INFLUENCE OF PHYSICAL REHABILITATION ON SOCIAL NETWORKS AND QUALITY OF LIFE AMONG PEOPLE WITH PARKINSON'S DISEASE

Krzysztof Lizoń[1], Joanna Cholewa[1], Ivan Uher[2]

[1] The Jerzy Kukuczka Academy of Physical Education in Katowice, Department of Physiotherapy, Poland
[2] P. J. Šafárik University in Košice, Institute of Physical Education and Sport, Slovak Republic

Abstract

Parkinson's Disease (PD) is the second most common neurodegenerative disease. Symptoms relate to the movement and cognitive sphere; they have a negative impact on the quality of life of people suffering from PD. Pharmacotherapy and rehabilitation slow the progression of the disease. The aim of the work was to determine the impact of physical rehabilitation on the level of social relations in the context of the quality of life of people with PD. 47 people with idiopathic PD were involved in the study, all were in the second stage of the disease according to the Hoehn & Yahr scale. The Courage Social Network Index (CSNI) was used to assess social relations. The scales: Quality of Life in Parkinson's Disease 39 (PDQ-39), Medical Outcomes Study 36-item Short-Form Heath Survey (SF-36) and Parkinson's Disease Quality of Life Questionnaire (PDQL) were applied in order to evaluate the quality of life of patients The subjects were divided into two groups: research and control. The research group took part in a rehabilitation program two times a week for 45 minutes for three months. The control group did not participate in any form of physical rehabilitation. The results of the research showed a significantly higher level of social bonds as well as quality of life of people with PD participating in physical rehabilitation. At the same time, a higher level of correlation between the level of social bonds and the level of quality of life was found in the research group. Therefore, the positive impact of physical rehabilitation on the level of social bonds and the quality of life of people with PD constituted the conclusion of the work.

Key words: *Parkinson's disease, social networks, quality of life, rehabilitation*

Introduction

Parkinson's Disease (PD), the second most common neurodegenerative disease [14], was named after the English physician James Parkinson. He was the first who undertook research and observed people suffering from characteristic symptoms and presented the results of research in the work "An essay on the shaking palsy" in 1817 [8]. The occurrence of PD is associated with age. It is estimated that about 1-2% of people over 65 years of age may struggle with the disease, and among 85 year olds this problem may affect even 4-5% of the society. Usually, the disease begins to develop around the age of 60; however, up to 10% of all cases [24] are patients under 45 years of age, who are diagnosed with the disease. According

to estimates, in 2005, 4.1-4.6 million people were suffering from PD around the world, and by 2030, this number may increase up to 9.3 million [25].

PD etiology is still unknown: both genetic and environmental factors could be significant [3]. They affect the disappearance of dopaminergic cells in the pigmented volume of the brain called substantia nigra pars compacta. It leads to a reduction in dopamine production as well as dysfunction involving basal ganglia which is responsible for initiating motor skills [19]. Studies have shown that the disappearance of dopaminergic cells can be up to 70% compared to their amount among healthy people [3]. Another typical pathophysiological feature of PD is the presence of Lewy bodies, that are composed of the α-synuclein protein molecules,

the genes of which have been mutated [5]. In the course of the disease they appear both within the substantia and in the basal ganglia [21].

The characteristic motor symptoms of PD include bradykinesia which causes progressive loss of amplitude and velocity of movement. Other symptoms include rest tremor occurring in affected parts of the body in a state of rest; stiffness of the limbs and shoulders characterized by increased muscle tension during static movements; inflexibility of postural reflexes and gait disorder characterized by small "shuffling" steps, and last but not least episode symptoms resulting in, among others, frequent falls [8]. In addition to abnormalities of motor function, there are also non-motor symptoms related to neuropsychiatric problems as well as the occurrence of pain and fatigue [9]. Due to these non-motor symptoms it ought to be noted that PD can begin to develop much earlier before it is diagnosed, and symptoms may be non-specific (eg. impaired sense of smell, sleep problems or depression) [13].

