The Influence of Physical Therapy Intervention on Respiratory Functions, and Gait Parameters in Parkinson's Disease

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ABSTRACT

The purpose of the study was to evaluate the effect of a program of therapeutic exercises for 12 weeks on respiratory functions and gait parameters in Parkinson's disease (PD).This study included twenty male PD patients (group A), and 20 normal control subjects matched age, sex and height (group B). The physical therapy program consisted of respiratory, postural exercises and gait training. The external cues and cognitive strategies were used during all aspect of the treatment. The mean values of respiratory function measurements and gait parameters tests before starting the treatment in group A were compared with normal predicated values of the control group (group B). Comparison of pre and post treatment data of PD group were conducted. All spirometric data and flow lung volume except residual volume (RV) were decreased pre treatment in PD group compared to control group. The maximum inspiratory and expiratory pressure (PI max and PE max) were decreased also before starting the treatment which indicated weakness of respiratory muscles strength. Gait analysis revealed also decrease velocity and stride length with no changes cadance. The results of group A at the end of treatment revealed significant improvement in the mean values of all spirometric flow volume loop, lung volumes data and respiratory muscles strength. Significant gain in the mean values of stride length and walking velocity were also observed comparing with the corresponding mean values of pre treatment, with no changes in cadance ($P < 0.5$). In conclusion: pulmonary dysfunction associated with gait disorders have a high incidence in PD disease. Patients with moderate PD can benefit significantly from physical therapy training. Physical therapy considered to be an important approach for PD treatment.

INTRODUCTION

Parkinson's disease (PD) is the most prevalent type of parkinsonism. It makes up approximately 80% of all cases of parkinsonism[26]. It is a chronic slowly progressive disease of the basal ganglia predominately in the substantia nigra that produce deficits in motor behaviour[35]. The hallmark manifestations of PD are resting tremors, rigidity, bradykinesia, akinesia, postural reflex impairment and reduced excursion of the movement[6]. Overtime PD patients tend to adapt these changes and gradually reduce the amount and variety of regular physical activity they perform. This leads to a restriction of physical activity over and above that attributable to disease process[9].

Respiratory function is known to be affected directly by the disease process; with upper airway obstruction being the major pulmonary obstructive disorder[5]. Gait abnormalities with PD patients is characteristic of the disease. It is described as festinating

(shuffling) with decreased stride length; reduced velocity and increased cadance for any given velocity[4]. These respiratory and gait impairment may make it difficult for PD patients to remain physically active[14]. The disability and immobility with PD patients can contribute to cardiovascular de-condition[38].

Exercise is thought to be an important adjunctive therapy for parkinsonism[18,36,46]. It may be beneficial to establish specific rehabilitation strategies for patients with Parkinson's disease, since effective training might improve their long term functional prognosis[30].

The purpose of this study was to evaluate the effect of physical therapy program for three months on respiratory pump, pulmonary and gait functions in idiopathic PD patients.

MATERIAL AND METHODS

A) Subject selection

- Twenty male patients with moderate Parkinson's disease diagnosed by neurologist and confirmed by computed tomography scan (CT) and magnetic resonance imaging (MR) were selected from neurology department of Kasr El Eini Hospital, and (20) healthy persons matching the patients age, sex and height taken as a control group participated in the study.
- The mean ages of the patients was 61.4 ± 3.2 years (range 59.6 - 65.8). The mean duration of PD was 3.2 ± 1.6 years (range 3.8 - 2.1), the mean weight was 82 ± 8.5 (range 91.3 - 76.4) kg, the mean height was 174 ± 7.4 (range182.4 - 168.8) cm.
- The severity of the disease was rating from stage II and III according to Hohen & Yahr disability scale[24].
- The general and clinical characteristics of each stage of PD are presented in table (1).
- None of PD patients were medicated during the study.

Exclusion criteria included

Pre existing lung disease, current smoking, history of cardiac disease, uncontrolled psychiatric illness, dementia, severe depression, cogentive impairement and major neurological impairement (e.g. stroke), musculoskeletal (e.g. rheumatoid arthritis) or metabolic disorders (e.g. diabetes).

b) Methods

1- Instrumentations

A computerized gas analysis system was used to collect and analyse expired gases before and after treatment. The system consists of: mouth piece, air way breathing valve, a rolling seal spirometer, an oxygen and carbon dioxied analyser. It was calibrated with known gas concentration and volume prior to each test.

2- Assessment

All the patients were subjected to:

- Neurological and general examination especially chest & heart by the physican.
- Physical examination by the author.
- Chest X ray P.A view.
- Pulmonary function tests.
- Electro cardiograph. Gait analysis.

