Neuro-Motor Facilitation in Children with Cerebral Palsy Using the Masgutova Method®

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This abstract presents, in brief, the study, *Effects of Activation of the Neuro-motor System in Children with CNS Damage using MNRI®* by K. Niezgodzka, L. Sadowsksa, J. Kowalewska, and A-M. Choińska as reported at International Conference of the Day of Handicapped: *Healthy Children – Healthy Europe* (Poland) and received an award for second place.

Introduction

Damage to the central nervous system (CNS) is characterized by a combination of symptoms of varying etiology and complex clinical symptomatology, including disorders of the CNS as determined using the Vojta Method (reflex locomotion), to various forms of cerebral palsy (CP) as described by the International Classification of GMCs (Palisano, Hanna, Rosenbaum, et al., 2000; Palisano, Rosenbaum, Walter, et al., 1997; Sadowska, 2001).

In the psychomotor assessment of children with damage to the CNS, functional tests are used to verify the reactions and reflex mechanisms of posture, rectification, and balance. Currently there are many diagnostic and therapeutic concepts used in treating children with brain damage such as NDT-Bobath, Vojta, Pető, Ayres, Castillo-Morales, and Masgutova Neurosensorimotor Reflex Integration (MNRI®). MNRI® evaluates and also provides integrating exercises for reflexes, a genetic pattern of physiological functions created by nature as a code and structure insuring neurosensorimotor development based on the clinical functioning, neurological status, and biological age of the child (Sadowska, 2004, 2012; Kaluzna, 2004).

The basis of the MNRI® method is the fact that a child is born equipped with a complex system of natural resources, reflexes, and instincts. Reflexes and primary motor responses in infancy, early childhood, and later in life pave the way for the connection between sensory and motor neurons creating reflex circuits and connecting with the motor system, brain, and body functions. These initial reactions and reflexes occur in children as automatic sensory-motor patterns.

Reflexes fulfill the role of activating the nervous system, a defensive mechanism triggering survival strategies in situations where the hindbrain focuses on reactions of survival, blocking the conscious reasoning process in the new cortex. There are several reasons why we need reflexes, such as the development of the nervous system, physiological survival, and the development of a protective defense system (Masgutova, Akhmatova, 2005). Reflexes can exhibit various dysfunctions such as poor coordination in sensory and motor processing and lack of development and maturation with negative affects on overall neuro development and learning.

The MNRI® method puts forth the idea of a 'conversation' with pathological reflex patterns in a positive way, not activating their defense programs, offering therapy that works with the genetically programmed static and dynamic reflexes of the mind-body system. MNRI® specialists create modeling exercises or repatterning procedures showing the brain how it can return to a positive system of functioning normally (Masgutova, Sadowska, 2008; Masgutova, 2006). The MNRI® programs used in the therapy of these pathological reflex patterns consist of the following: Neuro-structural integration of reflex patterns, integration of Archetype Movements, Neurotactile therapy, Oral-Facial and Visual-Auditory Reflexes, and the re-patterning of reflexes. (S. Masgutova, D. Masgutov, 2005; Masgutova, Regner, 2009).

An Assessment of 30 dynamic reflex and postural patterns is completed before an individual program is developed in order to determine which reflexes are disturbed, or non-integrated, and develop a plan direction of corrective, integration exercises. For every malfunctioning reflex there are specific exercises aimed at the coordination and integration between the sensory and motor neurons (Masgutova, 2004; Masgutova, Akhmatova, 2005). This work is important for children who fall in developmentally delayed at-risk groups and those diagnosed with neurological damage in the operation of reflex arcs similar to children with CP (Sadowska, 2012).

Table 1 Study groups of children with CP based on neurological symptom, age, and gender.

