individuals (3 males and 5 females) with hemiparetic cerebral palsy involving the left side, age ranging from 8 to 12 years and education level from 1st to 6th series of public school.

Criteria for inclusion of cases were presence of congenital hemiparetic cerebral palsy, chronological age 7 to 13 years old, intellectual abilities as evaluated by the Wechsler Intelligence Scale for Children (WECHSLER, 1974) or no auditory and ophthalmologic alteration.

After approval of the project (Committee of Ethics n.º 306/2001) and signature of the Informed Consent Term, the individuals were submitted to the evaluation as follows:

– interview with parents: they were interviewed in order to obtain data on the neuropsychomotor development, speech and language, aiming to better characterize the individuals;

– phonological evaluation: by means of proofs already standardized for the Brazilian population aiming to assess the individual's phonological performance in orality, speech and writing. The evaluation included the following tests – Children's Phonologic Evaluation (YAVAS, 1992), Test for Phonologic Conscience (CAPOVILLA and CAPOVILLA, 1998), Test of oral speech and writing under dictation (PINHEIRO, 1994);

– additional tests: Reading level test (GRÉGOIRE; PIERART, 1998), Silence reading speed test (CONDEMARIN; BOLMQUIST, 1989) School performance test (STEIN, 1994) and Rapid serial naming speed test (DENCKLA, 1974), (FERREIRA et al, 2003).

The statistical analysis include the Mann-Whitney test (CONOVER, 1971) and the Test of Fisher (FLEISS, 1981), besides the comparison among groups of the data obtained in the tests and compared with the standard results of these tests.

RESULTS

Parents reported that seven individuals (3 with right cerebral palsy and 4 with left cerebral palsy) did not show alteration in language development and the 4 individuals with left hemiparetic cerebral palsy showed delay in all phases of the motor development.

The results for reading performance indicated that individuals in both groups showed the same level of performance with no statistical difference ($p = 1.0000$).

In the silent reading speed test it was revealed that individual from both groups had a performance lower than is expected for their age and education. It was observed that individuals from group GSd (right) had lower reading speed as compared to individuals of the GSe group (left). However, there was no significant statistical difference between the groups ($p > 0.05$). In what regards the understanding of silent reading for individuals of the GSd group the performance was below the educational level and that four individuals showed no understanding at all of the silent reading.

TABLE 1 shows the performance of hemiparetic individuals in the Test of Phonological Awareness. It was observed worse performance for all individuals in phonemic test than in syllabic tests. Data showed statistical difference only for the sub-test of phonemic transposition, which revealed a better performance in individuals of the GSd group ($p = 0.0317$). The result allowed to verify a tendency for an overall better performance in individuals of the GSd group ($0.05 < p < 0.10$).

In what concerns the writing dictation test for real and virtual words (FIGURE 1), it was seen that in the present study individuals of groups GSd and GSe showed better qualitative result in writing test under dictation with high frequency of real and virtual words that in test for oral reading of these same words. In the writing dictation test individuals of both groups showed greater occurrence of regularization than of neologisms (deaf-sonorous substitution). The statistical analysis showed significant differences ($p = 0.0291$) between the groups only for low frequency virtual writing words. The right hemiparetic (GSd) individuals showed greater number of errors and, therefore, lower performance.

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TABLE 1 – Result of the performance of individuals with right and left cerebral palsy in the Test of Phonologic Awareness.

	Group	Mean	P	Sd
Syllabic Synthesis	GSd	4.00	0.0769	0.00
	GSe	3.13	0.0769	1.13
Phonemic Synthesis	GSd	3.13	0.1539	0.99
	GSe	2.25	0.1539	1.16
Rhyme	GSd	2.75	0.2858	1.04
	GSe	2.00	0.2858	1.31
Aliteration	GSd	2.88	0.5399	1.46
	GSe	2.38	0.5399	1.51
Syllabic Segmentation	GSd	3.75	0.1515	0.46
	GSe	2.75	0.1515	1.39
Phonemic Segmentation	GSd	2.38	0.4379	1.60
	GSe	1.75	0.4379	1.49
Syllabic Manipulation	GSd	3.63	0.4365	0.52
	GSe	3.13	0.4365	0.99
Phonemic Manipulation	GSd	2.38	0.0656	1.41
	GSe	1.25	0.0656	1.16
Syllabic Transposition	GSd	3.13	0.1683	0.99
	GSe	1.88	0.1683	1.73
Phonemic Transposition	GSd	2.00	0.0317	1.41
	GSe	0.50	0.0317	0.76
Total Score	GSd	30.13	0.0632	5.79
	GSe	20.88	0.0632	9.76

In the test of oral reading of real and virtual words, it was observed that the GSd group showed a lower performance for high and low frequency virtual words than individuals of the GSe group, revealing a difficulty in the use of the phonologic route for the reading and writing process. In oral reading individuals of the GSd group showed greater amount of regularization of real and virtual words than the GSe individuals.

