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The advantage of using Nordic Walking in the rehabilitation of persons with PD-evidence based review

EWELINA ŻYŻNIEWSKA-BANASZAK[1], DONATA WOITAS-ŚLUBOWSKA[2], KUBA ŻYŻNIEWSKI[3], MAGDALENA GĘBSKA[1]

Abstract

Parkinson's disease (PD) is a chronic, progressive disease of the central nervous system, which gradually impairs functioning of the people who suffer from it. It is the second most prevalent neurodegenerative disease after the Alzheimer's disease. PD affects both women and men. The risk of PD increases with age. Patients diagnosed with PD present with progressive difficulty in walking, speaking and in the ability to perform activities of daily living (ADL). The symptoms of PD include resting tremor of the upper limbs, postural instability and walking difficulty. Comprehensive rehabilitation is recommended in patients with PD. It improves muscle strength, the sense of balance, mobility and independence. One form of the rehabilitation is Nordic Walking training recommended by the clinician based on the initial functional assessment where indications and contraindications for exercises are established. This paper presents evidence based recommendations for classes of Nordic Walking in the rehabilitation of people with PD.

KEYWORDS: Parkinson's disease, rehabilitation, Nordic Walking, LVST-BIG.

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Corresponding author: banaszak@pum.edu.pl

[1] *Pomeranian Medical University, Department of Physiotherapy and Biological Rejuvenation, Health Sciences Faculty, Szczecin, Poland*

[2] *University of Bydgoszcz, Institute of Physical Culture, Department of Physical Education, Health and Tourism, Bydgoszcz, Poland*

[3] *Pomeranian Medical University, Student Scientific Physiotherapist and Manual Therapist at the Department of Physiotherapy and Biological Rejuvenation, Szczecin, Poland*

Introduction

Parkinson's disease (PD) is a chronic, progressive disease of the central nervous system, which gradually impairs functioning of the people who suffer from it. It is the second most prevalent neurodegenerative disease after the Alzheimer's disease. In the general population the incidence of PD is 0.15% and increases with age. At the age of 65+ PD affects around 1.8% of the population, but in in the age group over older than 85 years old the incidence is 2.6% [5, 15]. The average age of onset of PD is approximately 58 years. Men are diagnosed more frequently than women [28]. The incidence of PD is 13-19 per 100 thousand per year [17, 19, 28]. PD affects about 7 million people worldwide, and the incidence ranges from 1% at age 60+ to 4% in the population of the people older than 80. Approximately 5-10% of all cases are classified as early occurring, developing in people who are 20 to 50 years old. According to the estimates, 8 thousand people in Poland develop PD and 70,000 patients are diagnosed annually [8].

The essence of the pathological process causing PD is the degeneration and the atrophy of dopaminergic neurons of the substantia nigra in the midbrain. Atrophy occurs also in other neurons, which leads to disorders of the serotonergic, noradrenergic and cholinergic systems. The development of the PD pathological

process takes many years. This process is divided into six stages. Characteristic but not pathognomonic for PD inclusion bodies appear in every stage of the disease. Those appearing within the cell neurite are Lewyneurites, and those located within the neuronal cell bodies are called round Lewy bodies. Inclusion bodies are present in both the central and in the peripheral nervous system [2, 3]. The cause of the neurodegeneration in the course of PD is not fully understood.

Progression of the disease causes motor deficits, bradykinesia and the dysfunction of the cardiovascular, respiratory, nervous and musculoskeletal systems, symptoms of motor deficits, limited trunk mobility, muscle tremors, impaired balance and the persons inability to perform complex tasks and activities.

The above-mentioned motor dysfunctions are indications for motor function rehabilitation. Lack of standards for the rehabilitation in PD induces the research and assessment for the evidence based guidelines in the rehabilitation program for all stages of the disease.

Setting short and long term goals for the rehabilitation for rehabilitation in PD requires an assessment of the degree of disability. The commonly used tool for this assessment is a five stage Hoehn and Yahr scale. The scale defines the stages and the severity of the symptoms in the course of the disease [14, 16].

Stage I

Symptoms are unilateral, usually with minimal or no functional impairment, with no apparent effect on the patient's daily activity. This stage lasts about three years.

Stage II

Symptoms are bilateral or axial, no postural instability. Almost all of the typical symptoms of the disease are observed: hypomimia (masked face, hypotonia, reduced volume of speech), slower gait, anteversion of the trunk, impaired mobility. This stage lasts about 3-4 years.

