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Rehabilitation Versus no Intervention – Only a Continued Intensive Program Conducted Statistically Significant Improvements Motor Skills in Parkinson's Disease Patients

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1. Introduction

Parkinson's disease (PD) is a degenerative disease characterised by movement disorder, which consists of bradykinesia (movement slowness), hypokinesia (reduced movement), tremor, rigidity and alterations in gait and posture; mood changes also constitute a main component of PD (Marsden, 1994), which is also related to postural instability and often to cognitive deficits (Carne, et al., 2005). Working memory —which is defined as the capacity to maintain, supervise and use inner information for behavioural self-control— is an essential cognitive skill which works as base for other more complex and executive functions affected by PD (Baddeley, 1992). Since 1987, the Parkinson Study Group has undertaken a series of random controlled tests. In these studies, researchers used standardized clinical scales to examine the impact of pharmaceutical interventions on the progression of PD symptoms (Carne, et al., 2005). Other authors (Hiroyuki, et al. 2003) have studied modifications in balance, demonstrating that balance exercises lead to improvement in the function of static balance and that gait exercises improve dynamic balance and wandering functions in fragile or dependent elderly patients(Hiroyuki, et al. 2003). Quantitative reduction of muscular strength in the back, hips, ankles, with damage in propioception —visual sense and the lowest support base— are the main cause of instability in patients with Parkinson's disease. Motor complications caused by the disease have an important effect on physical and functional capacity.

Regarding gait, Herman et al., (Herman, et al. 2007), have evaluated the effects of 6 weeks of treadmill exercises, which allow rhythmic training of gait, functional mobility and quality of life in PD patients; the results obtained show the exercises' potential to improve gait rhythmically in PD patients and suggest that a progressive and intensive training program in treadmill may be used to reduce gait alterations and falling risk, and increase the quality of life of such patients[5]. In this sense, some authors (Brichelto, et al. 2006) showed potential short-term effectiveness of gait-slowness training in PD patients. Positive results were documented by clinic position scales and gait objective evaluation. Quick loss of clinical advantage suggests that further researches are necessary for a more precise definition of optimum frequency and treatment duration (Brichelto, et al. 2006). In order to reduce bradykinesia, the combination of motor imagery and real practice of motor movement might turn out to be efficient in PD treatment. Putting into practice such treatment regime allows improving quality of life involving non-significant risks and low cost (Tamir & Huberman, 2007). Several standard guidelines as well as interdisciplinary measures have been established with the purpose of achieving overall improvement of personal wellbeing, such as physical exercise, occupational and speech therapies, and psychological, food and social guidance, obtaining encouraging results (Quality Standars Subcommitte, American Academy of Neurology, 1993; Köler, et al., 1994). According to observations, occupational and behavioural therapies based on psychological and motivational aspects might induce improvements in movement initiation and quality (Muller, et al., 1997). Treatment by functional recovery or physiotherapy has already shown its effectiveness in PD patients (Comella, et al., 1994; Formisano, et al., 1992; Franklyn, et al., 1981; Gibberd, et al., 1981; Pederson, et al., 1990), although such evidence is questioned in several reports (Ellgring, et al., 1990). Physical therapy generally works as reinforcement for the motor program, but such kind of intervention generally lacks of motivational and emotional spheres which might explain why physiotherapy traditionally achieves little influence on mood condition and is not easily incorporated into the patient's way of life (Ellgring, et al., 1990). On the other hand, it is also well-known that psychosocial variables such as emotional or psychosocial tension have a strong influence on gait and postural anomalies, as well as on other motor functions (Carne, et al., 2005; O´Shea, et al., 2002).