In the school performance test data showed performance lower than what could be expected by individuals of both groups in the arithmetic sub-test (TABLE 2). There was no statistical difference between the groups.

		REGULARIZATION			NEOLOGISM		
		N	p	sd	N	p	sd
PRRAF	GSd	2	0.1923	33.33	2	= 1.0000	28.57
	GSe	0	0.1923	0.00	3	= 1.0000	42.86
PRRBF	GSd	0	1.0000	0.00	1	= 1.0000	14.29
	Gse	0	1.0000	0.00	2	= 1.0000	28.57
PRlRAF	GSd	2	0.1923	33.33	0	= 1.0000	0.00
	Gse	0	0.1923	0.00	0	= 1.0000	0.00
PRlRBF	GSd	2	0.5594	33.33	0	= 1.000	0.00
	Gse	1	0.5594	14.29	0	= 1.000	0.00
PRRgAF	GSd	0	1.0000	0.00	2	= 1.0000	28.57
	Gse	0	1.0000	0.00	3	= 1.0000	42.86
PRRgBF	GSd	4	0.5594	0.00	5	= 0.2861	71.43
	GSe	6	0.5594	0.00	2	= 0.2861	28.57
PIRRAF	GSd	4	0.1923	33.33	2	= 1.0000	28.57
	GSe	7	0.1923	0.00	2	= 1.0000	28.57
PIRRBF	GSd	0	1.0000	0.00	1	= 0.5594	14.29
	Gse	0	1.0000	0.00	3	= 0.5594	42.86
PIlRAF	GSd	3	0.5921	50.00	3	= 1.0000	42.86
	Gse	2	0.5921	28.57	4	= 1.0000	57.14
PIlRBF	GSd	5	0.1026	83.33	0	= 1.000	0.00
	GSe	2	0.1026	28.57	0	= 1.000	0.00
PIRgAF	GSd	3	0.0699	50.00	0	= 0.4615	0.00
	GSe	0	0.0699	0.00	2	= 0.4615	28.57
PIRgBF	GSd	5	0.0291	83.33	0	= 1.0000	0.00
	GSe	1	0.0662	14.29	0	= 1.0000	0.00

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FIGURE 1 – Performance of left right hemiparetic individuals in the dictation test.

The assessment of the speed of lexical access or the rapid serial nomination revealed absence of statistical difference between the two groups (GSd and Gse). However, the analysis allowed to observe a tendency ($0.05 < p < 0.10$) of individuals of group GSd to be more effective in the lexical access for colors, letters and numbers. The results of individuals with right or left hemiparesia is in a lower level when compared to school children without learning difficulties, making clear the intrinsic relation with the reading and writing performance once the speed to lexical access is directly related to the ability of phonological processing as well as to the visual perception and mnemonic processes.

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		REGULARIZATION			NEOLOGISM		
		N	P	sd	N	p	sd
PRRAF	GSd	7	1.0000	100.00	1	1.0000	14.29
	GSe	7	1.0000	100.00	1	1.0000	14.29
PRRBF	GSd	7	1.0000	100.00	0	1.0000	0.00
	Gse	7	1.0000	100.00	2	1.0000	28.57
PRlRAF	GSd	1	1.0000	14.29	0	1.0000	0.00
	Gse	1	1.0000	14.29	1	1.0000	14.29
PRlRBF	GSd	0	1.0000	0.00	0	1.0000	0.00
	Gse	1	1.0000	14.29	2	1.0000	28.57
PRRgAF	GSd	6	1.0000	85.71	5	1.0000	71.43
	Gse	1	1.0000	14.29	4	1.0000	57.14
PRRgBF	GSd	0	1.0000	0.00	5	1.0000	28.57
	Gse	1	1.0000	14.29	7	1.0000	71.43
PIRRRAF	GSd	6	1.0000	85.71	5	1.0000	71.43
	GSe	6	1.0000	85.71	5	1.0000	71.43
PIRRBF	GSd	1	1.0000	14.29	6	1.0000	85.71
	Gse	2	1.0000	28.57	4	1.0000	57.14
PIlRAF	GSd	1	1.0000	14.29	4	1.0000	57.14
	GSe	2	1.0000	28.57	3	1.0000	42.86
PIlRBF	GSd	0	1.0000	0.00	4	1.0000	57.14
	GSe	2	1.0000	28.57	1	1.0000	14.29
PIRgAF	GSd	2	1.0000	28.57	0	1.0000	0.00
	GSe	2	1.0000	28.57	2	1.0000	28.57
PIRgBF	GSd	2	1.0000	28.57	3	1.0000	42.86
	GSe	0	1.0000	0.00	5	1.0000	71.43

FIGURE 2 – Performance of right and left hemiparetic individuals in the oral reading test.