Stage III

The first symptoms of impaired posture are present including instability during rotation, difficulty in recovering after tripping, and instability while standing with legs together and eyes closed. The patient is somewhat functionally limited in performing daily activities (ADL scale – activities of daily living), but potentially is able to work depending on the type of employment. Physically, patients are able to lead an independent life, and their performance may be limited to varying degrees. The patient retains independence in everyday life, although many activities are performed with difficulty and slower. The patient develops parkinsonian posture and gait. This stage can last for many years.

Stage IV

The disease is fully developed. There is significant mobility impairment. Standing and walking is still preserved, despite numerous falls. The patient is still able to walk without assistance, but it is much more difficult. Help with daily activities is necessary. This stage can last for many years.

Stage V

The patient is totally dependent on the environment (the patient is mainly sitting or lying). Walking is only possible with the help of caregivers [1].

Disability in PD is associated with impaired motor control which is the inability to regulate or control the movement [26]. Disorders of motor control are accompanied by many other dysfunctions and rarely occur alone. Stage assessment of the disability allows you to create a plan of care and physiotherapy treatment, and also to determine whether the treatment will have repair or compensatory effect. The aim of the repair approach is to restore previously lost motor ability and function. The compensatory approach is designed to maximize the function within the motor abilities of the patient. This approach is normally the most appropriate choice of treatment for patients with PD, since the symptoms can progress over time.

The main dysfunctions in PD are:

– Abnormal posture and gait characterized by shortened step, tripping, narrowing the base of support, shuffling feet, lack of coordination of the upper limbs, stiffening of the trunk, movement restriction, freezing.

– Risk for falls, which is caused by cognitive impairment, blurred vision, taking medications leading to trauma as a consequence of loss of balance.

Comorbidities such as arthritis, coronary heart disease, diabetes and other diseases are also common in PD.

The treatment approach for persons with PD should be universal, easy to modify and applicable for every stage of the disease. Unfortunately, the access to the rehabilitation program for patients with Parkinson's disease is still insufficient. Only half of the interviewed patients performed home exercise program systematically, and only every fourth patient has trained with a professional [16].

Many methods are used in the rehabilitation of people with PD to improve physical fitness, but an important aspect of

the rehabilitation for the patient and his family is availability and low waiting times for rehabilitation services. Nordic Walking (NW) is a simple and accessible form of physical activity and it meets the above stated expectation. It can be implemented in the home environment of the patient.

The most important benefits of NW are engagement of large muscle groups compared to regular marching, increased energy expenditure during activity, improving the overall function of the joints, and learning technical skills applicable in everyday life. In addition NW was found to be beneficial for psychological wellbeing [12].

According to Monteiro and Franzoni, walking with poles is more complex than normal gait activity, as it was found to stimulate the subcortical activity of the brain. The authors, using Hoehn and Yahr's scale, compared 6 weeks of NW with 6 weeks of regular walking activities without pole in PD patients[14]. The results confirmed the following effects of training: increased stride length, a positive change in the movement pattern caused by the rhythmic stimuli affecting the gait sequence, corrected posture with reduced risk for falls with their complications. The improvement in motor function was statistically significant in the NW group [18].

A behavioral treatment program reviewed by Fox and Ebersbach includes the combination of an exclusive target on increasing amplitude, a focus on sensory recalibration to help patients recognize that movements with increased amplitude are within normal limits, even if they feel "too big", and training self-cueing and attention to action to facilitate long-term maintenance of treatment outcomes. In LVST BIG (Lee Silverman Voice Treatment), training of amplitude rather than speed was chosen as the main focus of treatment to overcome bradykinesia/hypokinesia because training of velocity can induce faster movements but does not consistently improve movement amplitude and accuracy. Furthermore, training to increase velocity of limb movements may result in hypokinetic (reduced) movement amplitude [7]. Increasing the maximal amplitude of the step and focus on self-cueing are also goals of NW training. In addition, the NW training accentuates the movements in closed kinetic chains, which results in better joint stabilization [11].

Morris, studying the effect of practicing NW on motor functions in patients with PD found that the use of NW poles combined with Frenkel exercises (step tags) has significantly improved the quality of the gait [20].

Reuter and Engelhardt, showed that people with PD who were training NW were more likely to undertake hard physical work, for example working in the garden, as compared with patients who did not train NW. This favorable change was observed up to several months after practicing NW has ended. In the studied group of patients with PD who practiced NW, a reduction in neck, hip and joint cross pain, improvement in stability, increased step length, increased submaximal exercise capacity, and improvement in cognitive ability was observed, thereby improving the quality of life. The authors conclude that practicing NW affects posture, gait and coordination patterns in patients with PD in a more efficient way than the standard gait training. In addition to the direct impact on the exercise capacity of the patient, there is a high social and emotional benefit present in the NW training group [23].

Number of written testimonials from the rehabilitation centers indicate a greater benefit in exercise compared with other forms of walking exercises [12, 18, 20, 23].

