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**“Benefits of associated physical therapy used in the recovery of the functional deficiencies of the lower limb in children with cerebral palsy - spastic paraparesis form”**

**SUMMARY**

**SCIENTIFIC COORDINATOR**

Prof. Univ. Dr. Roxana Sanda Popescu

**PhD STUDENT:**

Caimac Visarion Dănuț

**CRAIOVA**

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## CONTENTS

### I. GENERAL ASPECTS – STAGE OF KNOWLEDGE

1. DEFINITION AND CLINICAL PRESENTATION OF INFANTILE CEREBRAL PALSIES (PCI).....	1
2. FUNCTIONAL CHANGES IN THE LOWER LIMB.....	18
2.1. Balance and posture control.....	18
2.2. Acquisition and walking development .....	24
2.3. Pathological aspects with impact on the lower limb functionality in ICP children.....	35
3. FUNCTIONAL REHABILITATION OF THE SPASTIC LOWER LIMB IN PATIENTS SUFFERING FROM PARAPARESIS .....	43
3.1. Current approaches to recovery therapy .....	43
3.2. Therapeutic management of ICP.....	48
II. SPECIAL SECTION- PERSONAL CONTRIBUTIONS	
4. MOTIVATION AND PREMISES.....	64
4.1. ICP cases management.....	64
4.2. Physical-kinetic treatment.....	72
4.3. Research prerequisites.....	75
5. PURPOSE AND SPECIFIC OBJECTIVES.....	79
6. METHODS AND MATERIALS.....	81
7. SURVEY RESULTS.....	126
7.1. Etiological, clinical and functional assessment in a group of ICP children - spastic paraparesis.....	126
7.2. Physical-rehabilitation program's effects on lower limb functionality in the group of children with ICP- as spastic paraparesis.....	141
7.3. Clinical and functional correlations in assessing the spastic lower limb's functionality.....	165
8. DISCUSSIONS.....	169
9. CONCLUSION.....	180

REFERENCES..... 183

**Keywords:** Infantile cerebral palsy; spastic paraparesis, evaluation; rehabilitation; walking; balance.

## GENERAL ASPECTS

Infantile cerebral palsy (ICP) covers a very wide variety of clinical issues and a variety of functional limitations manifested in various degrees. The definition and classification of ICP have recently been re-examined and revised. The new definition identifies the associated diseases in order to emphasize the fact that the ICP child has multidimensional needs whose management requires a multidisciplinary approach. Therefore, this is the unanimously accepted definition of CP : *“Cerebral palsy is a term that describes disorders of movement and posture development which causes restriction of the activity, due to certain non-progressive deteriorations in the fetus or infant’s brain development. „The motor disorders are often accompanied by sensory disturbances, cognition, communication, perception and / or behaviour or convulsions.*

PC brings together a variety of clinical manifestations that do not have a specific management pattern. The attitudes regarding therapeutic intervention and case management are the consequence of an analysis provided by each patient’s evaluation. The management provided by a multidisciplinary team is based on a wide range of therapeutic options. Spasticity and its association with reduced activity that may cause secondary changes (underdevelopment of longitudinal muscles, muscle-tendon retraction, deformities and segment misalignments) is the main change that contributes to the functional disorders in children with ICP.

The occurrence of these changes in the lower limbs, as occurs in the form of spastic paraparesis, leads to major disruption of the activities and child’s participation due to major effects on posture control, activity and balance with significant negative impact concerning neuromotor development and learning process. Therefore, most of the therapeutic programs aim to control spasticity and its effects on segmental and global functionality. PC is still an important health problem despite the significant progress in medicine.

The present thesis, *“Benefits of associated physical therapy used in the recovery of the functional deficiencies of the lower limb in children with cerebral palsy- spastic paraparesis form”* contains 200 pages, 62 pages regarding general aspects and 138 pages of personal contribution.

