

# REHABILITATION STRATEGIES FOR THE IMPROVEMENT OF BALANCE IN POST-STROKE HEMIPLEGIC PATIENTS

## PhD Thesis ABSTRACT

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### *PART I: The theoretical context of the research*

According to statistics, stroke is a global health problem, with an occurrence of more than 16 million new cases annually. It is the second death cause worldwide and one of the main cause of severe impairment. Approximately 80% of all strokes may be prevented through specific means of reducing the individual's personal risk. Starting with the 1990s, the survival rate after a stroke has increased, yet most of the survivors have specific motor impairments, sensibility, communication, cognitive deficits or noticeable impairments in time and space perception.

Stroke among young individuals is a major social and economic issue. Such survivors are impaired for a longer period of time than the elders with similar conditions. This implies higher costs for the social and medical national systems due to a decrease in work productivity and an increase of the social and psychological secondary complications. These complications refer to a rise in the stress level generated by their families, institutionalization, community reintegration and future needs.

Romania is amongst the first 10 European countries regarding stroke incidence, with almost 200 new cases per 100000 inhabitants annually. In the past years statistics have shown that it is also one the first European countries regarding death incidence after stroke, therefore it is extremely important to have a high performance medical approach of these patients.

Functional rehabilitation is the main objective of physiotherapy following stroke. It is important to have a contemporary understanding and approach of the patient so that the rehabilitation program is correctly individualized to his needs. Modern rehabilitation does not rely on a specific method or technique but on the accurate selection of the specific elements that belong to a certain method and their integration in an individualized rehabilitation plan. Thus, the literature refers to concepts (e.g. the Bobath concept).

In the first part of this paper we described the general theoretical context of our field of interest. We provided the latest information regarding stroke diagnosis, risk factors and the modern balance rehabilitation strategies. In the second and third part we tried to determine the efficiency of our own balance

rehabilitation means in post ischemic stroke patients. We compared the initial and final assessment results inside a trial group treated with the original kinetic program that we designed, as well as the results of two larger groups of subjects, an experimental and a control one. The experimental group benefitted of the kinetic program that we created and the control one was submitted to a classical rehabilitation approach.

In this context, our research may be a valuable scientific document for all the professionals who want to gain experience in stroke rehabilitation, taking into account the fact that in Romania one cannot find enough information regarding the balance rehabilitation in post-stroke patients.

There are two main types of stroke, ischemic strokes and hemorrhagic strokes, which affect the brain in different ways and can have different causes. This classification is based on its mechanism of occurrence. Stroke risk factors are divided into modifiable (e.g. high blood pressure, obesity, sedentary lifestyle) and non-modifiable ones (e.g. age over 55, male gender). It is important that the population is informed about the acute stroke symptomatology, in order to have a fast medical intervention. The concept „time is brain” means that every minute of delay in the treatment has severe implications in brain functionality. Stroke initial symptoms are:

- ✓ Numbness in the face and limbs, mainly in one half of the body;
- ✓ Confusion, speech disability or difficulties in understanding speech;
- ✓ Vision impairment in one or both eyes;
- ✓ Difficult performance of gait, dizziness, loss of coordination;
- ✓ Severe headache with no reasonable cause.

Stroke is the main cause of falls in adults. Their static and dynamic balance is severely impaired, having a postural balance almost twice as large as that of age matched individuals with no physical impairments.

The international literature provides a large number of studies regarding stroke rehabilitation. Scientists have analyzed the efficiency of various concepts in motor rehabilitation. In case of stroke patients, the central nervous system is severely impaired, making rehabilitation difficult and provoking.

The literature has described two types of recovery: the neurological one and the functional one. The neurological recovery is the result of brain reorganization and refers to the recovery of the neural deficits. It is influenced by the therapeutic strategies used in rehabilitation. The functional recovery addresses the motor impairments and its main objective is the improvement of ADL performance. It is determined by the rehabilitation means used by the therapist and also by the patient’s motivation, learning abilities and family support. Functional recovery is influenced by the neurological one, but does not rely on it.