Pulmonary function tests:

The pulmonary studies included spirometry with flow volume loop, lung volume & air way resistance. All pulmonary function measurements were done with the subject sitting on breathing room air. Air flow and volumes were measured with vitalograph spirometer with pneumotachygraph. Every subject was asked to breath as much air in and

out as possible in 10 seconds, the best three attempts were recorded for all tests. The tests were performed using the American Thoracic society guidelines[2]. The measured values were compared with normal age, height and gender matched values. **The following measurements were determined**

1- Forced vital capacity (FVC).
2- Forced expiratory volume (FEV).
3- Forced inspiratory flow rate (FIR).
4- Peak inspiratory flow rate (PIFR).
5- Peak expiratory flow rate (PEFR).
6- Maximum voluntary ventillation (MVV).

Lung volume:

Total lung capacity (TLC), vital capacity (VC) and residual volume (RV) were measured via the closed circuit helium dilution techniques according to Hathirat & Associates[(23)]. The values were expressed pre and post treatment, and compared with predicted normal age, height and gender matched values.

Respiratory pump function:

Maximum inspiratory and expiratory pressure (PI max and PE max) were obtained at closed to residual volume and total lung capacity levels according to Black and Yatt[3]. It reflects the respiratory muscles strength.

The results of PD patients were compared pre and post treatment. The pre-treatment data also compared with predicted normal age, and gender matched values.

Ten meter Walk tests:

All subjects performed randomise 10m walk tests. The patients were asked to walk as fast as possible during the evaluation. All the measurements were taken over the middle "10" meter of a "14" meter walk way to avoid the effect of acceleration and deceleration. Before testing marker pen were taped to the subject's heels, so that the stain marks left on the ground at heel strike could be used to determine stride length and cadance. Gait speed and number of steps were evaluated five times before and after the treatment.

The median values were used for outcome measures. Velocity was measured by using a stopwatch. Velocity and stride length (SL) measures were compared pre and post treatment. The pre-treatment values were compared with predicted normal age and gender matched values. Cadance measures were compared with normal age and gender matched cadance derived from predicted velocity and stride length data.

3- The physical therapy program

- The exercise program was carried out for 12 weeks (three - 1 hour sessions per week) in the out patient clinic of faculty of physical therapy under the supervision of the author. All the exercises were performed with a painless range of motion. The treatment began with low intensity exercises which were gradually increased. The patients were instructed to continue the exercises three times daily at home.
- The frequency & intensity of exercises were adjusted in accordance with the results of physical evaluation of each patient and increased as endurance of the patients improved.
- The physical reconditioning therapy program consisted of repetitive exercises directed to increase mobility of lung wall, improve lung ventilation, maintain or improving normal flexibility, range of motion, balance, gait re-education, endurance & correction of faulty posture.
- Medication changes were not allowed during the therapy program.

The physical therapy program included:

- Breathing exercises in all aspects of intervention as rhythmic relaxed breathing to gain relaxation response.

- Respiratory exercises connected with the upper limbs (bilateral & symmetrical Proprioceptive Neuromuscular Facilitation).
- Posture exercises consisted of: mobilizing, strengthing & stretching exercises. Extension, rotation and lateral bending of the trunk (mobilization exercises). Stretching exercises to all shortened muscles, especially pectoralis major (clavicular portion) hip flexors and calf muscles.
- Rhythmic initiation technique of Proprioceptive Neuromuscular Facilitation (PNF) to help initiation of the movements. To restore rhythmic quality of the movement bilateral reciprocal pattern of PNF was used.
- To improve kinethatic awareness of movement, feed back about movement was used (all exercises were performed in front of mirror).
- Visual cues and attention strategies such as breaking down complex task into parts and focusing on unitask performance.
- Gait training.
- Music & metronome was used during all aspects of the treatment to provide controlled rhythmic background of the movement.
- Cycling for 15 minutes pedalling on a cycle ergometer for three successive periods of five minutes each separated by five minutes of active recovery.

Statistical analysis

The mean values, standard deviations of each variable were calculated. The mean difference between baseline & follow up values was tested by using pair t test. Statistical significance was corresponded to (P<05).

RESULTS

The general characteristic of PD patients are summarized in Table (1). The severity of PD was classified according to Hoehn & Yahr[24] scale. Twelve patients were in stage II and eight in stage III. According to clinical assessments, 14/20 (70%) of the PD patients pre-dominatly rigid / hypokinesia, (6/20) 30% predominantly tremulous.

The Parkinson's patients (the patients group) had lower mean values of all spirometric data (FVC, FEV, PEFR, PIFR, MVV, TLC) and higher RV values than those expected for normal control group. Significant increase in mean values of all spirometric data and TLC were observed post treatment comparing with the corresponding mean values of each variable before starting the treatment (P<05). However the mean values of (RV) was significantly decreased in patients group post treatment as compared to mean value of pre treatment data table (2).