Groups of Children with CP based on their neurological symptoms, age and gender									
CP Groups / Gender and age		GR I Spastic hemiparesis (Hemiparesis) n = 19		GR II Spastic paresis of four limbs (Tetraplegia) n = 8		GR III Cerebellar CP syndrome (Ataxia and Hypotonia) n = 22		GR IV Extrapyramidal CP (Dyskinesia accept Dystonia) n = 11	
Age, Number and %		n	%	N	%	n	%	N	%
Boys n=33	0- 2 year old	3	5	0	0	4	6.7	2	3.3
	2.1- 4	5	8.3	3	5	2	3.3	3	5
	4.1- 6	0	0	0	0	3	5	0	0
	6.1-8	0	0	0	0	1	1.7	1	1.7
	Total	8	13,3	3	5	10	16,7	6	10
Girls n=27	0-2	2	3,3	1	1,7	4	6,7	2	3,3
	2.1- 4	8	13,3	3	5	4	6,7	1	1,7
	4.1 – 6	1	1.7	0	0	2	3.3	1	1.7
	6.1- 8	0	0	1	1.7	2	3.3	1	1.7
	Total	11	18.3	5	8.3	12	20	5	8.3
	Total n = 60 (100%)	19	31.6	8	13.3	22	36.7	11	18.3

Children who have brain injuries described as CP are found to exhibit involuntary psychomotor retardation and excessive muscle tension or laxity. The negative impact of CP on the development of motility is an impairment or delay of the equivalent reaction mechanisms and postural muscular tone control. The description and criteria of clinical evaluations of four age groups with large motility disorders of children with brain damage are determined by the international classification system Gross Motor Function Classification System (GMFCS) Test. This is an approximate five-level scale specifying increasing levels of movement disorders to assess the overall current level of large motor skills and their limitations and possibilities (see Table 2). Generally, when the GMFCS scale has a high point level, the intensity of the restriction of movement activity will be noted (Palisano, Hanna, Rosenbaum, et al., 2000; Palisano, Rosenbaum, Walter, et al., 1997).

Purpose of This Study

This study will determine the effectiveness of neuromotor rehabilitation on 23 chosen reflex patterns of children with CP in infancy, preschool, and early school using the MNRI® program and the evaluation of motor skills according to the international classification system GMFCS.

Materials and Method of Research

Characteristics of the study group

The research study was performed on 60 children aged 0 – 8 years, who were medically diagnosed with CP, in the form of: 1) spastic paresis of varying severity (hemiparesis), 2) spastic paresis of four limbs (tetraplegia), 3) mild cerebellar syndrome with mental disorders (ataxia and hypotonia), and 4) extrapyramidal syndrome (dyskinesia, not including dystonia). The children all attended MNRI® camps organized by the Dr. Svetlana Masgutova International Institute (SMEI) in Mielno, Poland at the Sirena Rehabilitation Center. Participants of the two-week camp were administered rehabilitation for 6 hours a day by MNRI® therapists with basic training as PT, OT, SP, and other fields of special corrective education. Parents/caregivers of the children who were involved in the therapy and this study gave their consent for the children to participate in this study. Evaluation and statistical analysis of the results were carried out before and after the completion of the MNRI® therapy program. Statistical information for the children with regard to clinical diagnosis, age, and gender is illustrated in Table 1.

Description of research methods

The level of development of reflex patterns was diagnosed within a scale of 0 – 20 points according to the Masgutova system. The Assessment takes into account the accuracy of the sensory-motor reflex pattern, the direction of the reaction, strength (regulation of muscle tone), latency (time of onset, duration and termination of the reaction), and the symmetry of the response to a stimulus (Masgutova, Akhmatova, 2010). Reflex Assessment criteria with the level of pathology, dysfunction, and norm, and their patterns is discussed in the chapter, *MNRI® Assessment for Determining the Level of Reflex Development* in this book.

The children in this study were also evaluated using the GMFCS system to determine their level of motor disability. The GMFCS was administered at the beginning and end of the MNRI® camp experience. The criteria and description of the GMFCS scale is on Table 2. A two-way analysis of variance (ANOVA) was calculated on participants' ratings on the MNRI® Reflex Assessment and the GMFCS to the statistical verification tests ANOVA and Chi-2McNemary using the level of $p < 0.05$ as statistically significant.