PD has an adverse impact on many aspects of a patient's life, and the effect becomes more visible and noticeable as the disease progresses. The difficulties concern coping with everyday activities, they also refer to the cognitive and communication sphere. That all results in reducing well-being and decreasing the patient's quality of life [17]. In order to prevent this process, therapies are introduced in order to delay the development of the disease and the occurrence of its symptoms. The main methods of treatment are pharmacotherapy and physical rehabilitation. In pharmacotherapy L-Dopa - supplementing the deficiencies of endogenous dopamine is mainly used [15]. On the other hand, rehabilitation should maximize the patient's motor skills and minimize the difficulties associated with disorders resulting from PD progression. Rehabilitation can constitute classical physiotherapy, which is focused on movement symptoms and conditioning workouts.

The therapist aims to improve the weight transfer as well as gait, upper limbs functions, prevents falls [23], but he can also focus on other forms of non-specific activities such as dance or yoga [12,18].

Taking into account the aging of the population and the increase in the frequency of PD, the aim of the study was to determine the impact of physical rehabilitation on the level of social bonds in the context of the quality of life among people with PD.

Material and methods

The study was conducted in a group of 47 people (63.58 ± 7.21 years), treated at the Department of Neurology of the Medical University of Silesia in Katowice, members of the Silesian Association for People with Parkinson's disease, diagnosed with idiopathic PD disease. Duration of the disease was 6.23 ± 4.68 years. The research was approved by the Bioethical Commission of the Academy of Physical Education in Katowice. All subjects were informed about the purpose and the course of the research and gave their written consent to participate in it.

PD diagnosis was based on the United Kingdom Parkinson's Disease Society Brain Bank criteria. The study included patients with stage II disease according to the Hoehn & Yahr scale [7]. The subjects did not have other coexisting neurodegenerative diseases. The purpose selection technique was applied. The subjects were divided into a group of those participating (A) and those non-participating in the process of physical rehabilitation (B).

In order to determine the clinical status of patients, Unified Parkinson's Disease Rating Scale (UPDRS) was used. It comprised of part I (mentation, behavior, and mood), part II (activities of daily living) and part III (motor examination) [1]. The characteristics of the subjects are presented in table 1.

Table 1. Examined characteristics.

Variable		Group A (n=21)	Group B(n=26)	Student's t-test	
		X± S	X± S	t	p
Age (years)		62,98±5,68	64,06±6,35	2,38	0,51
Disease's duration (years)		5,87±1,25	6,52±0,92	4,38	0,43
UPDRS [points]	part I	2,34±0,75	2,29±0,61	1,58	0,15
	part II	14,33±1,68	13,52±2,02	1,39	0,21
	part III	19,27±2,92	21,11±1,98	2,98	0,31
	part I, II, III	35,94±5,02	36,92±4,6	0,72	0,19

UPDRS – Unified Parkinson's Disease Rating Scale, X - arithmetic mean, S – standard deviation, t - value of t - test, p – probability.

To evaluate the level of social network, the Courage Social Network Index (CSNI) was used [26]. The CSNI scale evaluates the functioning of the three elements of the social network structure: social ties and intimacy level of relations - 8 questions (the first, separate concerning the spouse/ partner and the other seven, each of which is constructed in the same way, but concerns a different subject - parents, children, grandchildren, other relatives, co-workers, friends, neighbours), social support - 8 questions (each is constructed in the same way, but concerns other subjects mentioned above), direct contacts - 8 questions (each is constructed in the same way but concerns other subjects mentioned above). The questions contain a certain number of statements the total number of which in the questionnaire is 107. Each of the statements was assigned a certain number of points.

To determine the quality of life of the subjects, the following scales were used: The quality of life in Parkinson's disease 39 (PDQ-39) [9], Medical Outcomes Study 36-item Short-Form Health Survey (SF-36) [16] and Parkinson's Disease Quality of Life Questionnaire (PDQL) [6].

The PDQ-39 scale includes 39 questions, arranged in 8 subscales: mobility - 10 questions, daily life activites - 6 questions, emotional well-being - 6 questions, stigmatisation - 4 questions, social support - 3 questions, cognitive functions - 4 questions, communication - 3 questions, general discomfort - 3 questions. There are five options in the scoring system - from 0 to 4 points (0-never, 1-rare, 2-sometimes, 3-often, 4-always). The questions relate to the last month and are closely related to PD. Each question starts with the statement "Because of PD, over the last month, how often...?". The questionnaire was filled in by the subjects themselves. The score was calculated separately for each subscale (domain) according to the formula: sum of points of the given subscale x 100/4 x number of questions for the given subscale. The collective result of the questionnaire was given in the form of the so-called summary index (SI) in accordance with the formula: PDQ-SI = sum of points/8. The maximum number of points obtained in a given subscale was 100 and indicated the worst quality of patient's life.