The mean values of maximal pressures generated during both inspiration and expiration (PI max & PE max) in Parkinson's

respectively. While in normal matched control group the mean values were 89.2

3 respectively. The PD patients had lower PI max and PE max values than the normal control group at the base line. Post treatment, the mean values of PI max and PE

75.4

Comparison of mean values of PI max and PE max before treatment with the corresponding mean values after treatment showed significant improvement post treatment (P<.001), (P<0.5) respectively table (3) and figure (1).

Table (4) and figure (2) show the walking speed, stride length (SL) and cadance before and after completion of treatment. The mean values of speed and stride length in PD group were less than the mean predicated

values of normative data from age matched subjects without PD. Comparison of the mean values of walking speed , stride length (SL) and cadance before and after completion of the treatment in PD ground revealed significant improvement in speed & stride length (P<05), while their was non-significant changes in cadance (P=0.079), table (4).

Table (1): General and clinical characteristics of the patients.

	Stage II	Stage III
Number	12	8
Mean age (year)		
Rigid hypokinetic / tremulous	8/4	6/2
Duration of illness (years)		

Table (2): The mean values of pre and post treatment spirometric and lung volumes in Parkinson's group (pre and post treatment) and control group.

		Parskinson's Group			Control group
		Pre treatment	Post treatment	P. value	
1.	**FVC(L)**				
	X ± SD	3.0195±0.20	3.452±0.248	0.0005*	3.89±0.35
	T. value	11.82			
2.	**FEV**				
	X ± SD	2.4265±0.2145	2.949±0.15	0.003*	3.21±0.33
	T. value	13.85			
3.	**PEFR**				
	X ± SD	5.076±0.255	5.93±0.738	0.002*	6.85±1.65
	T. value	5.40			
4.	**PIFR**				
	X ± SD	2.849±0.28	3.606±0.34	0.001*	4.52±1.03
	T. value	12.68			
5.	**MVV(L/M)**				
	X ± SD	75.92±2.09	87.25±4.55	0.003*	110±10.25
	T. value	20.09			
6.	**TLCI(L)**				
	X ± SD	3.715±0.220	4.217±0.30	0.0004*	4.51±0.067
	T. value	11.56			
7.	**RV**				
	X ± SD	1.826±0.215	1.414±0.25	0.002*	1.20±0.21
	T. value	12.02			

X : mean.
SD : standard deviation.
Significant* at P < .05.
FVC :forced vital capacity, FEV : forced expiratory flow, PEFR : peak expiratory flow rate, PIFR : peak inspiratory flow rate, MVV : maximum voluntary ventilation, TLC : total lung capacity, RV : residual volume.

Table (3): The mean values of respiratory pump function in Parkinson's group (pre and post treatment) and predicted values in control group.

	Parkinson's Group		P. value	Control Group
	Pre treatment	Post treatment		
P_I max (Cm/Ho_2)	53.5±18.4	65.9±26.7	.001*	89.2±7.67
P_E max (Cm/Ho_2)	64.6±20.2	75.4±22.5	0.05*	112±6.93

Significant* at P < .05.
P_I max: maximum inspiratory flow.
P_E max: maximum exspiratory flow.

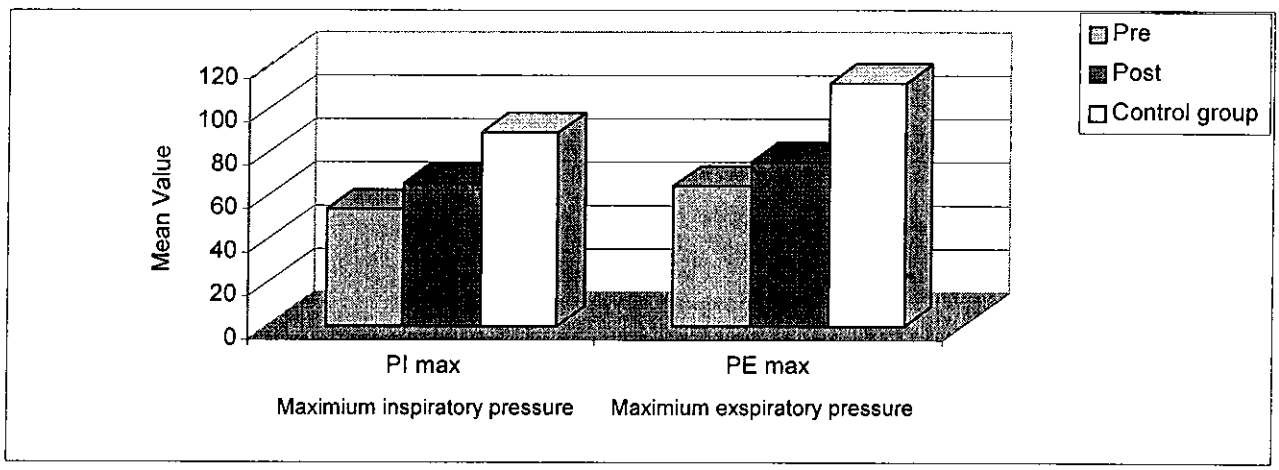

Fig. (1): Mean values of maximum inspiratory flow $(P_I)_{max}$ and maximum expiratory flow $(P_E)_{max}$ in the Parkinson's group (pre and post treatment) and predicted values in control group.

