

Case Report

# Neurophysiotherapy and its effects on school performance

Erna Žgur<sup>a,b</sup>

<sup>a</sup>*Center za izobraževanje, rehabilitacijo in usposabljanje Vipava/Centre for Education, Rehabilitation and Training (Cirius Vipava), Vojkova 33, Vipava*

<sup>b</sup>*Univerza v Ljubljani, Pedagoška fakulteta/University of Ljubljana, Faculty of Education, Kardeljeva ploščad 16, Ljubljana*

**Abstract.** This article shows the school achievement results in reading and writing of a female pupil in primary school with adapted programme and lower educational standards. Cerebral palsy and impaired mental development, manifests various mobility and academic deficits. Case study shows how individual therapies (neurophysiotherapy, based on the concept of Neurodevelopmental Treatment (NDT), and hipotherapy) influence reading and writing performance in a child with special needs. The effects of a direct therapeutic treatment are reflected in results achieved at individual tasks. The aim of the study was to establish the correlation between a therapy type and its effects on the task performance. To demonstrate the effects of a therapy type on the task performance, the statistical method of chi - square test was used. The results of four observations showed that NDT has a significant effect on completion time in a text writing task. The most significant effect on the reading performance was demonstrated by the NDT before class.

Key words: NDT, physiotherapy, hipotherapy, organic disorder

## 1. Introduction

Adequate therapeutic treatment enables children with various mobility deficits to develop certain motor abilities and skills and to improve their school achievements. Highly structuralized academic skills activities (reading ability, writing ability) depend not only on intactness of the central nervous system (CNS), but also on the adequate maturity of motor system (1). People with cerebral palsy can thus have additional problems in school achievement due to their numerous neuromotor deficits (2). In order to establish how individual therapeutic activity (neurophysiotherapy - Neurodevelopmental Treatment, hipotherapy) influence reading and writing performance, in this case study a female pupil with a cerebral palsy was included, attending a primary school which implements adapted programme with educational standards at a lower level. Apart from an adequate educational programme, she underwent an overall therapeutic treatment (neurophysiotherapy, hipotherapy) before and after class.

---

Corresponding Author: Erna Žgur, PhD,  
Univerza v Ljubljani, Pedagoška fakulteta/University of  
Ljubljana, Faculty of Education, Kardeljeva ploščad 16,  
E-mail: erna.zgur@cirius-vipava.si.

Received: 12.10.2013

Accepted: 13.02.2015

The pupil at school work was observed, through a test situation containing reading and writing tests, performed four times. Each time she underwent an adequate therapeutic treatment (45 minutes of neurophysiotherapy, 45 minutes of hipotherapy) beforehand.

### 1.1. Cerebral palsy

Apart from distinct motor dysfunctions, people with cerebral palsy (CP) exhibit various accompanying disorders: visual or hearing impairment, impairment in mental development, emotional and behavioural disorders, sensory and perceptual disorders, speech disorders, epilepsy and various learning disabilities (3). Physical limitations of movement in people with CP can sometimes be so evident that they interfere with their intellectual and arithmetic development, which furthermore influences the development of basic cognitive functions (4).

### 1.2. Neurophysiotherapy, based on the Concept of Neurodevelopmental treatment

Karl and Bertha Bobath (5) set up the basis for Neurodevelopmental Treatment (NDT) through the inhibition of pathological reflexes and facilitation of normal movement. The tapping technique is used to stimulate the impulses through the proprioceptors to influence the muscle tonus (6). A combination of adequate techniques of inhibition and facilitation or stimulation is used to influence the central

control and is followed by a correct motor response (7).

#### *1.3. Hipotherapy*

Hipotherapy - performing exercises on an unsaddled horseback (trunk straightening, rotation) helps improve numerous motor functions (8). Constant adjustment to the horse movement stimulates muscle relaxation and thus encourages supportive, straightening and balance responses, facilitating the movement. Hipotherapy provides sensory integration of kinesthetic, visual and vestibular influxes that are important for the development of postural and balance control (9).

