

**MINISTRY OF EDUCATION NATIONAL UNIVERSITY OF PHYSICAL
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ABSTRACT OF THE DOCTORAL THESIS

**Title of the doctoral thesis: THE INFLUENCE OF HYDROKINETOTHERAPY
ON THE QUALITY OF LIFE OF PATIENTS WITH AMPUTATION OF
LOWER LIMBS**

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Introduction

Amputation refers to the surgical removal of a limb, part of a limb or part of the body. The major causes of lower extremity amputation are complex and varied: chronic vascular disease, diabetes and trauma, which are followed by the onset of a very high rate of disability and handicap of the musculoskeletal system. The frequency of amputations of different aetiologies has significantly increased over the last 25 years, and this number is expected to double in the next 15 years. The prosthetic possibilities have been continuously improved, relying on the principles of gait biomechanics. Lower limb amputation is a permanent surgical procedure with major functional, psychological and social sequelae that are likely to affect the quality of life.

The loss of a limb is extremely challenging and can cause various physical and psychological problems. Depression, anxiety, decreased well-being and quality of life, dissatisfaction with body image, and changes in self-concept and identity are common after lower limb amputation (Panyi, L., Labadi, B., 2015).

Motivation and purpose

I chose this topic due to the increasing incidence of this condition in the adult population and also because I have the opportunity to work with such patients. The rehabilitation department where I work also has an orthotics and prosthetics clinic and a hydrotherapy pool, which allows me to work with the patient throughout the pre- and post-prosthetic rehabilitation period. The cases of lower limb amputation are varied and vast, as patients come from the workplace, where accidents are common and have mutilating consequences.

Motivated by the evolution and technical progress in the field, within the multitude of types of amputations and prostheses, I chose to develop this topic because it gives me the opportunity to gather up-to-date data from the international literature on this condition and its rehabilitation and to implement and develop them in our country as well.

Part I of the thesis

A major challenge for physiotherapists in the case of partial or total amputation of the lower limb is the optimisation of motor and functional capabilities, with a focus on the rehabilitation of patients' balance and gait.

Studies reveal that lower limb amputation leads to an imbalance in the biomechanics and biostatics of the whole body in general, but especially in the amputated extremity. The lack of a segment of the lower limb causes motor deficit in the muscle and joint groups, with disruption of

functional capabilities due to imbalanced gait patterns. The absence of the amputated segment induces partial and global activity restrictions. The resulting dysfunctions lead to the onset of disability, which has an influence on the patient's psycho-emotional status, independence, quality of life and life expectancy.

In Romania, the total number of amputations is constantly growing; it has been concluded that the incidence of lower limb amputations is a quality marker of the diabetic foot management, and a high rate of amputations can be associated with poor patient education, late presentation to the doctor and insufficient resources. In the last decade, the range of motor activities aimed at increasing the quality of life has diversified, and thus one can choose according to preferences, material living conditions, etc.

The motor and functional rehabilitation of patients with lower limb amputation is mainly achieved through various physical therapy exercises. Over the past decade, kinetic rehabilitation programmes have been considerably diversified as a result of developing modern motor and functional recovery devices and equipment and adapting information technologies to the needs of patients with lower limb amputation. This trend also includes the adaptation of kinesiotherapy to the aquatic environment, which is called hydrokinetic therapy and aims at rehabilitating patients with lower limb conditions and amputations, due to the multiple benefits of practising in the water environment and taking advantage of materials, equipment and devices designed to be used in immersion.

Hydrokinetic therapy has many positive effects on improving health, neuromotor and functional rehabilitation potential and mental abilities. Balance, muscle strength and proprioception can be better addressed in the aquatic environment, especially during adulthood and old age. Exercising in the aquatic environment enhances the nervous excitation and muscle relaxation processes, which creates conditions for the patients' vestibular disinhibition and in-water practice. Studies highlight that water recovery exercise is indicated for patients with musculoskeletal impairments, and the effectiveness of these programmes depends on the time of starting kinetic rehabilitation, the length of implementation, the materials and equipment used and the exercise content complexity.