Table (4): The mean values of gait parameters (pre and post) treatment for subjects with Parkinson's disease and control subjects.

	Parskinson's Group			Control group
	Pre treatment	Post treatment	P. value	
Speed (m/min)				
-				
X ± SD	58.71±5.37	65.68±5.31	0.000*	72.42±8.23
T. value	9.58			
Stride length (cm)				
-				
X ± SD	80.38±3.98	85.94±4.91	0.000*	128±14
T. value	8.02			
Cadance (Steps/min)				
-				
X ± SD	98.45±10.04	102.15±2.16	0.079	112.25±8.52
T. value	1.86			

X : mean.
SD : standard deviation.
Significant* at P < .05.

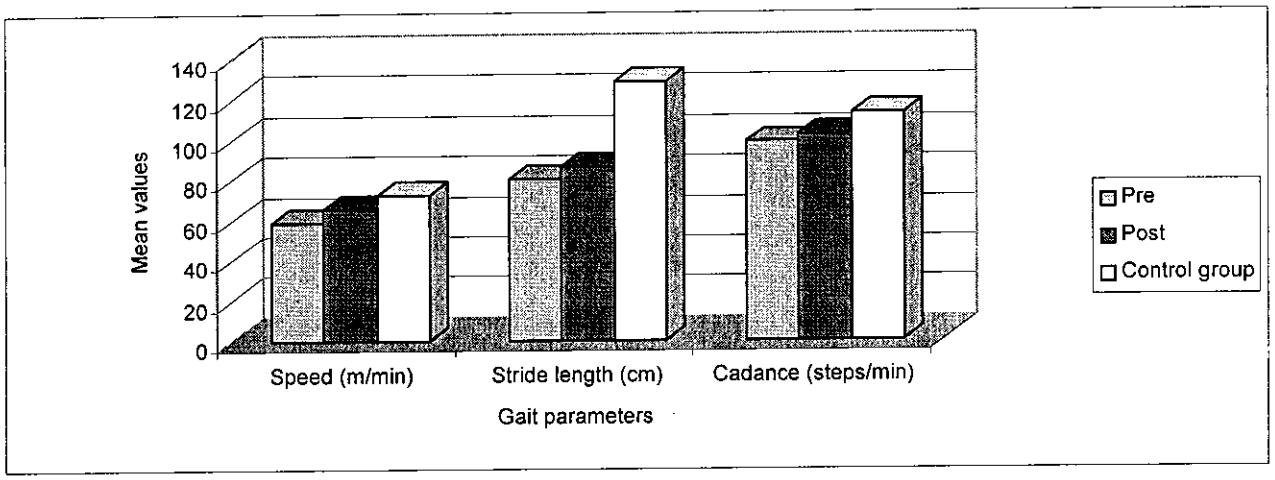

Fig. (2): Mean values of gait parameters (speed, stride length and cadance) in parkinson's group (pre and post treatment) and control group.

DISCUSSION

The results of the present study clearly demonstrated the positive evidence of physical therapy intervention on respiratory and pulmonary functions in PD patients. The gain in pulmonary functions were also associated with significant improvement in quantitative assessment of gait including stride length and velocity.

Respiratory problems are the major cause of death in patient with PD disease[24]. Most patients don't however report respiratory problems perhaps because physical disability does not lead to activities where such problems can manifest themselves[23] The pulmonary dysfunction in PD patients may be either obstructive, restrictive, or both obstructive and restrictive impairment[(3)]. The airway obstruction can be explained by muscle rigidity and hypokinesia which are the two cardinal manifestations of PD patients[23]. Rigidity could induce decrease chest wall compliance, with inability to complete exhale leading to excessive air trapping. Bradykynesia could lead to disorganization of movements of respiratory related muscles facilitating airway obstruction[25]. Finally the possibility of parasympathetic over activity in those patients[39].

Reduction of both thoracic and vertebral column mobilization[3], subclinical manifestation of pleuropulmonary side effects of dopaminergic agoinsts facilitate the development of pulmonary restriction[16]. Kyphotic posture of the vertebral column[23,39], decrease muscle force, rhythmic involuntary movement of glottic and subglottic structures lead to abnormality in the inspiratory limb of the flow volume loop and irregular inspiratory flow oscillation[10,31].