#### *1.4. Reading and writing*

Reading is a process of decoding written symbols for which an adequate visual perception is needed (10). Successful development of reading and writing is influenced by general perceptive abilities - adequate level of perceptive maturity and some specific perceptive abilities - visual perception, auditory perception (11,12). People with CP are likely to have difficulties with the mobility of chest, head and shoulders as well as with speech control apparatus (13,3). To develop successful reading and writing, intellectual abilities, as well as adequately developed organs supporting the task performance, are needed.

## **2. Methods**

#### *2.1. Hypotheses*

The study exposes the following hypotheses:

H1: different types of therapy influence the quality of reading and writing

H2: adequate therapeutic treatment improves reading and writing attention

H3: NDT before class is more effective than NDT after class.

For testing the hypotheses theoretical frequencies of the same probability were used.

#### *2.2. Sample*

The subject of research was a female pupil, aged 14, attending the seventh grade of the primary school which implements the adapted programme with educational standards at a lower level. The pupil has CP and a mild cognitive impairment. We observed her in a test situation (repeated four times) containing reading and writing tasks. Each time she underwent an adequate therapeutic treatment beforehand (45 minutes of NDT or 45 minutes of hipotherapy).

#### *2.3. The observed variables*

1. Contact lineation (number of mistakes in exact joining of letters in a writing task)

2. Reading - completion time (time spent on a reading task – in seconds)
3. Writing - completion time (time spent on a writing task – in seconds)

#### *2.4. Instruments*

Instruments were chosen according to the observed tasks:

1. Contact lineation - we measured the number of mistakes in text copying. Every inaccurate letter joining in a word was considered as a mistake.
2. Reading – completion time - we measured the time (in seconds) needed for completing a task of text reading.
3. Writing – completion time - we measured the time (in seconds) needed for completing a task of text copying.

#### *2.5. Evaluation and method description*

The study was carried out by a direct observation of the pupil at individual school tasks, outside class, after having undergone an adequate therapeutic treatment.

#### *2.6. Initial and final state*

The observations were performed four times. In the first observation the test was performed without previous therapeutic treatment. The first observation included all three variables. During the second observation the test was performed after a 45- minute NDT, carried out immediately after class. In the third observation test was performed before class, after a 45- minute NDT. During the fourth observation the test was performed after a 45- minute hipotherapy.

#### *2.7. Statistical methods used in the study*

The hypotheses were tested by the chi - square test.

## **3. Results**

Table 1 shows the results of the measurement of individual observed variables (contact lineation, reading, writing) after each therapeutic activity.

The first observation, carried out after the pupil's holiday, represents the initial state. The results were measured for all three variables. In the second observation neurophysiotherapy was carried out immediately after class. We determined better results in contact lineation and completion time in a text writing task. We can conclude that regular neurophysiotherapy has a positive effect on both elements. In the third observation neurophysiotherapy was carried out before class. We determined improved contact lineation and better completion time results for reading and writing tasks. The results obtained show that neurophysiotherapy before class has

the most positive effect on measured variables. We can conclude that an adequate motor status obtained during neurophysiotherapy (immediately before class – when the fatigue did not yet occur) provides the best results in terms of measured variables.

The fourth, the final observation evidences the differences between neurophysiotherapy and hipotherapy, the first demonstrating more positive effects. We can conclude that maintaining an active position on a horseback demands more effort. The pupil was thus less successful in task performance due to her fatigue after the session of hipotherapy. The results show that regular and systematic neurophysiotherapeutic activity has positive effects on improving results in all measured variables, evidencing different results obtained within the two types of therapy (neurophysiotherapy and hipotherapy).

Table 1. Achievement results for individual tasks in correlation to individual therapeutic treatment

Observation	Initial state		Final state	
	Without therapeutic treatment	NDT after class	NDT before class	Hipotherapy class
Contact lineation (number of mistakes)	20	16	13	14
Reading (completion time)	120	120	90	120
Writing (completion time)	840	720	600	660

Legend: contact lineation /number of mistakes, reading and writing completion time after individual therapeutic activity.

### 3.1. Contact lineation (exact joining of letters)

$$\chi^2 = 1,82$$

$$\chi^2_{0,05} (3) = 7,81$$

We can claim (with a 5 percent risk) that the two therapies (NDT and hipotherapy) have the same effect on the mistakes in contact lineation. The difference, as regards the contact lineation, is between the initial and the final state, and is not conditioned by the therapy type itself.