In order to quantify improvement in patient's motor condition and be able to show variations in his/her quality of life, the use of the Unified Parkinson's Disease Rating Scale (UPDRS) has prevailed (Movement Disorder Society Task Force on Ratio Scales for Parkinson´s Disease, 2003). Pellecchia et al. (Pellecchia, et al., 2004) observed that —after a physiotherapy protocol— a significant improvement of UPDRS scoring took place in the section of daily-life activities and the motor section, but also in the Self-rating Scale for PD Incapacity, the 10-metre walking test and Zung Self-rating Depression Scale; after three months such clinic improvements were maintained to a great extent (Pellecchia, et al., 2004). In the same way, Ellis et al. (Ellis, et al., 2005) found out that total scoring within the mental and motor sections was not much different among different groups and that significant differences were only found three months after treatment in the UPDRS section devoted to daily-life activities and its total scoring (Ellis, et al., 2005), observing that PD patients obtain short-term benefits from physiotherapeutic group treatment and long-term advantages in UPDRS total scoring, although significant variations were found among different groups(Ellis, et al., 2005). Therefore, it seems to be evident that sustained improvement in motor skills can be achieved in PD patients through a physiotherapy program within a reasonable long term time-period (Pellecchia, et al., 2004; Ellis, et al., 2005).

Therefore, the aim of the present study is to demonstrate the effectiveness of a physiotherapy protocol in PD patients, quantified in terms of improvement in UPDRS scoring within its motor subscale.

2. Material and methods

2.1 Sample

27 PD patients (12 females and 15 males), members of the PD Patient Association from Astorga and its Region (Spain), of 69.50± 10.34 years of age —ranging from 55 to 80 years of age— and with an average number of disease evolution years of 11.39±1.614, ranging from 10 to 15 evolution years.

All subjects met the following inclusion criteria: Stable reaction to anti-Parkinson medication; Hoehn and Yahr stage I, II or III; At least one mobility-related activity limitation within the core areas of physiotherapy practice in PD (gait, balance and posture); No severe cognitive impairment, defined by Mini-Mental State Examination, score ≥24; No other severe neurologic, cardiopulmonary, or orthopedic disorders and not having participated in a physical therapy or rehabilitation program in the previous 4 month.

We divided our patient into two groups: control group (n=9, received only medication therapy) and experimental group (n=18, received physical therapy and medication therapy).

2.2 Kind of study

Descriptive study which consists of analysis —within the particular context of a PD association— of the relation between physiotherapeutic treatment and scoring obtained through motor examination in UPDRS scale; and Transversal study, since two measurements are carried out within two particular time periods (beginning and end of physiotherapeutic treatment).

2.3 Method

Qualitative: carried out on a reduced population (n=27), analysing physiotherapeutic strategy; and Quantitative: analysis of data obtained through motor examination in UPDRS scale.

2.4 Data collection process

We interview each patient and one of his/her relatives, who were provided with a complete description of the project. Through the following weeks we undertook data collection of the study variables composing the section of motor examination in the UPDRS scale (O´Shea, et al., 2002; Movement Disorder Society Task Force On Ratio Scales For Parkinson´s Disease, 2003) with each patient in both on and off phases. The physical therapist involved in conducting UPDRS was not involved in performing the intervention. All subjects were required to take their medications at the same time of day for all assesment sessions. All subjects usage: L-dopa, dopamine –agonist and amantadine. It should be pointed out that —during study development— we decided to carry out greater incidence on physical work focused on the variables of neck rigidity, posture, postural stability and gait in each patient; as a consequence of such approach, we analyse —apart from results of global scoring in motor examination in UPDRS scale— the results of these four variables.

2.5 Intervention protocol

For the application of the study, we undertook a program of physiotherapeutic treatment according to protocol (Ellis, et al., 2005; Keus, et al., 2007; Morris, 2000; Scandalis, et al., 2001), in which all patients in the sample received physiotherapy group sessions.

The group sessions took 90 minutes. All treatment sessions occurred at the same time of the day throughout the study. The physiotherapist involved in performing the intervention was not involved in conducting UPDRS scale.

The treatment consisted of cardiovascular warm-up activities (5min), stretching exercises (15min), strengthening exercises in a functional context (15min), functional training (15min), gait training overground and on a treadmill with external auditory cueing (15min), balance training and recreational games (15min), and relaxation exercise (10min).

According to the frequency of attendance to such sessions, we divided our experimental group (n=18) into four different subgroups: Subgroup 1 (from 1 to 3 monthly sessions), Subgroup 2 (from 4 to 6 monthly sessions), Subgroup 3 (from 7 to 9 monthly sessions) and Subgroup 4 (from 10 to 12 monthly sessions); each group will obtain different scores in motor examination, as it will be demonstrated in the section corresponding to result analysis.
We also undertook program revision after 32 weeks, in that the physical therapist entrusted to gather to the beginning of the study the punctuations in the subscale engine of the scale UPDRS with every subject of the study so much in the stadium on as (like) in the off, returns to gather the corresponding punctuation in identical conditions to those of the beginning of the study (at the same hour in two interviews). All the subjects finished the study, so much those of the group control as those of the experimental group.