In the present study, before starting the physical therapy treatment the spirometric parameters of the studied patients as regard (FVC, FEV, PIFR, PEFR, MVV & TLC) in addition to PI max, PE max were decreased compared to age matched control group, however there was increase in RV. These results were in accordance with De Bruin et al.,[10] and Sabat etal.,[40] they found that patients with PD often have reduction in maximum flows and pressure during maximum inspiratory and expiratory efforts. The significant and greater impairment in maximum voluntary ventilation (MVV) indicated an impaired performance of

repetitive respiratory motor acts as a result of bradykinesia and rigidity of the respiratory muscles[28,17]. In the present study, the weakness of respiratory muscles was evaluated by the reduction of maximum inspiratory and expiratory pressure (PI max & PE max) which adversely affect lung volume, respiratory system compliance, gas exchange & alveolar ventilation[28].

The decreased TLC in PD patients compared to control group my be attributed to reduction in VC, with inspirtory muscle weakness. The increased RV can be explained by profound expiratory muscle weakness due to inability of the expiratory muscles to decrease the volume of thoracic cavity. The increase in RV would in turn decrease VC[17]. Consistent with the results of previous studies[22,13], the results of the present study confirm significant improvement in FVC and respiratory function at the end of the treatment. The strength of inspiratory and expiratory muscles can be detected by the significant improvement of PI max and PE max and, consequently FVC. This improvement may be explained by the training effect of the accessory inspiratory muscles, diaphragm, as well as expiratory muscles. This results are contradicted with Wanke et al.,[49] and DiMarco et al.,[11] The former,[49] evaluated the effect of inspiratory muscle (IM) training in Duchennes muscular dystrophy, and found no changes in VC, forced expiratory volume, or MVV in either the control or training group. DiMarco et al.,[11] found also no improvement in IM force or VC following physical training. The lack of changes might be caused by sever inspiratory muscle impairment and reduced training protocol. The degree of improvement with training was directly related to patient's base line VC[11,49] The difference between the previous & present study might be explained by differences in patient population, training protocol or both.

The alternative explanation for the improved inspiratory muscle strength is a reduction of RV caused by expiratory muscle training. It might put the inspiratory muscles on a more advantageous part of their length tension relationship. During expiratory muscle strength, the patients increased their inspiratory lung volume, and hence, elastic recoil pressure. This stimulus was probably high enough to cause a training response of inspiratory muscles[21].

The various parameters of gait cycle are one set of quantitative measures of functional activity important to daily living[37]. In the present study, the evidence supporting the impact of PD on abnormal gait cycle is much higher in patients with pulmonary dysfunction. In PD respiratory function disability could be a factor contributing to daily living activities disabilities[42].

In agreement with Scandalis[41] and Morris[32] and comparing with normal gait pattern of the control matched subjects, the gait in PD at the present study was slow, short strides with no changes or decrease cadance. This result is contradicated with previous reports in literature that the subject with PD have a short stride and high cadance pattern[4].

The reduction of walking velocity may be attributed to movement disorders which are the hallmark of PD. Bradykinesia results from disruption of the neurotransmitter used in the neural projections from the internal segment of the globus pallidus of the basal ganglia to the supplementary motor area & the primary motor cortex[1]. Rigidity is due to abnormal activation of long latency stretch reflexes coupled with an increase in central reflex gain[8]. Muscle stiffness due to change in peripheral mechanical properties of the muscles[12]. Reduce the adapation of co-ordination between pelvic and thoracic rotation which is systematic manipulation of walking velocity[47,48]. Posture response are

compromised and the ankle, hip, arm, and steeping strategies are either absent or diminished in amplitude. In addition to reduced leg extension activation[12,30].

The increase in stride length post treatment was accompanied by increased movement velocity without an increase cadance. This result was consistent with Scandalis et al.,[41]. Direct relationship was observed between walking speed and stride length (SL) in subjects with PD[27] This finding, contradicting with other physical treatment methods, suggested that market velocity changes are associated with significant increase in stride length and cadance[50,51].

The improvement at the end of treatment may be attributed to intensive training effect of physical therapy intervention. It was concluded that generalization of training is most effective than the isolated movement training[43]. The repeated exercises simultaneously train the skeletal and respiratory muscles. The training program have been found to increase Vo_2 and reducing ventilatory requirement. Using the external cues eyes visual and audiotory in the present training program is another important factors for the improvement of gait at the end of treatment. The research literature provides considerable evidence that visual cues normalize the spatial and temporal variables of gait[7,45].

Thaut et al.,[45] demonstrated that a three weeks gait training program using audio tapes and rhythmical musical beats enhanced gait speed and stride length as well as altering the electromyographic patterns of the tibialis anterior and vastus lateralis muscles in PD patients. Mc Instosh et al.,[29] found that rhythmical auditory stimulation normalized the temporal and spatial variables of the footstep patters, in both the "on" and "off" stage of the levodopa medication cycle.