The conclusions of the first part of the thesis are as follows:

Amputation is a condition that leads to disability and limits the patient's level of functionality and independence, also having a high psychological factor. Quality of life

automatically decreases after the loss of any major part of the body. The most affected aspects are the physical and mental ones, and this is very common in amputations. The functional recovery of people with lower limb amputation is multidimensional and is influenced by the complications of concomitant pathologies, the level of amputation and the quality of prosthetics, as well as by psycho-emotional and environmental factors. Improving the quality of life has a personalized character through the acceptance of the physical and functional situation with restrictions in the interaction with the social environment.

Part II of the thesis

STUDY I - EFFECTS OF PHYSIOTHERAPY VERSUS HYDROKINETOTHERAPY IN THE RECOVERY OF PATIENTS WITH AMPUTATION OF LOWER LIMBS

Objectives of the study 1

The objectives of the study were: highlighting the means and methods of work during the recovery period, through which the quality of life can be improved; the fastest possible recovery of the quantitative and qualitative parameters of the neuro-myo-arthro-kinetic system by applying methods whose efficiency has not been verified in the national literature; identifying the aspects necessary for a good quality of life.

Study hypotheses 1

1. The level of dynamic balance and gait will be superior in patients who performed hydrokinesiotherapy compared to those who performed physical therapy.
2. Quality of life will be superior in patients who have had a hydrokinetic program compared to those who have had a kinetic program.

The purpose of the study 1

The main aim of this study, is to create and test in parallel two different functional recovery protocols with the main objective of improving the quality of life in patients with lower limb amputation.

Since in the national literature there are few reports about the rehabilitation of this pathology through hydrokinetic and kinetic therapy, I wish through this paper to update the existing information with information from the international literature and to test their effectiveness on the Romanian population, where the number of amputations is increasing.

Evaluation, participants, period and location of the study 1

The study was conducted at the National Institute of Medical Expertise and Work Capacity Recovery in Bucharest, between July 2021 and March 2022. The subjects included in the study were 16 in the pre-prosthetic and prosthetic period. Inclusion criteria were: transfemoral amputation; transtibial amputation; work accident as the genesis of the amputation; age between 40-60 years; age of amputation less than 12 months; the male gender. Exclusion criteria were: amputation level other than thigh and calf; bilateral amputation; female; other causes of amputation; age under 40 and over 60; people with mental problems; hyperthermia; sphincter incontinence; respiratory failure; fear of drowning; allergy to chlorine; subjects who did not consent.

We applied the TAPES scale to analyze quality of life. To assess dynamic balance, we applied the 4-square step test assessing a person's ability to step over obstacles in several directions: forward, sideways, backward. The effort capacity was assessed by applying the 6-minute test, monitoring the pulse with the H10 polar belt. For gait analysis, PodoSmart equipment was used, designed to provide precise measurements for precision analysis of cadence and symmetry in real-life conditions.

Conclusions of the study 1

The study highlighted the improvement of the quality of life having a personalized character by accepting the physical and functional situation, with restrictions in the interaction in the social environment through the time and quality of the work performed.

The results of the study highlighted a greater importance on the changes produced by the medical condition and how they manage to manage different everyday situations and the use of the prosthesis. We emphasize that the possibility of using the prosthesis and the medical condition determine a good quality of life rather than the type of recovery program applied.

Heart rate adaptation to exercise are more effective when implementing hydrokinetic therapy programmes due to the water properties and temperature, as well as the various possibilities of action and movement of the body and segments in the aquatic environment. Kinesiotherapy programmes had a greater impact on gait rehabilitation and functional capacity optimisation as regards the travelled distance parameter compared to hydrokinetic therapy programmes. We believe that diversifying the contents of recovery exercise programmes and applying them as early as possible can play a major role in the motor and functional rehabilitation

of patients with lower limb amputation in the pre-prosthetic and prosthetic phases. Also, the adaptation of kinetic programmes to the aquatic environment can optimise the rehabilitation process of certain proprioceptive, motor and functional components of the amputated limb and thus reduce the degree of disability.

STUDY II - THE RECOVERY BY HYDROKINETOTHERAPY OF PATIENTS WITH AMPUTATION OF LOWER LIMBS.

Objectives of the study 2

The objectives of the study were: highlighting the means of work during the recovery period, through which the quality of life can be improved; highlighting the level of self-esteem according to the level of amputation and identifying the aspects necessary for its improvement; the fastest possible recovery of the quantitative and qualitative parameters of the neuro-myo-arthrokinetic system by applying methods whose efficiency has not been verified in the national literature.