The general aspects of the study comprise three chapters that systematize data regarding the etiopathogenesis, epidemiology and the pathological aspects with impact on the lower limb functionality in children with ICP- spastic paraparesis. The third chapter presents the therapeutic management of these cases, focusing on the physical means of treatment.

The second part of the thesis (personal contributions) is divided into six chapters (Motivation and Premises, Purpose and Specific Objectives; Materials and Methods, Results, Discussion, Conclusions). Given the variety of studied parameters and in order to provide an overview on the etiological, clinical, functional, and evolutionary and recovery issues we have organized a study that analyses the functional deficiencies’ recovery in children with ICP- spastic paraparesis.

The essential aim of this paper is to study the etiological, clinical and functional aspects involved in the design and evaluation of complex recovery therapy for children with psycho-neuro-motor disabilities diagnosed with cerebral palsy - spastic paraparesis, according to the worldwide used terminologies.

The study (observational, non-experimental) was conducted during March 2007 - March 2011 on a group of 94 children diagnosed with ICP, spastic paraparesis, aged between 5 to 10.

The children were part of complex therapeutic programs within the General Directorate of Social Assistance and Child Protection Dolj county: Rehabilitation Centre for children with neuromotor disabilities nr.6 Craiova , Neuromotor rehabilitation centre for children after the age of seven from Craiova and Training centre for medical support, prevention and recovery within the Faculty of Physical Education and Sport - Physical Therapy, University of Craiova.

*Study objectives:*

- setting goals and methods of functional recovery based on clinical and functional status as well as on the associated disorders,
- the management of lower limb spasticity,
- impact research, results and effectiveness of physical-kinetic recovery of the lower limb's function in children with spastic PCI,
- overall evaluation and gross motor skill assessment after a complex rehabilitation program for a 12 - month period in a group of ICP children
- clinical and functional correlations regarding the outpatient (ability of walking autonomously) in the therapeutic process of recovery of these children.

The therapeutic method gradually used conservative methods, these being combined depending on the functional level and the spasticity severity. The conservative rehabilitation therapy's progression was the following:

*1. Means of preventing spasticity*

*2. Therapeutic interventions - physical-kinetic treatment*

*3. Posture / orthotics*

Lower limb's functional parameters as well as global functions have been assessed using clinical and functional standardized scales and instrumental methods that allowed functional staging, choice of therapeutic method and assessing the effectiveness of therapy. The studied parameters were represented by joint mobility limitations, changes in muscle tone, balance and postural control elements and coarse motor function.

Functional parameters lower limb, as well as global functions have been assessed using scale clinical standardized functional and instrumental methods which have enabled functional stadializarea, the choice of method and assessment therapeutic effectiveness therapy.

We used SYSTAT software, version 13 specialized in scientific statistical calculations for data processing as well as Data Analysis module of Microsoft Excel with XLSTAT 2009 statistical add-on, manufactured by ADDINSOFT.

The evaluation of the therapy results on joint mobility by testing the studied movements, revealed increasing amplitudes for hip abduction ( $p < 0.0001$ ), knee extension ( $p < 0.0001$ ) and dorsal flexion of the foot ( $p < 0.0001$ ).

The muscle tone status before and at completion of the physical-rehabilitation treatment, was assessed in two ways. We used the spasticity score values calculated with modified Ashworth scale in the adductor muscles of the hip, knee flexor and plantar flexion of the foot, and the results of the evaluation's instrumental stiffness by using the Myoton device.

We evaluated the balance following the evolution of the scale score calculated by Berg (BBS) and using the Pagani testing platform. The obtained parameters used to assess treatment outcomes were represented by average X and average Y.

The analysis of the average score calculated according to the BBS chart scale has shown growth of 19.85 to 26.12 ( $p = 0.002$ ) between T0 and T2 of the assessment. By moving the gravity center's projection related to the X and Y axes we can highlight the improvement at the end of treatment phase.

The global functional analysis was performed using 88-66 GMFM scale. The calculated score for assessing gross motor function shows an increase in its average of 54.92 (T0) to 61.52 (T2) ( $p < 0.0001$ ).