Another advantageous effect of practicing NW is the ability to increase the plasma levels of the endogenous neurotrophic factors, such as: BDNF (brainderivedneurotrophic factor), GDNF (glial cell derived neurotrophic factor), IGF3 (insulin like growth factor 3) and neurotransmitters (dopamine and serotonin) [18]. For this reason, improvement in motor function and reduced movement dysfunction caused by the NW training may have a neuroprotective effect. From a clinical point of view the improvement in mobility and independence in PD patients is crucial in shaping the daily activities of these persons [18].

In the rehabilitation of the elderly PD patients, as in the rehabilitation of the healthy individuals in the same age group, it is particularly important to: strengthen the muscles of the upper limb and back muscles, reduce back pain [18], increase energy expenditure and improve cardiopulmonary efficiency [22]. Achieving these goals results in an improved efficiency of the upper limbs, improved mobility and improved quality of life of the older people, including patients suffering from PD [4]. As of today, published research reports using NW in comprehensive cardiac rehabilitation allow for the implementation of the walking training for therapeutic procedures in patients regardless of fitness level, gender and age [12].

Rehabilitation of people with PD aims to improve the ability to cope with the limitations of motor functions, which in turn allows for social functioning and a better quality of life. This result is able to effectively lower the degree of disability [6].

These objectives can be achieved by the use of the standard NW training consisting of proper technique training, stretching exercises, and increasing the cardiopulmonary capacity [23].

Although numerous scientific reports confirm the possibility of using NW in the rehabilitation of people with PD [9, 18, 21, 22, 25], there is still no clear answer to the therapist's key questions regarding the length, frequency, and intensity of the activity appropriate for the patients with PD.

Rehabilitation of people with Parkinson's disease

In order to avoid cardiovascular complications, qualification for the exercises is mandatory after the exercise tolerance assessment is completed. Based on the assessment, a scheduled training program for people with PD can be set, which should be adapted to the stage of disability and should take the duration, frequency and intensity of exercise into account [20].

The purpose of treating PD patients while the patient is medicated is to supplement dopamine deficiency (levodopa) [24]. When the drug levels are low the patient is often in a bad physical state and does not show the desire to exercise. In some patients fluctuations of the functional status may be so significant that when the medicine level is at its lowest, the symptoms prevent the patient from walking, and in the period of their strongest impact symptoms disappear to the extent that the patients activity is close to normal. Therefore, the training should take place during the "on phase" of the dose of levodopa [23].

The purpose of the NW training can be rehabilitation, recreation or training. Whatever the adopted character, NW training should include: a warm up period, marching practice and a phase of relaxation with breathing exercises and stretching. In addition, the poles used for NW can be used for other gymnastic exercises such as coordination and balance training. Physiotherapists should direct patients with PD to high intensity NW training. In order to improve the quality of the gait, rhythm should be incorporated into the training program for the patients with PD.

Level of fitness in correlation with the disease staging should be considered for the optimal movement therapy. In the first stage of the long distance training on different surfaces and various speed level with long steps is recommended. It is also recommended to march through narrow and wide paths, complete slow and fast turns and to perform additional activities during walking, for example talking on the phone. Group classes are recommended [16, 20].

In stage II of the disease special attention should be given to the maintenance of an upright posture. The use of stretching exercises, posture stabilizing and proprioception exercises, training of climbing stairs and vestibulo-ocular reflex exercises on a flat surface are recommended. Coordination activities with changing the direction of the movement with the use of varied surfaces should also be applied [10, 16, 27].

In stage III of the disease the same exercises as in stage II are proposed, but shorter distances are recommended, although not shorter than 100 m per day. Focus should be placed on practicing a longer stride with lifting the feet at least 1.5 cm above the ground on a varied surface while avoiding obstacles, such as stair steps or curbs [16, 20].

Stage IV and V are the stages of the fully developed disease with significantly reduced mobility which leads to being bed or wheelchair bound. NW training should also be considered in patients after Deep Brain Stimulation (DBS) surgery.

In summary, the analysis of the presented studies confirms the usefulness of NW in the rehabilitation of patients with PD in stages I, II and III of the disease. Mandatory assessment for exercise tolerance based on physical capacity evaluation and level of disability should precede participation in the NW classes. Although there is a lack of standards for rehabilitation of PD patients in Poland, programs such as LVST- BIG (Lee Silverman Voice Treatment) can be combined with other types of training. The main goals of the rehabilitation treatment should be preventing immobility, preserving of the physical capacity and the joint mobility, stimulating of the physical activity and preventing the complications of immobilization. Methods of rehabilitation with the use of NW proposed by the authors should be tailored to the needs and abilities of people with PD.

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