2.6 Statistical analysis

These study design was a Prospective, Randomized, Placebo-Controlled, Double-Blinded Study. For data analysis we use statistical software SPSS® in its 16.0 version.
We calculate measures for central trend (mean, median, mode, standard deviation, minimum and maximum value); we use Student's t-test to analyse the existing relation among the four study variables. Significance level was fixed with $p<0.05$ and $p<0.01$, with a confidence interval of 95% and 99%, respectively.

3. Results

3.1 Experimental group

Regarding measures of central trend of global scoring obtained in the section of motor examination in the UPDRS scale achieved in pre- and post-intervention stages, it is obtained in the on phase that the value of the mean comes from 64.22 ±16.383 before physiotherapeutic intervention to 50.89±19.499 after intervention; in the off phase the value of such mean comes from 85.78±12.549 to 75.78±17.745.
If one compares data obtained in the pre- and post-intervention stages, apart from the decrease in global average scoring, it is also obtained a decrease in the values of the means of the central trend in variables of neck rigidity, posture, postural stability and gait (Table1).
In the neck-stiffness variable, it is where greatest difference among mean values of pre- and post-intervention are obtained, for both on (from 3.33 to 2.11) and off (from 3.72 to 2.94) phases.
The Table2 shows study-variable changes in the different modalities in on phase; by comparing data (expressed in percentages) obtained in pre- and post-intervention stages, it can be pointed out: a decrease in normal-posture modality from 0% to 11.1%;an increase postural stability (recovered without help) from 11.1% to 50% and a decrease in severe-gait-condition modality from 38% to 22.2%.
Table 3 shows study-variable changes in different modalities in off phase; by comparing data (expressed in percentages) obtained in pre- and post-intervention stages, it can be pointed out: a decrease of severe-rigidity modality from 72.2 % to 27.8 %; a variation in slight-rigidity modality or only in neck activity from 0% to 11.1% after physiotherapeutic intervention; a decrease in postural stability (unable to stand) from 38.9% to 22.2% and a decrease in severe-gait-condition modality from 55.6% to 16.7%.

	Valid N	Missing N	Mean	Median	Mode	Standard deviation	Min.	Max.
PHASE ON								
Pre-intervention								
Neck rigidity	18	0	3,33	3,00	3	,594	2	**4**
Posture	18	0	2,33	2,50	3	,907	1	**4**
Postural stabillity	18	0	2,33	2,00	2	,686	1	**3**
Gait	18	0	2,33	2,00	2	,840	1	**4**
Post-intervention								
Neck rigidity	18	0	2,11	2,00	2	,900	1	**4**
Posture	18	0	1,89	2,00	2	1,231	0	**4**
Postural stabillity	18	0	1,50	1,00	1	,985	0	**3**
Gait	18	0	1,94	2,00	2	,938	0	**3**
PHASE OFF								
Pre-intervention								
Neck rigidity	18	0	3,72	4,00	4	,461	3	**4**
Posture	18	0	3,11	3,00	3	,676	2	**4**
Postural stabillity	18	0	3,22	3,00	3	,732	2	**4**
Gait	18	0	3,11	3,00	3	,676	2	**4**
Post-intervention								
Neck rigidity	18	0	2,94	3,00	3	,938	1	**4**
Posture	18	0	2,72	2,00	3	,958	1	**4**
Postural stabillity	18	0	2,56	3,00	2	,984	1	**4**
Gait	18	0	2,78	3,00	4	1,166	1	**4**

Table 1. Experimental group, measures of central trend in on and off stages in pre- and post-intervention stages.