Table 2: Gross Motor Function Classification System
Criteria and Description of Scale

GMFCS Level I:
- **Can walk indoors and outdoors and climb stairs without using hands for support**
- **Can perform usual activities such as running and jumping**
- **Has decreased speed, balance and coordination**

GMFCS Level II:
- **Has the ability to walk indoors and outdoors and climb stairs with a railing**
- **Has difficulty with uneven surfaces, inclines or in crowds**
- **Has only minimal ability to run or jump**

GMFCS Level III:
- **Walks with assistive mobility devices indoors and outdoors on level surfaces**
- **May be able to climb stairs using a railing**
- **May propel a manual wheelchair and need assistance for long distances or uneven surfaces**

GMFCS Level IV:
- **Walking ability severely limited even with assistive devices**
- **Uses wheelchairs most of the time and may propel own power wheelchair**
- **Standing transfers, with or without assistance**

GMFCS Level V:
- **Has physical impairments that restrict voluntary control of movement**
- **Ability to maintain head and neck position against gravity restricted**
- **Impaired in all areas of motor function**
- **Cannot sit or stand independently, even with adaptive equipment**
- **Cannot independently walk but may be able to use powered mobility**

(Palisano, Rosenbaum, Walter, Russell, Wood, Galuppi, 1997)

Results and Discussion

Analysis of levels of integration of specific reflexes before and after therapy

Figure 1 presents the results of the average levels of integration of 23 reflex patterns before therapy (in red/orange), and after the MNRI® camp (in green). The lowest level of integration before treatment was characterized by reflexes: X19 - Flying and Landing (average value of 4.15), X13 – Bauer Crawling (average value of 4.50), and X9 - Leg Cross Flexion-Extension (average value of 4.89). The highest level of integration before treatment were characterized by reflexes: X27 - Pavlov Orientation (average value of 8.48), X15 – Fear Paralysis (average value of 7.65), X14 - Moro (average value of 7.65), and X6 – Hands Pulling (average value of 7.37). All reflex pattern test results show a higher level of integration after therapy at the MNRI® camp. Detailed comparative analysis of statistical tests (t-test for dependent samples) showed statistically significant differences at level $p < 0.05$.

Interestingly, the change in the level of reflex integration in the children of the study is different depending on the form of CP, as illustrated in Table 3. Analysis of changes in the level of the integration of reflexes in children, depending on the clinical form of paralysis showed that children with symptoms of extrapyramidal syndromes achieved, on average, the best improvement in the level of the development of reflexes, followed by children of hemiparesis, tetraplegia, and ataxia (cerebellar form).

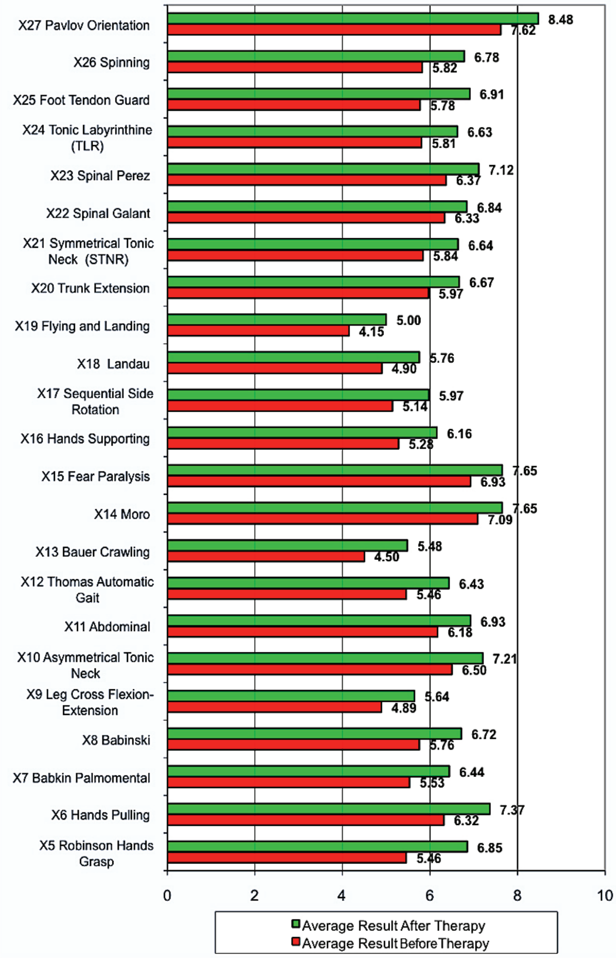
Testing motor disability level in children in GMFCS scale

Analysis of motor disability in the GMFCS scale in the study group, before (Test 1) and after (Test 2) MNRI® treatment during the rehabilitation camp, was carried out on the percentile basis, as illustrated in Table 4.