Study hypotheses 2

1. The level of functional recovery (gait) will be superior in transtibial amputation patients compared to transfemoral amputation patients.
2. The level of self-esteem will be higher in transtibial amputation patients compared to transfemoral amputation patients.

The purpose of the study 2

The aim of the study is to identify the level of functional rehabilitation (gait) in patients with transtibial and transfemoral amputation and to highlight whether the level of ablation constrains the duration of gait recovery following the application of aquatic treatment.

Evaluation, participants, period and location of the study 2

The study was conducted at the National Institute of Medical Expertise and Work Capacity Recovery in Bucharest, between May 2022 and January 2023. There were 40 subjects included in the study, divided into 2 equal groups according to the level of amputation (one group with transfemoral amputation, and the second group with transtibial amputation), in the pre-prosthetic and prosthetic period. Inclusion criteria were: transfemoral amputation; transtibial amputation; work accident as the genesis of the amputation; age between 40-60 years; age of amputation less than 12 months; the male gender. Exclusion criteria were: amputation level other than thigh and calf; bilateral amputation; female; other causes of amputation; age under 40 and over 60;

hyperthermia; sphincter incontinence; respiratory failure; fear of drowning; allergy to chlorine; subjects who did not consent.

We applied the TAPES scale to analyze quality of life. To assess self-esteem, we applied the Rosenberg scale consisting of a 10-item questionnaire. To assess dynamic balance, we applied the 4-square step test assessing a person's ability to step over obstacles in several directions: forward, sideways, backward. The effort capacity was assessed by applying the 6-minute test, monitoring the pulse with the H10 polar belt. For gait analysis, PodoSmart equipment was used, designed to provide precise measurements for precision analysis of cadence and symmetry in real-life conditions.

Conclusions of the study 2

The hypothesis that the level of functional recovery (gait) will be superior in patients with transtibial amputation compared to subjects with transfemoral amputation using hydrokinetotherapy is refuted.

Respondents who consider themselves to be in very good health have a higher average regarding the acceptance and adaptation of the medical condition to different aspects of life, while those who evaluate their health as bad are the most dissatisfied with the way they manage to manage prosthetic issues in everyday life. There is a positive association between the state of health and the way in which the respondents manage to face the challenges conditioned by the disability, thus as the state of health is perceived more positively and the perception of living with this medical condition is more positive.

Following the study that aimed to measure the level of self-esteem by making a parallel between the two groups in order to know the implications of different types of amputation on personal perception and morale, respectively the ability to manage the absence of the amputated limb, it was highlighted that in the case of respondents with transtibial amputation have increased self-confidence and a very high level of self-esteem. At the same time, positivity is more present, in general, among subjects with transtibial amputation than in the case of those with transfemoral amputation, the first group declaring themselves "totally satisfied" with themselves. Thus we can confirm the hypothesis that the level of self-esteem is higher in patients with transtibial amputation, compared to the level of self-esteem of patients with transfemoral amputation.

Conclusions drawn from the research

Amputation is a condition that limits the degree of functionality and independence of the patient, based on a high psychological factor causing disability.

A common thing in amputations is the automatic decrease in the quality of life after the loss of any important part of the body, the most affected aspects being the physical and mental.

Hydrokinetotherapy improves the quality of life of patients with lower limb amputation: The data obtained demonstrated that the hydrokinetotherapy program contributed to improving the patients' functional capacity. This intervention had a positive impact on their physical performance and level of functionality.

Adaptation to the prosthesis is a complex process: The study highlighted that adaptation to the prosthesis is ongoing for many patients, and dependence on other individuals and difficulty in performing certain activities remain significant challenges. Understanding these difficulties can contribute to the development of more effective solutions to support patients in their recovery process.

Health status influences the perception of life with an amputation: Patients who perceive their health status as very good have a more positive attitude towards managing their medical condition and have a better adaptation to the various aspects of life with a prosthesis. This emphasizes the importance of a comprehensive approach to health and psychological support in amputee care.

The results of the study **highlighted a greater importance on the appropriate selection of recovery methods in accordance with the proposed objectives, because aquatic therapy is not the most effective for the rehabilitation of walking, with the prosthesis, at the expense of physical therapy.**

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