36-item Short-Form Health Survey (SF-36), enables the evaluation of 8 sections concerning quality of life: physical role functioning (PF), limitation in performing roles due to physical disability (PL), bodily pain (BP), general health perceptions (GH), vitality (V), social role functioning (SF), limitations in fulfilling social roles due to emotional problems (EL) and mental health (MH). The questionnaire consists of 11

_____

questions containing 62 statements. Each of the statements was assigned a point value. The 0 point value means the lowest quality of life, while the 100 points value - the highest one. The point value corresponds to the individual's quality of life. There are two values: quality of life in terms of physical aspects (PF, PL, GH, MH) and the quality of life in terms of mental aspects (BP, V, SF, EL).

The assessment of the quality of life of the subjects was accomplished using the PDQL scale. It consists of 37 items covering four domains. They comprise parkinsonian symptoms (14 items), systemic symptoms (difficulty walking, malaise, sleep disorder, exhaustion, constipation, urinary incontinence (7-items), emotions (9 items) and social functions (hobby, sex, recreation, leisure trips, public speaking, transport difficulties, low mood and intimidation) - 7 items. The respondent had the opportunity to choose one out of five responses regarding the prevalence of disorders mentioned above: 1-permanent, 2-most of the time, 3-quite often, 4-sometimes, 5-never.

Patients involved in the process of rehabilitation (group A) participated regularly in rehabilitation classes in the gym twice a week for 45 minutes. They had already begun at least 3 months prior to the study. The rehabilitation program was focused on individual symptoms. In the case of the slow movement and inflexibility of postural reflexes, attention was paid to the optimal use of the retained patterns for acquired and automatic movements. The procedure included: frequent repetition of movements, combining movements with the special acoustic step initiator, repetition of movements with different frequency, introduction of arbitrary movements with stimulating mechanisms: visual, auditory and sensory cues, imaginative stimulation of the movement before its performance, cognitive strategies of the

equivalent reflexes induction, awareness of postural abnormalities and their correction. In the case of stiffness, rehabilitation treatment did not concern coping with stiffness itself but minimizing its negative impact, while in the case of tremors, a strategy for reducing them was implemented. The subjects were taught ways of controlling tremors through purposeful movements. During the course, each exercise was useful in terms of coping with everyday activities [2].

The obtained results of the research were statistically measured by calculating basic descriptive statistics. The homogeneity of variance in the compared groups was measured using the Levene's test and the normal distribution of features using the Kolmogorov-Smirnov test. Student's t-test was applied in order to determine the relationship between groups in the analyzed parameters. Pearson's correlation coefficient was used to specify the differences between the results of the tests concerning social bonds and the patients' quality of life.

Results

Before analyzing the results of tests evaluating the quality of life and social ties of the respondents, both groups were compared with respect to age, duration of disease and clinical condition. The conducted analyses did not reveal any statistically significant differences between the studied groups at the assumed significance level of $p<0.05$ (Table 1).

Through the use of statistical methods comparisons could be made and the results obtained in the tests completed by both groups showed that statistically significant differences between the groups occurred in all the tests. The largest absolute difference was observed in the PDQL test, while the smallest difference in the PDQ-39 test (Table 2).

Table. 2. The summary results of evaluation of the respondents' quality of life in the applied tests.

Variable		Group A	Group B	Absolute difference	Relative difference	Student's t-test	
		X1± S	X2± S	X2-X1	X2-X1 (%)	t	p
PDQ-39 (points)		19,59±3,45	23,05±4,12	3,46±0,72	15,01±2,81	2,46	0,003
SF-36 (points)	Physical Component	48,68±4,28	41,68±3,72	-7,00±0,72	-16,79±1,72	1,88	0,002
	Mental Component	51,35±5,05	43,24±3,62	-8,11±1,91	-18,76±3,78	1,89	0,03
PDQL (points)		149,28±12,64	127,26±13,46	-22,02±6,15	-17,30±4,52	5,46	0,001
CSNI (points)		67,28±7,05	59,87±4,28	-7,41±5,67	-11,01±1,028	2,58	0,001