Children examined before therapy (Study 1 - Test-1) attained skills from levels III-V, which indicates low psychomotor development, meaning a majority, as 39 children (65%) reached the fifth level, 16 children (27 %) achieved level IV and only 5 children (8%) achieved a level III on the GMFCS scale. The level of motor skills was also examined at the end of the rehabilitation camp. Statistical comparison shows significant differences $p < 0.05$, which are indicated in Table 4 in bold with an asterisk*.

Figure. 1

Average Level of Reflex Development Before and After MNRI® Therapy



The age group 0-2 years from level V, with limited self-control of reflexes and maintenance of antigravity posture of the torso and head, showed improvement entering compartment IV, acquiring skill rotation from back to stomach. After treatment, three children aged 2-4 years with level V motor skills, passed to level IV, and three children from level IV to level III, already achieving the ability to sit with help and to move about on the floor. They also started demonstrating an ability for trunk righting posture with the help of people and equipment.

Statistical analysis shows significant differences in the level of motor disability in test groups I and II. However, within the age group 4-6 years of seven surveyed, four present level IV, that is, sitting with the help of equipment and moving with the help of people and instruments for a short distance in trunk righting but having difficulty maintaining balance on an uneven floor. The remaining three children, in terms of motor skills display level V, that is, impaired movement including a limited ability of self-control and maintenance of an anti-gravity posture. After treatment in this age group, one child achieved abilities that reclassified him from level V to level IV.

In the oldest group, children aged 6-8 years, in the six surveyed before treatment two qualified for the III skill level, which translates to the ability to walk on flat surfaces indoors and outdoors with the help of additional equipment, and three presented level IV, whose skills remained at level of six years of age. One child presented level V of development. Improvement after therapy was observed in one child, recorded in the change of classification from level IV to level III, which can be considered as a great therapeutic success.

Discussion

The MNRI® therapeutic program is aimed at improving sensorimotor and cognitive function within the concept of reflex integration in children with various forms of CP. The MNRI® program proposes unique opportunities to encourage coordination between the work of the sensory and motor neurons which supports the neuro-rehabilitation process of children with CP. Based on the data gained in this study, the MNRI® program is effective in the treatment of children with various symptoms of brain dysfunction, both congenital and acquired (Masgutova, Sadowska, 2004). Physiotherapy specialists, knowing the profile of reflex patterns in children with CP may determine (1) the level of development in reflex patterns of individual cases, (2) analyze/find the links between reflexes and motor skills, and (3) effectively use this information to individualize therapeutic programs to enhance the possibilities of a child to gain improved motor function. This study shows the therapeutic effectiveness of the MNRI® method in children with CP with two weeks of intensive program. These results can be used to more effectively plan a program for each child using the MNRI® program as well as individualize it for different types of CP.

Table 3. Differences in the level of reflex development before and after MNRI therapy in children with hemiplegia, tetraplegia (=quadriplegia) and ataxic CP and extrapyramidal CP (athetosis).

#	Reflex	Reflex #	Average difference			
		X	Hemiplegia n=19	Tetraplegia n=8	Ataxia n=22	Extrapyramidal CP n=11
1	Robinson Hands Grasp	X5	0.79	1.69	1.43	2.14
2	Hands Pulling	X6	0.79	1.50	0.93	1.41
3	Babkin Palmomental	X7	0.71	1.00	0.82	1.36
4	Babinski	X8	0.89	1.19	0.77	1.27
5	Leg Cross Flexion-Extension	X9	1.03	0.94	0.48	0.68
6	Asymmetrical Tonic Neck Reflex (ATNR)	X10	0.71	0.75	0.50	1.09
7	Abdominal Sleep Posture	X11	0.82	0.88	0.57	0.91
8	Thomas Automatic Gait	X12	1.18	0.88	0.68	1.27
9	Bauer Crawling	X13	1.29	0.81	0.64	1.27
10	Moro	X14	0.63	0.56	0.25	1.05
11	Fear Paralysis	X15	0.79	0.63	0.34	1.45
12	Hands Supporting	X16	1.21	0.88	0.41	1.23
13	Sequencial Rolling	X17	0.97	1.11	0.30	1.45
14	Landau	X18	0.74	0.88	0.77	1.23
15	Flying and Landing	X19	0.84	1.19	0.68	0.95
16	Trunk Extension	X20	0.61	0.69	0.66	0.95
17	Symmetrical Tonic Neck	X21	1.00	0.56	0.68	0.86
18	Spinal Galant	X22	0.50	0.63	0.68	0.09
19	Spinal Perez	X23	0.84	0.50	0.64	1.00
20	Labyrinthine–tonic	X24	0.92	0.31	0.80	1.05
21	Foot Tendon Guard	X25	1.16	0.50	0.82	2.18
22	Spinning	X26	0.95	1.06	0.84	1.14
23	Pavlov Orientation	X27	1.34	0.81	0.45	0.86
24	**Average Difference for all reflexes**		**0,90**	**0,87**	**0.66**	**1.17**

