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Title of the doctoral thesis: OPTIMIZATION OF THE FUNCTIONAL RECOVERY IN POSTTRAUMATIC PARAPLEGIA THROUGH ADAPTED SPORTS

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The strictly specialized needs of the persons with posttraumatic paraplegia have determined, in the course of time, the emergence and development of some recovery methodologies that are not limited to medical treatment and kinesitherapy programs, but integrate information from many domains, so that the individual can regain his functional independence and his role of active citizen in the society where he lives. The concerns with recovering the persons with posttraumatic paraplegia converge to the maximum mobilization of their remaining functional potentials, by involving them into a recovery dynamic process meant to conceal their disabilities and underline their real possibilities of participation to social life.

Adapted physical education and sports also find their place in this context, because, due to their distinct content, they can potentiate the effects of the performed recovery exercises. Thus, adapted physical activities expressed through the practice of different sports branches or events become complementary to the kinesitherapy programs, by completing the functional recovery methodological tools destined to paraplegic persons and, consequently, by providing favorable premises to their social integration.

The present doctoral thesis is structured on 3 parts including 17 chapters.

Part I treats about the **Theoretical, methodological and conceptual foundations of the functional recovery in posttraumatic paraplegia.**

The *purpose* of our topic is to make a minute research on the possibilities of assessing and recovering the persons with posttraumatic paraplegia. This will lead to the creation of some functional recovery programs which also include, together with the kinesitherapy, adapted sports programs.

In this sense, we set up the following *objectives* for our research:

1. *To highlight the pathology elements related to verterbo-medullary traumas.*
2. *To identify and analyze the assessment methods applied to persons with posttraumatic paraplegia.*

3. *To approach the functional recovery methodology by identifying the most efficient means for the functional potential recovery.*
4. *To apply the operational exercises and systems, in order to provide the paraplegic subjects an appropriate physical training.*
5. *To approach sports as an activity integrated into the recovery process and to assess the subjects' results after their participation in adapted sports.*
6. *To assess the impact of adapted sports as a means complementary to the functional recovery programs and contributing to the social reinsertion of persons with posttraumatic paraplegia.*

The selection of this research topic is ***motivated*** by the author's professional activity - Assistant Lecturer at the Faculty of Physical Education and Sports, specialization Kinesitherapy and special motricity, within the "*Spiru Haret*" University, and recovery activity - developed at the *Community Center for Youth and Persons with Special Needs* of the Motivation Foundation, as well as by her training stages within the *Center of Recovery and Rehabilitation of Nancy, France*, and the *Guttmann Institute - Neuro-reeducation Center of Barcelona, Spain*, her recovery practical activities developed at the Rehabilitation Hospital of Băile Felix, the Institute for Mother and Child Protection of Bucharest, the "Ana Aslan" Institute of Bucharest, the "Traian" Health Care Center of Eforie Nord and by other numerous volunteering activities afferent to the sports events organized by the *Special Olympics Romania Foundation*.

Regarding the ***pathology*** approached in the present scientific research, we should mention that paraplegia is the consequence of a vertebro-medullary trauma that leads to the lower limb complete/incomplete paralysis.

At the world level, the incidence of spinal traumas is comprised between 11 and 53 cases/ 1 million inhabitants.

Causes of the spinal traumas:

- ✓ 45% road accidents,
- ✓ 20% work accidents,
- ✓ 15.9% sports accidents,
- ✓ 15% direct traumas produced by fire guns.

The ***assessment and evolution of the functional capacities*** in persons with posttraumatic paraplegia are an important part of their recovery process. The assessment methods used in neurologic pathology, in general, and in paraplegia, in particular, are described in a distinct chapter (chapter 4). These ones are represented by a series of global functional assessment scales that quantify both the disability level and the need for assistance.

The recovery means in the spinal cord injuries are specific to kinesitherapy and to physical education and sports. Their permanent improvement represents the main objective in the functional recovery of persons with posttraumatic paraplegia.

Depending on their role and finality, on their weight and importance, as well as on their affiliation to a certain domain, the means are classified in: specific, non-specific and auxiliary (or complex) ones.

The last chapter of the first part (chapter 6) approaches the adapted sports as a complementary means in the functional recovery and the social integration of persons with posttraumatic paraplegia.

One of the *advantages* of sports practicing by persons in difficulty is that of “insuring their independence, because sports can be successfully used as a reeducation means complementary to the kinesitherapy techniques. Thus, through sports, the physical recovery activity becomes attractive and stimulating”.

Part II is a preliminary research on the functional recovery optimization in paraplegic persons through adapted sports.

The *purpose* of this preliminary research consists of studying the adapted sports impact on persons with posttraumatic paraplegia.