			Fq	%	Valid %	Cumulative %
Neck rigidity pre-intervention.	Valid	mild/moderate.	1	5,6	5,6	**5,6**
		marked, but full range of motion easily achieved.	10	55,6	55,6	**61,1**
		severe.	7	38,9	38,9	**100,0**
		Total	18	100,0	100,0	

			Fq	%	Valid %	Cumulative %
Neck rigidity post-intervention.	Valid	slight or only with activation.	4	22,2	22,2	**22,2**
		mild/moderate.	7	38,9	38,9	**61,1**
		marked, but full range of motion easily achieved.	4	22,2	22,2	**83,3**
		severe.	3	16,7	16,7	**100,0**
		Total	18	100,0	100,0	
Posture pre-intervention.	Valid	slightly stooped posture.	4	22,2	22,2	**22,2**
		moderately stooped posture.	5	27,8	27,8	**50,0**
		severely stooped posture with kyphosis.	8	44,4	44,4	**94,4**
		marked flexion with extreme abnormality of posture.	1	5,6	5,6	**100,0**
		Total	18	100,0	100,0	
Posture post-intervention.	Valid	normal erect.	2	11,1	11,1	**11,1**
		slightly stooped posture.	5	27,8	27,8	**38,9**
		moderately stooped posture.	8	44,4	44,4	**83,3**
		severely stooped posture with kyphosis.	2	11,1	11,1	**94,4**
		marked flexion with extreme abnormality of posture.	1	5,6	5,6	**100,0**
		Total	18	100,0	100,0	
Postural stability pre-intervention.	Valid	recovers unaided.	2	11,1	11,1	**11,1**
		would fall if not caught by examiner.	8	44,4	44,4	**55,6**
		falls spontaneously.	8	44,4	44,4	**100,0**
		Total	18	100,0	100,0	
Postural stability post-intervention.	Valid	normal.	1	5,6	5,6	**5,6**
		recovers unaided.	9	50,0	50,0	**55,6**
		would fall if not caught by examiner.	4	22,2	22,2	**77,8**
		falls spontaneously.	2	11,1	11,1	**88,9**
		unable to stand.	2	11,1	11,1	**100,0**
		Total	18	100,0	100,0	
Gait pre-intervention.	Valid	walks slowly.	3	16,7	16,7	**16,7**
		walks with difficulty, but requires little or no assistance.	7	38,9	38,9	**55,6**
		severe disturbance of gait, requiring assistance.	7	38,9	38,9	**94,4**
		cannot walk.	1	5,6	5,6	**100,0**
		Total	18	100,0	100,0	
Gait post-intervention.	Valid	normal .	2	11,1	11,1	**11,1**
		walks slowly.	6	33,3	33,3	**44,4**
		walks with difficulty, but requires little or no assistance.	5	27,8	27,8	**72,2**
		severe disturbance of gait, requiring assistance.	4	22,2	22,2	**94,4**
		cannot walk.	1	5,6	5,6	**100,0**
		Total	**18**	**100,0**	**100,0**	

Table 2. Experimental group, modifications in scores of variables neck rigidity, posture, postural stability and gait in the *on* phase of the pre- and post-intervention stage.

			Fq	%	Valid %	Cumulative %
Neck rigidity pre-intervention	Valid	marked, but full range of motion easily achieved.	5	27,8	27,8	**61,1**
		severe.	13	72,2	72,2	**100,0**
		Total	18	100,0	100,0	
Neck rigidity post-intervention	Valid	slight or only with activation.	2	11,1	11,1	**11,1**
		mild/moderate.	2	11,1	11,1	**22,2**
		marked, but full range of motion easily achieved.	9	50	50	**72,2**
		severe.	5	27,8	27,8	**100,0**
		Total	18	100,0	100,0	
Posture pre-intervention	Valid	moderately stooped posture.	3	16,7	16,7	**16,7**
		severely stooped posture with kyphosis.	10	55,6	55,6	**72,2**
		marked flexion with extreme abnormality of posture.	5	27,8	27,8	**100,0**
		Total	18	100,0	100,0	
Posture post-intervention	Valid	slightly stooped posture.	2	11,1	11,1	**11,1**
		moderately stooped posture.	5	27,8	27,8	**38,9**
		severely stooped posture with kyphosis.	7	38,9	38,9	**77,8**
		marked flexion with extreme abnormality of posture.	4	22,2	22,2	**100,0**
		Total	18	100,0	100,0	
Postural stability pre-intervention	Valid	would fall if not caught by examiner.	3	16,7	16,7	**11,1**
		falls spontaneously.	8	44,4	44,4	**61,1**
		unable to stand.	7	38,9	38,9	**100,0**
		Total	18	100,0	100,0	
Postural stability post-intervention	Valid	recovers unaided.	2	11,1	11,1	**11,1**
		would fall if not caught by examiner.	9	44,4	44,4	**55,6**
		falls spontaneously.	4	22,2	22,2	**77,8**
		unable to stand.	2	22,2	22,2	**100,0**
		Total	18	100,0	100,0	
Gait pre-intervention	Valid	walks with difficulty, but requires little or no assistance.	3	16,7	16,7	**16,7**
		severe disturbance of gait, requiring assistance.	7	55,6	55,6	**72,2**
		cannot walk.	7	27,8	27,8	**100,0**
		Total	18	100,0	100,0	
Gait post-intervention	Valid	walks slowly.	3	16,7	16,7	**16,7**
		walks with difficulty, but requires little or no assistance.	5	27,8	27,8	**44,4**
		severe disturbance of gait, requiring assistance.	3	16,7	16,7	**61,1**
		cannot walk.	7	38,9	38,9	**100**
		total	**18**	**100,0**	**100,0**	