TABLE 2 – Performance of individuals of groups SDd and SDe in the school performance test.

		Mean	P	Sd
Writting	GSd	20.38	0.9378	5.66
	GSe	20.38	0.9378	12.26
Arithmetics	GSd	13.13	0.8998	9.05
	GSe	13.38	0.8998	7.74
Reading	GSd	58.63	0.7375	10.00
	GSe	56.63	0.7375	23.21
Total	GSd	92.13	0.6454	22.45
	GSe	90.38	0.6454	39.99

Colors / seconds	GSd	60.68	0.6250	16.03
	GSe	57.93	0.6250	14.15
Letters / seconds	GSd	43.10	0.7786	26.32
	GSe	43.63	0.7786	31.14
Numbers / seconds	GSd	36.72	0.7984	10.80
	GSe	34.55	0.7984	6.90
Objects / seconds	GSd	63.77	0.4418	22.63
	GSe	70.81	0.4418	18.59

FIGURE 3 – Performance of individuals for groups GSd and GSe in the rapid automatic naming test.

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DISCUSSION

We can see from this study that individuals with right or left hemiparetic cerebral palsy, once submitted to phonological evaluation involving oral and writing modalities, show alteration in the phonological process through phonological disturbances in the orality characterized by deaf-sonorous substitution and transposition of the orality in writing.

Results of the test of phonological awareness did not match to the finding of Blischak (1994) and Sandberg & Hjelmquist (1996), which suggested that children with motor and speech impairments can develop phonologic conscience in advanced levels, even attaining performance of phonological awareness tasks similar to normal children. In fact, in the present study it was identified hazards of the phonological abilities that were not overcome and had compromised its use in oral emission and writing activities.

Even in the occurrence of during dictation or in oral reading, although without statistical significance, the data are similar to those of RACK et al. (1992), in which regular words of low frequency acts as non-words, whereas individuals with good phonological abilities are able to read them correctly. The same sort or mistakes in reading do not occur with the low frequency irregular words, that is, there is less probability of individuals with good phonological abilities to read them incorrectly, as suggested by Snowling (1980) that believes that the difficulty in graphema-phonem conversation can be the expression of a more general verbal deficit. To this author, the translation letter-sound is a quite complex task formed by various components such as the phonemic segmentation, the use of verbal tags, orthographic conscience and, perhaps, verbal memory.

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The resolution of math calculation is more related to emission and understanding of language. Because of that, individuals with language impairments, as the ones mentioned in this study, show difficulties to relate basic notions of numbers with daily life situations as described by Rutter et al. (1970) and reported in this study in the arithmetics sub-test of TDE.

The presence of phonologic alterations in the orality of individuals with right and left hemiparesia is supported by the studies of Yavas et al. (1992) that report that the majority of children with marked communication disorders have at least some phonological difficulty in language and this difficulty will lead to problems.

The learning problems related to the development of oral language and their consequences as observed in the present study are supported by the studies of Mark et al. (1997), Gerber (1996) and with the hypothesis advanced by Rumelhart (1977), which referred that the development of reading and writing skills is based on a complex interaction of cognitive development and experiences that act in parallel and are not sequential, inducing the contact or involvement with phonological, syntactic, semantic and pragmatic processes; individuals with alterations in the phonological processing and/or phonological decodification abilities make use of visual strategies to compensate such deficit; these individuals show difficulties in the perception of the linguistic units.

CONCLUSION

Taking into consideration the statistical data from the present study, it is possible to conclude that:

- the presence of phonological impairment has compromised the performance of hemiparetic individuals in the performed proofs and tests.
- in what regards language phonological abilities, all individuals showed alterations, but those of the GSe (left) group showed lower performance if compared to individuals of the GSd group.
- the phonological performance of all individuals was below the expected for the age and education, both in oral and writing language.

As a result, the findings of this study lead to the conclusion that these individuals have an audiological diagnosis of learning disturbances derived from disabilities of development of the oral language.

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