Our *main objective* is to determine if the social reinsertion and reintegration of persons with posttraumatic paraplegia who practice adapted sports is better than that of persons diagnosed with the same pathology, but who don't practice such an activity.

For our preliminary research, we formulated the following *hypotheses*:

1. *The adapted sports practicing by persons with vertebro-medullary trauma facilitates their socio-professional reintegration.*
2. *Persons with posttraumatic paraplegia who practice adapted sports relate an increased satisfaction level concerning the quality of their life, an increased self-efficiency and a better psychological status as compared to the subjects diagnosed with posttraumatic paraplegia, but who don't practice adapted sports.*

The sample was made up of 60 persons included into the programs sustained by the Motivation Foundation. All the participants diagnosed with posttraumatic paraplegia were aged 20 to 54 years old.

The methods used in our research are described in chapter 8: documentation method; survey method, within which we applied: Social Reinsertion Questionnaire, Quality of Life Enjoyment and Satisfaction Questionnaire, Anxiety and Depression Scale, Reintegration to Normal Living Index, General Self-Efficacy Scale; statistical-mathematical method; graphical representation method.

The *results* of our preliminary research, obtained after the application of the selected tools, prove the importance of the adapted sports practicing by the paraplegic persons to both their socio-professional reintegration and their quality of life improvement. The study results represent the foundation of our doctoral thesis theoretical-applicative approach. Besides the fact that these results are comparable to those obtained in a significant series of studies showing the positive

impact and the social reinsertion benefit on persons with disabilities, particularly on those with vertebro-medullary traumas, the participation of persons with posttraumatic paraplegia in adapted sports highlights that their possibilities of recovery and rehabilitation can be much improved through functional recovery programs which should also include, together with the kinesitherapy, adapted sports programs.

Despite some limits inherent to such a study (the sample made up of 60 subjects) and the relatively difficult application of the selected tools, we think that the present research brings extremely necessary information concerning the adapted sports impact and benefits on the social reinsertion of persons diagnosed with posttraumatic paraplegia. Moreover, this study can also provide to other specialists in the field a set of valuable information that should be corroborated, so that they allow the insertion of new programs for the paraplegic persons' functional recovery through kinesitherapy and activities specific to adapted sports.

Part III includes the **main contributions related to the functional recovery optimization in posttraumatic paraplegia through adapted sports.**

The *purpose* of our experimental research is to identify some strategies meant to optimize the recovery of subjects with posttraumatic paraplegia by using the means specific to kinesitherapy and to physical education.

In this sense, we formulated the following *hypotheses*:

1. Within the functional recovery process in posttraumatic paraplegia, the adapted sports programs, together with the kinesitherapy programs, if applied according to an appropriate methodology, contribute to the *increase of the functional independence degree*.
2. The systematic application of the adapted sports programs will lead to an *improvement of both the motor control and the postural balance*, with effects on the functional independence and the social reintegration degrees.
3. The systematic participation in adapted sports inclusive programs create premises facilitating the *social integration improvement* in the case of persons with posttraumatic paraplegia.

To conduct our research, we selected 30 subjects aged 20 to 47 years old, all of them diagnosed with posttraumatic paraplegia. Among them, 18 were male and 12 female participants. They were submitted to kinesitherapy intervention programs composed of exercises aiming at the functional recovery of the remaining capacities, but also of adapted sports programs that included exercises specific to adapted basketball and field tennis.

The methods used in this part of our research were the following: scientific documentation; observation; anamnestic interview-based survey; experiment; statistical-mathematical analysis; graphical representation.

Subjects' **assessment** was made by monitoring some parameters extremely important to this pathology:

- postural balance, for which we used *The Modified Functional Reach Test*, conceived to assess the balance sitting posture of persons with spinal cord injuries;
- functional independence, through *The Spinal Cord Independence Measure (SCIM)*, 3rd version, developed in Israel, by the Loewenstein Hospital Rehabilitation Center, in order to provide a more accurate assessment of the reaction to changes in patients with spinal cord injuries, the only complex scale assessing the ability of subjects with vertebro-medullary traumas to perform their daily activities according to their capacities;
- reintegration degree, by administering *The Reintegration to Normal Living Index*, developed to assess a patient's global functioning state during the recovery and his degree of reintegration to normal living.

An important stage of our study is represented by the conception and application of the **exercises for the recovery of the remaining physical capacities** (reeducation of breathing, mobility and balance, exercises for the upper and lower body muscular strength increase).

The **operational systems** for the subjects' physical and technical training included exercises for the learning of adapted basketball and field tennis.