Table 3. Experimental group, modifications in scores of variables neck rigidity, posture, postural stability and gait in the *on* phase of the pre- and post-intervention stage.

Thus, as it can be observed in Tables 2 and 3, better results were obtained in on phases than in off phases after physiotherapeutic intervention.
According to attendance to group sessions, different results were obtained for the four study-variables:
The results obtained by applying Student's t-test with a p<0.05 significance level were: Subgroup 1: the difference among the four variables —in on phase and pre- and post-intervention stages— is not statistically significant (p>0.05) and t-test could not be calculated in the off phase since the standard error of the difference equals zero; Subgroup 2: the difference among the four variables in both on and off phases of the pre- and post-intervention stages is not statistically significant; Subgroup 3: in the on stage, the difference between stiffness in pre- and post-intervention stages is statistically significant (p<0.05), as well as the difference in posture between pre- and post-intervention stages. However, the difference regarding balance in pre- and post-intervention stages could not be calculated, since the standard error of the difference equals zero; regarding posture and gait in pre- and

	Mean	Standar desviation	Standard error of mean	95% confidence interval		t-value	Degrees of freedom	Critical level
				Min	Max			
PHASE ON								
Neck rigidity pre-intervention_ neck rigidity post-intervention.	1,875	,354	,125	1,579	2,171	15,000	7	,000
Posture pre-intervention_ posture post-intervention.	1,250	,463	,164	,863	1,637	7,638	7	,000
Retropulsion test pre-intervention_ retropulsion test post-intervention.	1,375	,518	,183	,942	1,808	7,514	7	,000
Gait pre-intervention_ gait post-intervention.	,875	,354	,125	,579	1,171	7,000	7	,000
PHASE OFF								
Neck rigidity pre-intervention_ neck rigidity post-intervention.	1,375	,744	,263	,753	1,997	5,227	7	,001
Posture pre-intervention_ posture post-intervention.	1,000	,535	,189	,553	1,447	5,292	7	,001
Retropulsion test pre-intervention_ retropulsion test post-intervention	1,500	,535	,189	1,053	1,947	7,937	7	,000
Gait pre-intervention_ gait post-intervention.	1,000	,535	,189	,553	1,447	5,292	7	,001

Table 4. Experimental group: Student's t-test fro Subgroup 4 in on and off phase between pre- and post-intervention stages with a 95 % confidence interval.

post-intervention stages, statistical difference is not significant. T-test could not be calculated for stiffness in the on phase since standard error of the difference equals zero; differences were not either significant in the other three variables; and Subgroup 4: the difference among the four variables in the on and off phases in pre- and post-intervention stages is statistically significant (Table 4).
The results obtained by applying Student's t-test with a $p<0.01$ significance level, were: Subgroups 1, 2 and 3: No statistically significant difference was obtained among the four study variables in on or off phases ($p>0.01$) and Subgroup 4: the difference among the four variables in on and off phases in pre- and post-intervention stages is statistically significant (Table 5 and Figure 2).