PDQ-39 – Parkinson' Disease Questionnaire, SF-36, – Medical Outcomes Study 36-item Short Form Health Survey, PDQL – Parkinson's Disease Quality of Life Questionnaire, CSNI - Courage Social Network Index., X – arithmetic mean, S – standard deviation, t – value of t-student's test, p – probability

In order to achieve the main goal of the work the correlation coefficients between the social ties of the respondents and their quality of life were calculated. The obtained results show a negative correlation between the PDQ-39 and CSNI tests, which is more significant in the research group. There is a positive correlation between the SF-36 (PC and MC) and CSNI tests, also more significant in the research group. Whereas between PDQL and CSNI tests among patients who were rehabilitated there is a strong positive correlation, in the control group the correlation is negative and insignificant (figure 1).
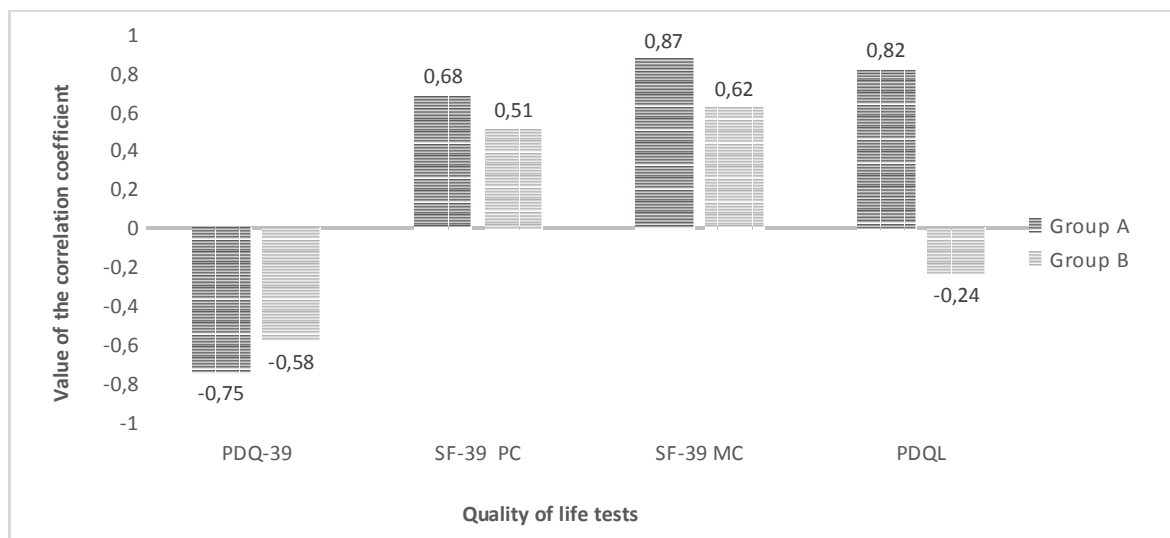
Fig.1. Correlations between the Courage Social Network Index score and the Quality of Life Tests.

Discussion

Studies have shown that the quality of life of PD patients is related to their social bonds. The correlation in the research group occurring between the CSNI and PDQ-39, SF-36, PDQL tests indicates that the better the quality of life, the higher the level of interpersonal relationships.

_____

In addition, it can be observed that implementation of the physical rehabilitation program has an influence on the development of these relations. In the research group, the correlation between test results is higher, which shows that after the introduction of such a program aimed at improving the quality of life of people with PD, the level of improvement in the area of social network can be more accurately determined.

The obtained results indicating the connection of both these aspects of PD patients' life are consistent with the observations that Takahashi et al. made [22]. They carried out the analysis using the SEIQoL-DW test. It assumes that the patient is supposed to choose five elements that are most important to him/her in life and evaluate the possibility of their implementation using the VAS scale. The authors found that patients themselves most often indicate social relations as a critical factor affecting their quality of life. However, in the same study the results of the SEIQoL-DW test with the total results of the PDQ-39 test and with the results of each of the subscales were also compared. In contrast to the outcome we achieved, no significant correlation between the two tests was observed, but only between SEIQoL-DW and the PDQ-39 subscale which evaluated communication skills. It shows that the ability to communicate with relatives is interconnected with the quality of life of patients. The authors estimate that the lack of the relationship between the total PDQ-39 test result or other subscales, and SEIQoL-DW test is the result of its close connection with the physical sphere related to the patient's quality of life, and to a lesser extent, it affects the emotional sphere.