In the present study the training program included external cues visual and auditory and proprioceptive. The external cues utilize the intact premotor cortex of the brain rather than the defective basal ganglia supplementary motor area (circuits to control movement)[20]. An alternative explanation is that it may focus on the person's attention on critical aspects of the movement that need to be regulated such as stride length[33.34].

CONCLUSION

The results supported the hypothesis that respiratory dysfunction have a high incidence in PD disease, and are associated with gait disorders . Patients with PD can benefit from physical therapy training in term of pulmonary function and walking ability (speed and stride length) . Physical therapy mainly therapeutic exercises should be included as part of rehabilitation program. It is considered to be an important approach of PD treatment.

REFERENCES

1- Alexander, G.M. and Crutcher, M.D.: Functional architecture of basal ganglia circuits: neural substrates of parallel processing. Trends Neuro sci., 13: 266-271, 1990.

2- American Thoracic Society .Standardization of spirometry. Am. J. Respr. Gait Care Med., 152: 1107-1136, 1995.

3- Black, L.F. and Yatt, R.E.: Maximal respiratory pressures : normal values & relationship of age & sex. Am. Rev. Res. Dis., 99: 696-702, 1969.

4- Blin, O., Ferrandez, A.M. and Serratice, G.: Quantitative analysis of gait in Parkinson patients: increased variability of stride length. J. Neurol. Sci., 98: 91-97, 1990.

5- Boggard, J.M., Hovestadt, A., Meerwaldt, J.D., Vander Meche, F.G.A. and Stight, J.: Maximal expiratory and inspiratory flow volume curves

in Parkinson's disease. Am. Rev. Respir. Dis., 139: 610-614, 1989.

6- Bridgewater, K.J. and Sharpe, M.: Trunk muscle performance in early Parkinson's disease. Physical Therapy, 78 (6): 566-576, 1998 .

7- Bridgewater, K.J. and Sharpe, M.: Trunk muscle training and early Parkinson's disease. J. Physiotherapy and practice, 13: 139-153, 1997.

8- Burke, D., Hagbart, L.K. and Wallin, B.G.: Reflex mechanisms in Parkinsonian rigidity. Scand. J. Rehabil. Med., 9: 15-23, 1977.

9- Canning, G.G., Alison, J.A., Allen, N.E. and Groller, H.: Parkinson's disease: an investigation of exercise capacity, respiratory function and gait. J. App. physiol., 78(2): 199-207, 1997.

10- De Bruin, P.F.C., De Bruin, V.M.S., Lees, A.J. and Pride, N.B.: Effects of treatment on airway dynamic and respiratory muscle strength in Parkinson's disease. Am. Rev. Resp. Dis., 148: 1567-1580, 1993.

11- Di Marco, A.F., Kelling, J.S. and Di Marco, M.S.: The effects of inspiratory training on respiratory muscle function in patients with muscular dystrophy. J. Muscle., 8: 284-290, 1985.

12- Dietz, V., Leeders, K.L. and Cololombo, G.: Leg muscle activation during gait in Parkinson's disease: influence of body unloading. Electro Enceph. Clinic. Neurophsiol., 37: 400-405, 1997.

13- Estenne, M., Knoop, G. and Vanvaenbergh, J.: The effect of pectoralis muscle training in tetraplegie subjects. Am. Rev. Respir. Dis., 139: 1218-1222, 1989.

14- Fert, E., Doppelbauer, A. and Auff, E.: Physical activity and sports in patients suffering from Parkinson's disease in comparison with healthy seniors. J. Neural. Trans., 5: 157-161, 1993.

15- Fontana, G.A., Pantaleo, T., Lavorini, F., Benvenut, F. and Gangemi: Defective motor control of coughing in Parkinson's disease. Am. J. Respir. Crit. Care Med., 458-464, 1998.

16- Frans, E., Dom Rand and Demedts, M.: Pleuro pulmonary changes during treatment of Parkinson's disease with a long acting ergot derivatives cabergoline. J. Eur. Respir., 5: 263-265, 1992.

17- Gimenez, M., Severa, E., Vergara, P., Back, J. and Polu, J.: Endurance training in patients with chronic obstructive pulmonary disease. A comparison of high versus moderate intensity. Arch. Phys. Med. Rehabil., 81: 102-109, 2000.

18- Goede, C., Keus, S., Kwakkel, G. and Wagenaar, R.: The effect of physical therapy in Parkinson's disease. J. Arch. Phy. Med. Rehbil. 82: 509-515, 2001.

19- Gold, W.M: Pulmonary function testing. In Murray J f, Nadel J A eds. Text book of Respiratory Medicine W. B Saunders Co., Philadelphia, 781-881, 2000.

20- Goldberg, G.: Supplementary motor area: Structure and function review and hypotheses. Brain and Behavioural Sciences., 36: 567-616, 1985.