	Mean	Standar desviation	Standard error of mean	99% confidence interval		t-value	Degrees of freedom	Critical level
				Min.	Max.			
PHASE ON								
Neck rigidity pre-intervention_ neck rigidity post-intervention.	-,556	,527	,176	-1,145	,034	-3,162	8	**,000**
Posture pre-intervention_ posture post-intervention.	-,556	,726	,242	-1,368	,257	-2,294	8	**,000**
Retropulsion test pre-intervention_ retropulsion test post-intervention.	-,444	,726	,242	-1,257	,368	-1,835	8	**,000**
Gait pre-intervention_ gait post-intervention.	-,556	,527	,176	-1,145	,034	-3,162	8	**,000**
PHASE OFF								
Neck rigidity pre-intervention_ neck rigidity post-intervention.	-,556	,726	,242	-1,368	,257	-2,294	8	**,001**
Posture pre-intervention_ posture post-intervention.	-,444	,726	,242	-1,257	,368	-1,835	8	**,001**
Retropulsion test pre-intervention_ retropulsion test post-intervention	-,333	,707	,236	-1,124	,458	-1,414	8	**,000**
Gait pre-intervention_ gait post-intervention.	**-,444**	**,726**	**,242**	**-1,257**	**,368**	**-1,835**	**8**	**,001**

Table 5. Experimental group: Student's t-test fro Subgroup 4 in on and off phase between pre- and post-intervention stages with a 99 % confidence interval.

3.2 Control group

The results obtained by applying Student's t-test with a $p<0.05$ significance level were: the difference among the four variables —in on and off phases and pre- and post-intervention stages— is not statistically significant. The results obtained by applying Student's t-test with a $p<0.01$ significance level were: the difference among the four variables —in on and off phases and pre- and post-intervention stages— is not statistically significant (Table 6).