However, on the basis of the statement implying a high degree of connection of the PDQ-39 test with the sphere of the physical quality of life of the patient, it can be assumed that the improvement in the results of this test will, in consequence, reduce the degree of disability. In studies devoted to the influence of PD on disrupted social connectedness, Soleimani et al. [20] drew attention to the existence of four factors affecting social isolation, two of which are related to the physical aspect: progressive physical disability and shrinking of

social activities. The first of these was regarded as fundamental for patients as it created limitations in the social interaction they had before diagnosis of the disease. Whereas the second factor concerned patients' jobs where they were assigned tasks that exceeded their abilities. It resulted in the loss of employment or necessity of early retirement. Research showed that due to physical rehabilitation the PDQ-39 test results improve. Therefore, it can be concluded that through rehabilitation, it is possible to influence the functional state of patients, and thus to reduce the level of social isolation.

The relationship between the quality of life and the increase in the social network was also observed using the SF-36 test. The examined connections referred to the physical and mental aspects of this test. In order to observe factors affecting the quality of life of PD patients Morimoto et al. [11] used the time trade-off method (TTO). They searched for a relationship between this method and other variables, including each of the 8 domains of the SF-36 test. They demonstrated that the level of quality of life correlates significantly with domains concerning vitality and social role functioning. Therefore, it can be concluded that rehabilitation aimed at increasing the degree of vitality and improving social function would be the most beneficial for patients. Based on the authors' results, it would be reasonable to study the relation of the CSNI test results on particular SF-36 domains in order to determine the close connections.

The observed relation between the social network and the quality of life of patients with PD seems to be mutual. This means that increasing or decreasing the value of one factor will affect the value of the other one. The improvement of the quality of life expressed in the score obtained in a given test may enhance social relations as a result of, for example, increasing mobility or reducing the intensity of Parkinsonian symptoms. Participation in physical rehabilitation allows patients to participate in family life more frequently or meet with friends. At the same time, it can be stated that social support is a significant factor improving the quality of a patient's life. In a study on the significance of the patient's

relationship with close relatives and their quality of life, Ghorbani Saeedian et al. [4] show that there is a correlation between social support and the occurrence of anxiety and depression. Rehabilitation should therefore be a comprehensive process, including activities aimed at improving physical fitness, functional independence and quality of life, but also using the positive effects of social relations.

The issue of the relation between the level of social networks and the quality of life of patients with PD is a new issue, which is only slightly raised in literature. A small amount of research hitherto suggests the necessity of developing this notion. The actual results imply a significant relationship between both these aspects of the patient's life, which only emphasizes the importance of the problem.

Conclusions

The social network of people with PD is related to the level of quality of life. Physical rehabilitation increases this state and positively affects social activities among Parkinson's disease patients.