21- Gosselink, R., Kovacs, L., Ketelar, P., Carton, H. and Decramer.: Respirtory muscle weakness and respiratory muscle training in severly disabled multiple sclerosis patients. J. Arch. Phys. Med. Rehabil., 81: 747-751, 2000.

22- Gross, D., Ladd, H.W. and Riley, E.J.: The effect of training on strengh and endurance of the diaphragm in quadriplegies. Am. J. Med., 66: 27-33, 1980.

23- Hathirat, S., Renzetti, A.D. and MitchellM.: Measurement of total lung capacity by helium dilution in a constant volume system. Am. Rev. Respir. Dis., 102: 760-770, 1970.

24- Hoehn, M.M. and Yahr, M.D.: Parkinsonism : Onset, progression and mortality. Neurology, 17: 427-432, 1967.

25- Hovestadt, A., Bogaard, J.M., Meerwaldt, J.D. and Mechee, F.G.A.: Pulmonary function in Parkinson's disease. J. Neurology, Neurosurgery & psychiatry, 52: 329-333, 1989.

26- Jankovic, J.: The extrapyramidal disorders. In Bennett JC, Plun F, eds. Cecil Textbook of Medicine, 20th ed. Philadelphia, Pa: WB Saunders Co, 2042-2046, 1996.

27- Mackay Lyons. Variability in spatiotemporal gait characteristics over the course of the L. dopa cycle in people with advanced Parkinson

disease. Physical Therapy., 78(10): 1083-1094, 1998.

28- Mc Cool, F. and Tzelepis, E.: Inspiratory muscle training in patient with neuromuscular disease. Physical Therapy., 75(11): 1006-1014, 1995.

29- Mc Intosh, G.C., Brown, S.H., Rice, R.R. and Thaut, M.H.: Rhythmic auditory motor facilitation of gait patterns in patients with Parkinson's disease. J Neurol, Neurosurgy, Psychiatry, 62: 22-26, 1997.

30- Miyai, I., Fujimotoy, Ueda Y., Yamamoto, H., Nozaki, S., Saito, T. and Kang, J.: Treadmill training with body weight support. Its effect on Parkinson's disease. J. Arch. Phys. Med. Rehabil., 81: 849-851, 2001.

31- Morra, V., Polverno, M., Deluca, G., Land, P., Goldi, A. and Campanella, G.: Upper airway muscle dysfunction and Levodopa responsiveness in Parkinson's disease. Acta. Neurol., 14(4-6): 512-518, 1992.

32- Morris, M., Matyas, T., Iansek, R. and Summer, J.: Temporal stability of gait in Parkinson's disease. Physical therapy, 76(7): 763-777, 1996.

33- Morris, M.E., Iansek, R., Matyas, T.A. and Summers, J.J.: The pathogenesis of gait hypokinesia in Parkinson's disease. Brain, 115(pt5): 1161-1181, 1994.

34- Morris, M.E., Iansek, R., Matysa, T.A. and Summers, J.J.: Stride length regulation in Parkinson's disease: normalization strategies and underlying mechanisms. Brain, 119(pt2): 551-568, 1996.

35- Morris, M.E.: Movement disorders in people with Parkinson's disease: A model of physical therapy J. physical Therapy., 80(6): 578-597, 2000.

36- NgDc Parkinson's disease. Diagnosis and treatment. West J. Med., 165: 234-240, 1996.

37- Ounpuu, S.: Clinical gait analysis in: Spivack BS (ed): Evaluation and management of gait disorders. New York, Marcel Dekker, 1-51, 1995.

38- Protas, E.J., Stanley, R.K., Jankovic, J. and Mac Neill, B.: Cardiovascular and metabolic responses to upper and lower extremity exercise in men with idiopathic Parkinson's disease. Phys. Ther., 76: 34-40, 1996.

39- Sabata, M., Gonzalez, I., Ruperrez, F. and Rodriguez, M.: Obstructive and restrictive pulmonary dysfunction in Parkinson' s disease. J. Neurol Sci., 138(1-2): 114-119, 1996.

40- Sabate, M., Rodriguez, M., Mendez, E., Enrique, E. and Gonzalez1: Obstuctive and restrictive pulmonary dysfunction increase disability in Parkinson's disease. Arch. Phys. Med. Rehabil., 77: 23-34, 1996.

41- Scandalis, T.A., Bosak, A., Berline, J.C., Heman, L.L. and Wells, M.R.: Resistance training and gait functioning patients with Parkinson's disease. Am. J. Phys. Med. Rehabil., 80: 38-43, 2001.

42- Schenkman, M., Custon, T.M. and Kuchibhatla, M.: Exercise to improve spinal flexibility and function for people with Parkinson's disease: a randomized controlled trial. J. Am. Geritar. Soc., 46: 1207-1216, 1998.

43- Schmidt, R.A.: Motor control and learning. A Behavioral Emphasis. 3rd ed. Champaign, III: Human kinetics Inc; 1999.