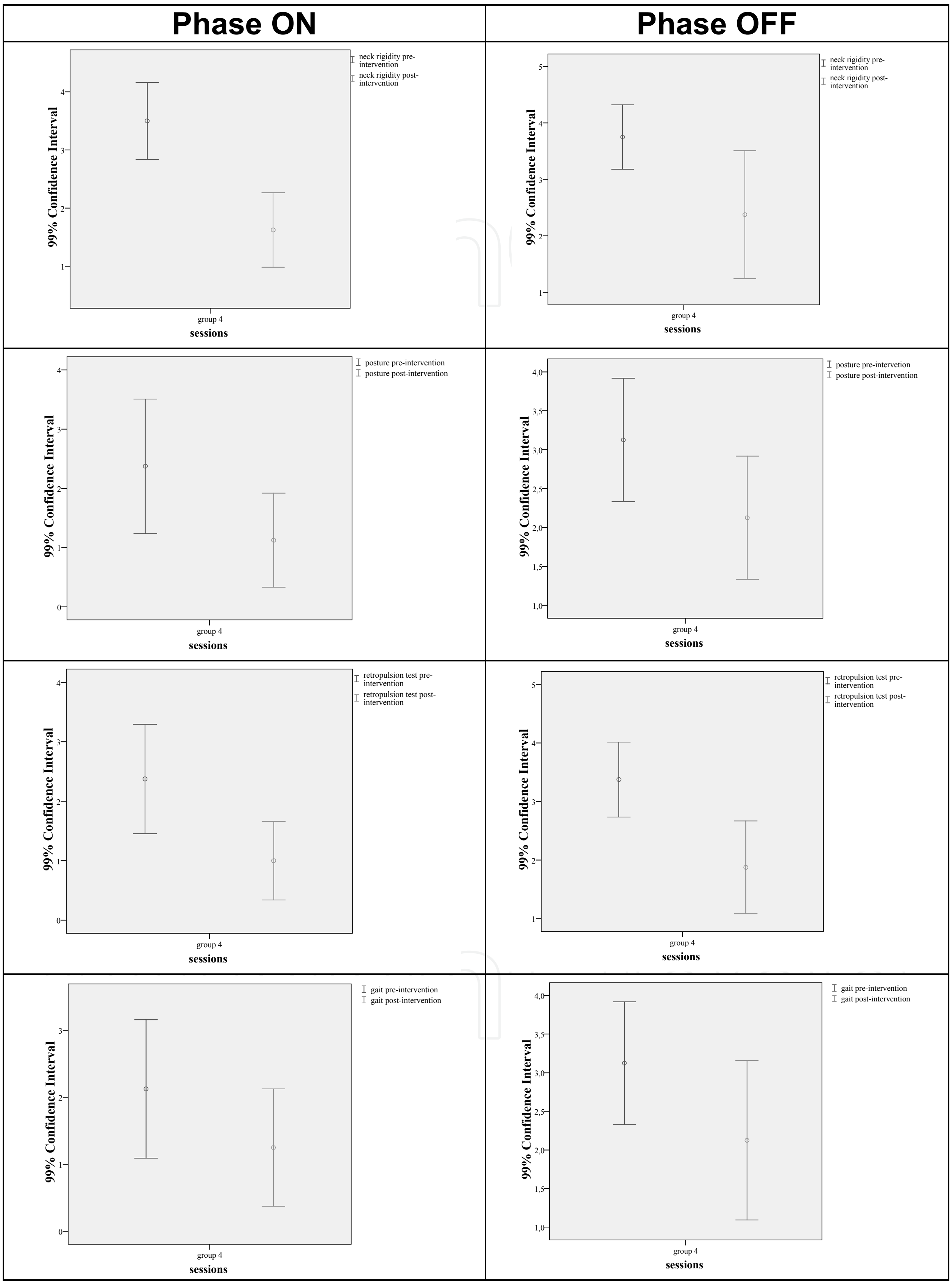

Fig. 1. Experimental group, Subgroup 4: mean values of clinical measurements (99% confidence Interval).

	Mean	Standar desviation	Standard error of mean	99% confidence interval		t-value	Degrees of freedom	Critical level
				Min.	Max.			
PHASE ON								
Neck rigidity pre-intervention_ neck rigidity post-intervention.	-,556	,527	,176	-,961	-,150	-3,162	8	**,013**
Posture pre-intervention_ posture post-intervention.	-,556	,726	,242	-1,114	,003	-2,294	8	**,051**
Retropulsion test pre-intervention_ retropulsion test post-intervention.	-,444	,726	,242	-1,003	,114	-1,835	8	**,104**
Gait pre-intervention_ gait post-intervention.	-,556	,527	,176	-,961	-,150	-3,162	8	**,013**
PHASE OFF								
Neck rigidity pre-intervention_ neck rigidity post-intervention.	-,556	,726	,242	-1,114	,003	-2,294	8	**,051**
Posture pre-intervention_ posture post-intervention.	-,444	,726	,242	-1,003	,114	-1,835	8	**,104**
Retropulsion test pre-intervention_ retropulsion test post-intervention	-,333	,707	,236	-,877	,210	-1,414	8	**,195**
Gait pre-intervention_ gait post-intervention.	**-,444**	**,726**	**,242**	**-1,257**	**,368**	**-1,835**	**8**	**,104**

Table 6. Student´s t-test fro control group in on and off phase between pre- and post-intervention stages with a 95% confidence interval

4. Discussion

As Morris et al. (Morris, 2000) state, there is a need to devise and evaluate locomotor training programs for both the on an off phases of the levodopa cycle. The effects of PD medications on movement and functional capacity should not be overlooked.

Following Jacobs et al. (Jacobs & Horak, 2006), greater validity and sensibility is achieved in balance valuation in PD patients by supplementing the retropulsion test of the UPDRS scale with the test on postural stability developed. Our work achieves global improvement in motor capacity in PD patients, as it is demonstrated by the decrease of average scores in motor examination and by significant modifications regarding the variables of neck rigidity, posture, postural stability and gait. Regarding the effectiveness of physiotherapy programs, we agree with De Goede et al. (De Goede, et al., 2001) and Ellis et al. (Ellis, et al., 2005), who demonstrate the benefits of a physiotherapy program supplementary to medical treatment; however, we have observed a significant increase in the improvement of the four variables studied in patients belonging to the Subgroup 4 of the present study.