Table 4. Level of disability according to the GMFCS scale before and after treatment compared to Chi-²McNemary test.

Level of disability according to the GMFCS scale	I GR. (0-2 y) n=18*		II GR. (2. 1-4 y) n=29*		III GR. (4. 1-6 y) n=7		IV GR. (6. 1-8 y.) n=6	
	Test-1	Test-2	Test-1	Test-2	Test-1	Test-2	Test-1	Test-2
I	0	0	0	0	0	0	0	0
II	0	0	0	0	0	0	0	0
III	0	0	**3**	**6**	0	0	2	3
IV	**3**	**5**	**6**	**6**	4	5	3	2
V	**15**	**13**	**20**	**17**	3	2	1	1
Total	18	18	29	29	7	7	6	6

Above, GMFCS scale results before and after MNRI® treatment show the percentage of children placed in each of four groups, based on their test performance compared to Chi-2McNemary test (asterisks indicate statistically significant results according to McNemar's Chi-square test).

Summary and Conclusions

The accuracy of the diagnosis determines the effectiveness of the rehabilitation process for children with brain damage at birth. This study explores the use of tests for assessing the functional motor skills (psychomotor test GMFCS scale) and the MNRI® Reflex Assessment (targeting the level of maturation of 23 reflex patterns). The neurological state of children with brain damage is quite diversified and diagnosis is difficult, both in terms of determining the level of reflex development, as well as motor skills related to chronological age of a child. Both the Assessment of the level of reflex development of the 23 studied reflex patterns as well as the test of the level of motor disability according to the GMFCS scale are complicated and demand the special training of a professional. This study demonstrates that when appropriate protocols are administered, the possibility of a positive outcome of the therapy process is probable and falls in a statistically significant range ($p > 0.05$). The research presented in this paper offers the following conclusions:

1. Children with CP are characterized by a pathological or low level of neurological development of reflexes and impaired skills in spontaneous motor activity.

2. Improvement in the reflex development in children with CP after 2 weeks of therapy following the typical program offered at the MNRI® camp was statistically significant ($p < 0.05$). Children with extrapyramidal CP symptoms achieved the greatest improvement followed by children with hemiplegia, quadriplegia, and ataxia.

3. The younger age group of children (under 4 years) in MNRI® treatment favorably correlated with the level of reflex integration and a reduction of motor disability at a higher statistically significant level of $p < 0.05$.

Abstract

The aim of this study was to determine the degree of development of 23 neurological reflexes in spontaneous motor activity according to the MNRI® method and the level of motor disability, measured by the GMFCS scale in 60 children with different clinical forms of cerebral palsy, aged 0-8 years. This study group of children was divided into four age groups (I- from 0 to 2 years, II- 2-4 years, III- 4-6 years, IV- 6-9 years) undergoing improvement according to the MNRI® program offered at a two-week MNRI® camp. Based on the results presented in the tables and graphs, which were verified statistically significant at the $p > 0.05$ level, demonstrated the efficacy of the MNRI® therapy, which was manifested by an increase in the average level of reflex development, while still remaining within the limits of a pathology or deep dysfunction. In each tested age group, after therapy, children were found to demonstrate a significant change in their level of motor disability on the GMFCS scale.

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We express our endless gratitude to these children and their parents for the participation in our research. We congratulate our children for their great improvement in sensory-motor development and wish them good health and new achievements! Your loving hearts and smiles are the best example to us on how to create joy in this life. – Authors