44- Stelzing, Y., Hockhaus, W., Gall, V. and Henneberg, A.: Laryngeal manifestations in patients with Parkinson' s disease. Laryngo - rhinootogic, 78(10): 544-51, 1999.

45- Thaut, M.H. and MC Intosh, Rice R.R.: Rhythmic auditory stimulation in gait training for Parkinson's disease patients . Mov. Disord., 11: 193-200, 1996.

46- Ulm, G.: The current significance of physiotherapeutic measures in the treatment of Parkinson's disease. J. Neurol, Transm. Suppl., 46: 455-460, 1995.

47- Van Emmerik, R., Wagenaar, R., Winogrodzka, A. and Wolters, E.: Identification of axial rigidity during locomotion in Parkinson disease. Arch. Phys. Med. Rehabil., 80: 186-191, 1999.

48- Van Emmerik, R.E.A. and Wagenaar, R.C.: Effects of velocity on relative phase dynamic in the trunk human walk. J. Biomech., 29: 1175-1184, 1996.

49- Wanke, T., Toifl, K. and Meke, M.: Inspiratory muscle training in patients with Duchenne

muscular dystrophy. Chest., 105: 475-482, 1994.

50- Wells, M.R., Bosak, A. and Scandalis, T.: Gait analysis in the evaluation of physical treatment and surgical methods in Parkinson's disease. Gait Posture., 7: 188-200, 1998.

51- Wells, M.R., Giantinoto, S.D. and Agate, D.: Standard osteopathic manipulative treatment acutely improves functional gait performance in patients with Parkinson's disease. J. Am. Osteopath. Assoc., 99: 92-98, 1999.

الملخص العربي

تأثير تدخل العلاج الطبيعي على الوظائف التنفسية والمشي في مرضى الشلل الرعاشي (باركنسون)

الهدف من البحث هو دراسة تأثير برنامج خاص من التمرينات العلاجية لمدة ثلاثة أشهر على الوظائف التنفسية والمشي في مرضى الشلل الرعاش(باركنسون). وقد أجريت الدراسة على عشرون مريضا يعانون من مرض الشلل الرعاش (باركنسون) متوسط أعمارهم ٣,٢± ٦١,٤ تـم اختيارهم من قسم الأعصاب بالقصر العيني بعد إجراء الأشعات و الفحص الإكلينيكي والاختبارات الطبيعية لهم كما تم اختبار عشرون من الأشخاص الأصحاء المماثلين للمرضى في السن والطول والوزن كعينة ضابطة لمقارنة نتائجهم بالمرضى .

وقـد اشـتمل اختـبار الوظائف التنفسية الذي أجري لكل مريض على حده على اختبار وظائف المضخة التنفسية ، قوة عضلات التنفس (الشـهيق والزفـير ، الكفـاءة الكلـية للرئتين كما تم تحليل المشي أثناء المشي بأقصى سرعة ممكنة لكل مريض لمعرفة السرعة وعدد الخطوات في الدقيقة والمسافة بين ملامسة القدم للأرض وملامسة نفس القدم مرة أخرى أثناء دورة المشي .

وبمقارنـة متوسـط نـتائج المرضى مع متوسط نتائج المجموعة الضابطة لوحظ وجود انخفاض في كفاءة كل الوظائف التنفسية(التهوية الإرادية، الضغط الشهيقي والزفيري ، المقدرة الكلية للرئتين) وزيادة في حجم الهواء المتبقي في الرئة في مجموعة المرضى كما أظهر تحليل دورة المشي بطئ في الحركة وصغر في المسافة بين ملامسة القدم للأرض وملامسة نفس القدم مرة أخرى أما عدد الخطوات فلم تتغير .

وبمقارنة النتائج الخاصة بوظائف التنفس والمشي قبل وبعد إجراء برنامج خاص من التمرينات العلاجية أظهرت النتائج وجود تحسن ذو دلالة إحصائية في كل من التهوية الإرادية العظمى وفي قوة العضلات المسئولة عن التنفس وفي المقدرة الكلية للرئتين كما انخفض الهواء المتبقـي فـي الرئتيـن كمـا أظهرت النتائج وجود تحسن ذو دلالة إحصائية في سرعة المشي وفي المسافة بين ملامسة القدم للأرض وملامستها مرة أخرى أثناء دورة المشي ولم يحدث تغيير ذو قيمة إحصائية في عدد الخطوات في الدقيقة بعد أداء برنامج العلاج الطبيعي الخاص .

ومـن هـذا نستنتج ضرورة وأهمية دور التمرينات العلاجية المقننة بالنسبة لمرضى الشلل الرعاشي (باركنسون) المتمثلة في رفع كفاءة الرئة وتحسين وظائف التنفس والمشي بصفة خاصة.