It has been studied (Lun, et al., 2005) the effect of a self-supervised home exercise program and a therapist-supervised exercise program on motor symptoms in PD; Lun et al., (Lun, et al., 2005), —through an evaluator-blinded clinical trial— observed that (confidence intervals at 95 % were calculated for change in secondary results measures with an 8-week duration) a statistically significant decrease took place in the motor-examination section of UPDRS during those scarce 8 weeks in both treatment groups; no difference was found in the confidence interval at 95 % of secondary results measures (Lun, et al., 2005). Although patients in our work have followed the protocol under strict professional guidance (undertaken by the physiotherapist in charge of their treatment), it can be found in the bibliographical references that the validity of a self-supervised home exercise program is similar to that of a physiotherapist-supervised program regarding improvement of motor symptoms in PD patients (Lun, et al., 2005). Such finding is important for advising PD patients with regard to co-adjuvant treatment through exercise (movement) of DP motor symptoms.

Apart from traditional treatments, a series of supplementary methods are also applied, such as Qigong. Studies in such line by Schmitz-Hübsch et al., (Schmitz-Hübsch, et al., 2006) demonstrated —after 3, 6 and 12 months— that there were more patients whose symptoms improved in the Qigong group than in control group within a 3 and 6-month period ($P = 0.0080$ for 3 months and $P = 0.0503$ for 6 months; using the Fisher's exact test); depression scores diminished in both groups, while the incidence of non-motor symptoms only diminished in the treatment group (Schmitz-Hübsch, et al., 2006). Nallegowda et al. (Nallegowda, et al., 2004), showed that medication improves muscular strength, gait-speed and ankle optimization when gaiting, and did not observe worsening of the propioceptive sense. However, it was observed a correlation among muscle strength, static and dynamic balance, and gait in both on and off phases (Nallegowda, et al., 2004).

5. Conclusions

In short, quantitative reduction of muscle strength in back, hip and ankle —with damage to propioception and visual sense, and lower supporting base— are the main causes for

postural instability in PD patients. We have observed in the present study that when increasing the number of sessions up to 7-12 (subgroups 3 and 4), scoring in motor subscale is higher, which indicates that neck rigidity, posture, postural stability and gait improve, and that such improvement is longer lasting; such fact is demonstrated establishing significance level at $p < 0.01$, for which subgroup 4 is the only group obtaining statistically significant improvements.
Definitively, since Jöbges et al., (Jöbges, et al., 2007) demonstrated the clinical relevance of rehabilitation programs for patients of PD is estimated to be sufficient if the following seven criteria are met: effectiveness, everyday life relevance, long-term effect, therapy frequency+setting, duration of therapy units, quality of live, timing of assessment+medication; for it, we conclude that the relevant of our work is to have demonstrated the long-term efficiency of a physiotherapy protocol in PD.

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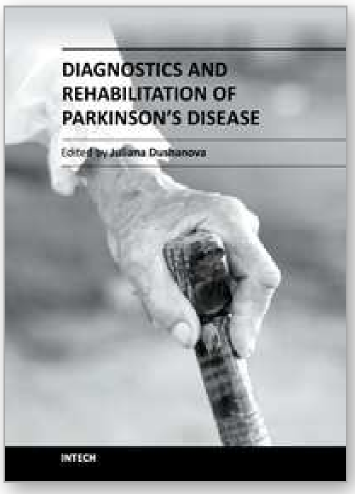

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Diagnostics and Rehabilitation of Parkinson's Disease presents the most current information pertaining to news-making topics relating to this disease, including etiology, early biomarkers for the diagnostics, novel methods to evaluate symptoms, research, multidisciplinary rehabilitation, new applications of brain imaging and invasive methods to the study of Parkinson's disease. Researchers have only recently begun to focus on the non-motor symptoms of Parkinson's disease, which are poorly recognized and inadequately treated by clinicians. The non-motor symptoms of Parkinson's disease have a significant impact on patient quality of life and mortality and include cognitive impairments, autonomic, gastrointestinal, and sensory symptoms. In-depth discussion of the use of imaging tools to study disease mechanisms is also provided, with emphasis on the abnormal network organization in parkinsonism. Deep brain stimulation management is a paradigm-shifting therapy for Parkinson's disease, essential tremor, and dystonia. In the recent years, new approaches of early diagnostics, training programmes and treatments have vastly improved the lives of people with Parkinson's disease, substantially reducing symptoms and significantly delaying disability. Written by leading scientists on movement and neurological disorders, this comprehensive book should appeal to a multidisciplinary audience and help people cope with medical, emotional, and practical challenges.

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