The **results** of our research emphasize the importance of each monitored parameter and of the functional recovery programs, as we noticed significant differences between the subjects' initial testing and final testing. The results registered in the two assessments significantly differ from the statistical point of view. The calculated arithmetical means are significantly different in both of the assessments, with evolutions in a positive sense. The coefficient of variation, in all the cases, has a smaller value in the final assessment and this diminution validates the increased means; the value results are closer, passing from a non-homogeneous or a relatively homogeneous structure to a homogeneous one, which means progress.

In all the parameters, after the process of testing the statistical hypotheses by using the **t** test, the null hypothesis was rejected and the alternative hypothesis was accepted, the calculated significance threshold (**p**) being smaller than 0.05. Relying on this result, we can assert that, on an average, the results of the assessment methods are significantly different from the statistical point of view, which means that the exercises for the functional remaining potential recovery, associated to the physical and technical training operational structures, were successful.

As **general conclusions**, we shall mention the following:

- Adapted sports is a strong therapeutic factor which contributes to the health maintaining, increases the subjects' functional autonomy and interrelation capacity and improves the circumstances facilitating their appropriate social integration.

- Recreational and competitive sports practice (even in the wheelchair) represents a modality through which subjects release their aggression, socialize and reach excellence in a context providing the recognition of their results and the creation of a new social status.

- A successful therapy in the paraplegic persons' functional recovery and the accomplishment of the main objectives in this invalidating pathology result from the association of the kinetic programs with the adapted sports programs.

The **experimental conclusions** of our research are the following:

- Related to our subjects' postural balance, there are differences between the two testing stages (initial and final ones), by noticing an increase of the mean values from 15.37 to 30.90 units. The applied functional recovery programs had considerable results concerning the **balance improvement** in these patients and thus the first hypothesis of our research is validated.

- The application of **The Spinal Cord Independence Measure** (SCIM) is an originality element in our study and the interpretation of the **functional independence** results emphasizes the differences between the two assessments for each item on the scale (self-care, breathing, sphincteric management, locomotion). The *arithmetical means* registered the most spectacular increase at the "integration level" indicator, one of the major objectives in these patients' recovery. As to the *differences between the obtained means*, the smallest value belongs to the "self-care" indicator (2.60), which is justified by the consistency and the minor fluctuations characteristic to it.

Self-care represents the primordial element which marks the beginning of these patients' recovery and which registers the most significant progresses (as an assessment indicator) in the first recovery period; in the course of time, it is submitted to minor fluctuations, its significance being less related to the lack of importance, but rather to the new limited gains.

At the "self-care" item, the differences between the two assessments are not very important, the patients having a good initial score, but at the "breathing and sphincteric management" item, there is a difference of 12.27 units, and at the "locomotion" item, there is a major difference of 21.07 units.

The **value amplitude** shows a dispersion of data in the final assessment, determined by the registered numerical extension, and the **coefficient of variability** presents the data increased homogeneity in the final testing, which corresponds to the data progress and improvement. This conclusion validates the second hypothesis of our research.

- The results in **The Reintegration to Normal Living Index** were registered for 30 patients in both of the assessments. In the interval between the two tests, we noticed an increase of the mean values from 30.70 to 95.00, the *difference between the obtained means* being of 64.30 units. The analysis performed with the **Bilateral**

t test showed a *statistically significant difference between means* ($P=0.000 < 0.05$). Thus, the null hypothesis was rejected and the alternative hypotheses were accepted. The obtained results indicate an evolution favorable to our patients after the application of the recovery programs. The highest value belongs to the “reintegration level” (64.30), it being supported by the sports practice social function.

The present research updates many theoretical aspects and proposes new work and assessment directions, by using the latest information in the field. Among them, we mention:

- new theoretical elements, updating and introducing in our country the latest findings related to paraplegic persons’ recovery, assessment and reintegration (as presented in the international literature);

- capturing the latest references provided by the specialty literature on the new possibilities and perspectives in the posttraumatic paraplegia treatment and recovery;

- conceiving and applying the exercises for the functional remaining potential recovery;

- conceiving and applying the physical and technical training operational structures adapted to paraplegic persons’ particularities and needs;

- utilization of the adapted sports as means complementary to recovery and reintegration;

- introduction and utilization of a new assessment scale that proved to be efficient, reliable and relevant, being already tested in excellence centers from other countries;

- introduction and application of the balance sitting posture assessment test;

- conceiving, together with a sociologist, and applying a social reinsertion questionnaire;

- obtaining (with the authors’ permission), translating and applying some assessment scales for the first time in such rehabilitation centers.

We think that the approach of this topic is important because it allows the identification of the most appropriate kinesitherapy programs and the promotion of adapted sports as an essential means for the socio-professional reintegration of persons with posttraumatic paraplegia, by having in view that the active lifestyle represents a priority to the European Union policies and, implicitly, to those of Romania.