### 3.2. Reading – completion time

$$\chi^2 = 6,00$$

$$\chi^2_{0,05} (3) = 7,81$$

We can claim (with a 5 percent risk) that the two therapies (NDT and hipotherapy) have the same effect on the completion time in a reading

task. Improved reading results occur due to the therapeutic activity not due to the type of therapy.

### 3.3. Writing – completion time

$$\chi^2 = 44,68$$

$$\chi^2_{0,05} (3) = 7,81$$

We can claim (with a 5 percent risk) that the time needed for completing the task depends on the type of the therapy – NDT. NDT before class enables the development of efficient neuromotor status which is reflected in improved results in the writing task. Quality NDT with its positive effects furthermore influences the quality of graphomotorical activity, which is evidenced in improved completion time in the writing task.

The literature itself indicates a wide correlation between child's motor and intellectual abilities, between the effectiveness of a therapy and the motor status and thus school achievement (3, 14). We need to consider the fact that due to a wide range of factors which take part in all reading processes, different consecutive types of reading may occur with the same reader, since an individual responds according to his/her state of mind and to different circumstances. The case study however confirms the correlation between a good neuromotor status, developed during an NDT, and individual results of the test performance (completion time in a writing task) indicating highly structuralized functioning of central nervous system (CNS).

## References

1. Carr LJ, Reddy SK, Stevens S, Blair E, Love S. Definition and classification of cerebral palsy. *Dev Med Child Neurol* 2005; 47: 508-510.
2. Haskell SH, Baret EK. *The Education of Children with Physical and Neurological Disabilities*. Third Edition. London, Chapman & Hall 1993; 17-19.
3. Miller F, Bachard SJ. *Cerebral Palsy. A Complete Guide for Care giving*. A Johns Hopkins press helath book, USA 2006; 112-113.
4. Keil S, Miller O, Cobb R. Special educational needs and disability. In R. Byres (Ed.). *British Journal of special Education*, Nasen, Helping Everyone Achieve. Oxford 2006; 33: 110.
5. Bobath B, Bobath K. *Motor development in the Different Types of cerebral Palsy*. William Heinemann Medical Books Limited. London 1981; 3-8.
6. Kong E. *A history of Physiotherapy in Cerebral palsy*. NUK, CIP-kataložni zapis o publikaciji. Ljubljana 2006; 12-13.
7. Dolenc Velicković T. *Neuro-Developmental treatment for early Intervention, Lectures and demonstrations*. In K. Žiberna (Ed.), *8-th Interantional Congress on Cerebral Palsy. An open-minded approach to the therapeutic options*, Bled, SLO 2010; 19.
8. Zadnikar M. *Učinek hipoterapije in terapevtskega jahanja na kontrolo drže in ravnoteže pri otrocih s cerebralno paralizo*. In M. Zadnikar (Ed.), *Zbornik, "1. Kongres terapevtskega jahanja v Sloveniji. Konj kot*

- terapevt – danes za jutri”. Kamnik: Zavod za usposabljanje invalidne mladine 2010; 33-44.
- 9. Rugelj D. Ravnotežje in hipoterapija. In M. Zadnikar (Ed.), Zbornik, “1. Kongres terapevtskega jahanja v Sloveniji. Konj kot terapevt – danes za jutri”. Kamnik: Zavod za usposabljanje invalidne mladine, 2010; 11-22.
  - 10. Pečjak S. Psihološki vidiki bralne pismenosti. Od teorije k praksi. Znanstveno raziskovalni inštitut Filozofske fakultete. Ljubljana 2010; 11-17.
  - 11. Wilson RA. Special educational Needs in the early years. Teaching and learning in the first three years of school. New York 1998; 42.
  - 12. Lovaas NW, Eikeseth S. Reading and Writing: A Brief Introduction. In NW. Lovaas (Ed.), Teaching Individuals with developmental Delays. Basic Intervention Techniques. Austin, Texas, Pro-ed, An International Publisher 2003; 122-123.
  - 13. Doherty J, Bailey R. Supporting Physical development and Physical Education in the Early Years. Open University Press Buckongham Philadelphia 2003; 12-15.
  - 14. Gage JR. The Treatment of Gait Problems in Cerebral Palsy. Mac Keith Press, Clinical in Developmental Medicine, University press. Cambridge (2006).