According to the international literature, the balance rehabilitation models in post-stroke patients are classified into bottom-up and top-down approaches. As a result of the complex assessment process, therapists can choose the optimal

therapeutic means that can determine the improvement of each patient's functional parameters.

Balance rehabilitation programs address each sensory component (visual and vestibular systems, proprioception), that provides the postural balance. Therefore, in order to improve one system, the therapist disrupts the others or the environment. Progression is mandatory; at the beginning more stable positions of the body are being used.

In the past decades, in the field of cognitive and cybernetic psychology, several attempts were made to a better understanding and approach of the human being. A systemic and functional-dynamic outlook was created, that of the human as a complex bio-psycho-social system (Engel, 1977). Together with the holistic approach, this new idea offers unique perspectives on the activities the humans are involved in, as well as on the many available therapeutic approaches.

For better results, patients should be treated in an integrative manner. The bio-psycho-social concept is an original and dynamic approach of the human personality, which refers to the interdependence that occurs between the biological, psychological and social components of each individual. It reveals the positive (salutogenesis) or negative (pathogenesis) interdependences existing between these three dimensions.

For a long time, Engel's model was preceded by the biomedical model, which considered only the biological factors as the main determinant of a disease. Even nowadays, many specialists prefer this approach, because the biological factors are easier to identify and treat. Many times, this approach does not have the best results.

Engel's model is still valid, but has many critics. It has also been enriched with new elements, such as the ecological factors (Ikemi) and the spiritual ones (Poldinger). "The human is not only a being, a biologic reality, but also a thinker and a volitional entity that has feelings and emotions. His essence is biological, but also psychical" (Negulescu, 2007). Human beings are responsible for their own lives and every choice is made based on a personal system of values.

Analyzed from this perspective, the human being is a living and evolving system, with energetic and informational origins, with a very well established structure of his subsystems. His purpose is the permanent adaptation of his behavior to the internal or external factors through complex mechanisms of regulation and self-regulation.

The main goal in physiotherapy is to establish function in a way that gives the patient independence in performing everyday activities. Each disability acts as a stressor on the human being, generating a decrease in his quality of life. Pain, loss of one's ability to perform tasks at its fullest or even the dependence on a third party lead to social and psychological disorders that will unbalance the human being and will also determine other diseases. This will also affect his motivation, will and desire to progress, thus increasing the imbalance.

In terms of salutogenesis, the effects of functional physiotherapy are seen in all the physical, psychological and social areas. The aim is to restore health by achieving a permanent balance between these three components.

Restoring the morphological and functional parameters generates personal satisfaction, which reflects in the individual's performance of daily activities. Therefore, his quality of life and his desire of social affiliation will improve.

## ***PART II: The preliminary research***

The preliminary research was conducted based on a series of premises which include:

1. The increasing incidence of post-stroke patients in most of the hospitals in Bucharest;
2. The increasing incidence of stroke in younger adults who have different needs than the elderly and should benefit from a carefully designed therapeutic approach;
3. According to the international practice, the efficiency of a method or new medical approach should be scientifically sustained with evidence;
4. The dynamic character and a wide possibility of use of the research results on different groups of subjects, at different ages.

The *aim* of the research is to determine the efficiency of our original rehabilitation strategies for the improvement of the static and dynamic balance in post-stroke hemiplegic patients. Its objectives are:

- ✓ The identification of the optimal assessment tools which can provide the data as a result of the therapy that we used;
- ✓ The identification of the optimal rehabilitation strategy which can lead to an improvement of the subjects' static and dynamic balance thus increasing their functional independence;
- ✓ The identification of the efficiency of our original kinetic programs.

According to the previous premises and taking into account these objectives we have tested the following hypothesis:

1. The use of our individualized kinetic programs leads to a diminishment of the subjects' lower limb spasticity;
2. The use of our individualized kinetic programs leads to an improvement of the subjects' functional independence;
3. The use of our individualized kinetic programs is useful for the improvement of the subjects' static and dynamic balance.