Based on analyzing the trends of the studied parameters between the two set times, we sought to establish clinical and functional correlations for assessing segmental and global functional gain that the therapeutic program proposed and developed for the spastic lower limb.

Correlations were assessed at the level of parameters pairs in order to determine the interdependence that characterizes the effects that different types of clinical and functional changes might make.

For the pair of parameters represented by the Ashworth score in the hamstrings muscles and the stiffness measured for the femoral muscle we calculated the r coefficient of linear correlation. The result shows the lack of correlation at T0 in both legs, while at T2 there is a direct correlation only in one leg. The same pattern, applied to the pair of gastrocnemius stiffness - the gastrocnemius Ashworth score, highlights a direct correlation, which is kept at all times of evaluation.

By analyzing the parallel evolution of the score provided by BBS scale and Average X and Y parameters we drew the following conclusions: there is a direct link between BBs score and Average X whereas between the BBS score and Average Y there is none. The explanation for these differences is the fact that the imbalance in the sagittal plane was influenced by the propensity of muscle and joint interventions on changes that occurred in the same plane.

The analysis of the hip joint mobility development, knees and ankles, the directions of motion tested in parallel with the development of spasticity (Ashworth score) in the muscle groups evaluated (adducts hip, hamstrings and gastrocnemius), highlights the existence of a direct correlation between the degree of knee extension deficit and hamstrings' degree of spasticity. On the other hand, there is an inverse correlation between the amplitude of both coxo-femoral abduction and hip adductor spasticity degree and dorsal flexion of the foot between the magnitude and extent of the gastrocnemius spasticity.

## **Conclusion**

ICP is an important public health problem, despite the progress made in medicine. It is difficult to set the incidence of PC at birth because motor dysfunctions can be frequently noticed only when the progress in evolution would admit a benefit regarding functionality.

The addressability of ICP cases in the healthcare system in our country is low, especially in the rural areas. This highlights the need to organize a social system that would provide medical diagnosis, assessment, functional classification and therapeutic management of children with this type of pathology through a multidisciplinary approach in which recovery programs are focused on the child and his family.

The study we organised followed the etiological aspects, clinical and functional implications in the treatment of lower limb complex disorders in children diagnosed with ICP, one of the main premises which we started from, being represented by the fact that physical therapy is an essential component of the recovery program. The doctor involved in pediatric recovery should cooperate and integrate multidisciplinary team of professionals regarding the choice of the best medical and educational therapeutic methods, to motivate the child and his family to involve in the recovery program, choosing the most appropriate therapeutic methods according to the age, clinical staging and functional distribution for each patient.

A strict clinical and functional evaluation is a precondition required to set clear therapeutic aims as well as the most effective treatment actions. For this reason we used, in addition to the classical methods of clinical testing, two reliable instrumental methods capable of providing quantifiable results for a number of parameters depending on the disorders' features of the studied pathology. Thus, we have tested muscle tone even using the Myoton with the Pagani platform, methods which we have linked with Ashworth, GMFM and BBS functional scales.

This paper presents a recovery protocol for children with cerebral palsy-spastic paraparesis -focusing on specific measures of kinesiology, and the significant auxiliary role of hydro kinotherapy and electrotherapy procedures and means of lower limb orthotics.

The results of spastic lower limb treatment are encouraging in accordance with the implementation of physical-rehabilitation programs consistently and gradually adapted. The outcome will be assessed with more precise evaluation methods for quantifying the dysfunctional aspects and allow individualization as a more accurate therapy.

We consider that the acquired results may become useful for medical recovery specialists in their job as care providers and recover functional deficits deficiencies shown in the lower body, but also the overall functionality of the child with spastic paraparesis. We also believe that further research is necessary in the future in terms of adaptation and individualization of therapeutic recovery programs in conjunction with the methods of evaluation and quantification of disabilities and the therapy results in cases of cerebral palsy.