BIBLIOGRAPHY

1. Brusse K, Zimdars S, Zalewski K, Steffen M (2005). Testing functional performance in people with Parkinson disease. Phys Ther, 2: 134–141.
2. Cholewa Joanna (2014): Rehabilitation procedures aimed at decreasing motor symptoms in Parkinson's Disease. International Journal of Physical Medicine and Rehabilitation. S5-009.
3. Davie CA (2008). A review of Parkinson's disease. Br Med Bull, 86: 109–127.
4. Ghorbani Saeedian R, Nagyova I, Krokavcova M, Skorvanek M, Rosenberger J, Gdovinova Z, Groothoff JW, van Dijk JP (2014). The role of social support in anxiety and depression among Parkinson's disease patients. Disabil Rehabil, 36(24): 2044–2049.
5. Gupta A, Dawson VL, Dawson TM (2008). What causes cell death in Parkinson's Disease? Ann Neurol, 64: 3–15.
6. Hobson P, Holden A, Meara J (1999). Measuring the impact of Parkinson's disease with the Parkinson's Disease Quality of Life questionnaire. Age Ageing, 28: 341–346.
7. Hoehn MM, Yahr MD (1967). Parkinsonism: Onset, progression and mortality. Neurology, 17: 427–442.
8. Jankovic J (2008). Parkinson's disease: clinical features and diagnosis. J Neurol Neurosurg Psychiatry, 79: 368–376.
9. Jenkinson C, Heffernan C, Doll H, Fitzpatrick R (2006). The Parkinson's Disease Questionnaire (PDQ-39): Evidence for a method of imputing missing data. Age Ageing, 35: 497–502.
10. Massano J, Bhatia PB (2012). Clinical Approach to Parkinson's Disease: Features, Diagnosis, and Principles of Management. Cold Spring Harb Perspect Med, 2: 1-15.
11. Morimoto T, Shimbo T, Orav JE, Matsui K, Goto M, Takemura M, Hira K, Fukui T (2003). Impact of Social Functioning and Vitality on Preference for Life in Patients with Parkinson's Disease. Mov Disord, 18: 171-175.
12. Ni M, Mooney K, Signorile JF (2016). Controlled pilot study of the effects of power yoga in Parkinson's disease. Complement Ther Med, 25: 126-131.
13. Obeso JA, Rodriguez-Oroz MC, Goetz CG, Marin C, Kordower JH, Rodriguez M, Hirsch EC, Farrer M, Schapira AHV, Halliday G (2010). Missing pieces in the Parkinson's disease puzzle. Nat Med, 16: 653-661.
14. Olanow CW, Stern MB, Sethi K (2009). The scientific and clinical basis for the treatment of Parkinson disease. Neurology, 72 (suppl 4): 1-136.
15. Radder D, Sturkenboom IH, van Nimwegen M, Keus SH, Bloem BR, de Vries NM (2017). Physical therapy and occupational therapy in Parkinson's disease. Int J Neurosci, 127: 930-943.
16. RAND Corporation: 36-Item Short Form Survey Instrument (SF-36) [Internet]: Corporation, Santa Monica 2017.
17. Schrag A, Jahanshahi M, Quinn N (2000). How Does Parkinson's Disease Affect Quality of Life? A Comparison With Quality of Life in the General Population. Mov Disord, 15: 1112–1118.
18. Shanahan J, Morris ME, Bhriain ON, Volpe D, Clifford AM (2017). Dancing and Parkinson's disease: updates on this creative approach to therapy. Journal of Parkinsonism and Restless Legs Syndrome, 7: 43–53.
19. Shulman JM, De Jager PL, Feany MB (2011). Parkinson's Disease: Genetics and Pathogenesis. Annu Rev Pathol Mech Dis, 6: 193–222.

_____

20. Soleimani MA, Negarandeh R, Bastani F, Greysen R (2014). Disrupted social connectedness in people with Parkinson's disease. Br J Community Nurs, 19: 136-141.

21. Spillantini MG, Crowther RA, Jakes R, Hasegawa M, Goedert M (1998). a-Synuclein in filamentous inclusions of Lewy bodies from Parkinson's disease and dementia with Lewy bodies. Proc Natl Acad Sci, 95: 6469–6473.

22. Takahashi K, Kamide N, Suzuki M, Fukuda M (2016). Quality of life in people with Parkinson's disease: the relevance of social relationships and communication. J. Phys. Ther. Sci. 28: 541–546.

23. Tomlinson CL, Patel S, Meek C, Stowe R, Shah L, Sackley CM, Deane KHO, Herd CP, Wheatley K, Ives N (2012). Physiotherapy versus placebo or no intervention in Parkinson's disease (Review). Cochrane Database of Systematic Reviews 2012, 8: CD002817

24. Weintraub D, Comella CL, Horn S (2008). Parkinson's Disease — Part 1: Pathophysiology, Symptoms, Burden, Diagnosis, and Assessment. Am J Manag Care, 14: 40-48.

25. Wirdefeldt K, Adami HO, Cole P, Trichopoulos D, Mandel J (2011). Epidemiology and etiology of Parkinson's disease: a review of the evidence. Eur J Epidemiol, 26: 1-58.

26. Zawisza K, Gałaś A, Tobiasz-Adamczyk B (2014). Polska wersja Courage Social Network Index - skali do oceny poziomu sieci społecznych. Gerontologia Polska, 22: 31-41.

Correspondence

Joanna Cholewa
E-mail: a.cholewa@awf.katowice.pl