The preliminary research lasted from March 2012 to March 2013 and was conducted on a group of 15 subjects aged 45-65 years old, hospitalized in the Rehabilitation Department of Ilfov Emergency County Hospital in Bucharest. The patients were diagnosed with hemiplegia secondary to a less than one-year-old ischemic stroke. The physical therapy program had a 8-week duration and a 5 times per week frequency.

The research methods that we used in the study were: the bibliographic research, the observation method, the survey method (personal interview of the patient or the caregivers), the experimental method, the statistical method, the graphic representation, as well as various specific functional assessment tests.

The initial and final assessments were tailored on collecting data about the patients' disability through specific tools such as:

- ✓ The patient history form;
- ✓ The Modified Ashworth Scale for spasticity;
- ✓ The Barthel Index for grading the patients' functional independence;
- ✓ The Postural Assessment Scale for Stroke (PASS) for the assessment of the patients' static and dynamic balance;
- ✓ Different tests for grading proprioception, kinesthesia and for the identification of the palpatory stimulus.

The subjects were assessed at hospitalization and discharge. Their blood pressure and heart rate were monitored before and after each physiotherapy session. In accordance to the results of the initial assessment, the rehabilitation plan consisted in analgesic electrotherapy, ultrasound therapy, functional electrical stimulation and individualized physiotherapy.

We used the following rehabilitation concepts:

- a. Bobath;
- b. PNF;
- c. Margaret Rood;
- d. Integrative Physiotherapy;
- e. Spacial Dynamics;
- f. Le Metayer;
- g. Perfetti.

The statistical analysis of the initial and final assessment results allowed us to validate all the three hypothesis and to proceed to the development of the main research.

### ***PART III: The main research***

The main research was developed based on the premise that every rehabilitation strategy should be integrated in its field of interest through an objective comparison with the other available concepts. Having the positive results of the preliminary research, we designed a scientific approach whose *aim* was to determine the efficiency of the original physiotherapy program that we created in comparison with a traditional outlook.

The main research had a 24-months duration, from April 2013 to March 2015. We tested the following hypothesis:

1. The original physiotherapy strategy that we created can lead to a higher improvement of the subjects' lower limb spasticity compared to a traditional approach.

2. The original physiotherapy strategy that we created is more efficient for the improvement of the subjects' static and dynamic balance in comparison to a classic approach and determines a more significant improvement of the subjects' functional independence degree compared with the traditional one.

The study was conducted on two groups of 28 subjects each, an experimental and a control group. The subjects' age was between 45 and 65 years old. The experimental group subjects were submitted in the Rehabilitation Department of Ilfov Emergency County Hospital in Bucharest while the control group subjects were hospitalized in the following units in Bucharest: Ilfov Emergency County Hospital, The Military Hospital, "St. Luca" Hospital and The National Rehabilitation Institute. They were diagnosed with a less than one-year-old ischemic stroke and each of them benefited of 8 weeks of functional rehabilitation.

We described the research methods and the assessment tools in the previous section. The classic therapeutic approach used in case of the control group included specific elements from the PNF, Bobath and Margaret Rood concepts, as well as various exercises that required different equipment (e.g. pulley therapy).

The statistical analysis of the final assessment results proved that our rehabilitation strategy was not statistically significant for the improvement of the subjects' lower limb spasticity and static balance, compared to the traditional approach, yet its efficiency was proven in case of the functional independence degree and the improvement of the subjects' dynamic balance. Therefore the first hypothesis of the main research was rejected and the second one only partly validated.

### *Conclusions*

1. Both rehabilitation strategies, the original and the classic one, were efficient in determining a decrease of the subjects' lower limb spasticity. The differences between the two methods were not statistically significant.
2. Both methods lead to the improvement of the subjects' functional independence degree and the differences were statistically significant.
3. The static balance was not significantly improved by the use of the original physiotherapy program compared to the traditional one, while the differences between the two methods were statistically significant in case of the dynamic balance.
4. Further research is needed in order to assess our rehabilitation strategy's efficiency on different age groups subjects.