

Review

Does Qigong Practice Have Benefits on the Management of Parkinson's Disease?

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Abstract: Parkinson's disease (PD) is a progressive neurological disorder leading to loss of autonomy and a decline in quality of life. Qigong, a practice rooted in traditional Chinese medicine, has been positively reported on a variety of complaints of chronically ill patients and on gait imbalance in the elderly. PubMed and B-On databases were accessed during March 2018 to carry out an inventory of relevant scientific papers relating PD to Qigong. Fifteen articles were found and analyzed allowing us to highlight that: (1) in addition to medication, Qigong shows potential gains in PD management; (2) there is a stabilizing effect of motor symptoms and positive results in several frequent autonomy symptoms; (3) Qigong is highly accepted by patients, and is a cost-effective treatment that can be self-practiced, improving sleep quality, gait speed, functional mobility and quality of life, thus reducing the risk of falling; (4) Qigong improves muscle hardness, functional ability to walk, hand-eye coordination and balance. Despite the promising results, the limitations and the disparity of experimental designs of the included studies do not allow us to have a conclusive answer to the question whether Qigong benefits the management of PD or not.

Keywords: Parkinson's disease; Qigong; traditional Chinese medicine; elderly; exercise; quality of life

1. Introduction

Parkinson's disease is seen as a progressive neurological disorder of the basal ganglia with insidious onset [1]. This disease affects approximately 1.5% of the adults above 65 years of age [2]. Parkinson's disease (PD) expresses a variety of motor and non-motor symptomatology whose clinical hallmarks include akinesia (difficulties in starting movements), bradykinesia (slowness), set shifting (reduced ability to switch between different coordination patterns), rigidity (stiffness in arms, legs and trunk), and pathologic tremor. These motor features combine to create a characteristic gait pattern including reduced arm swing, reduced trunk rotations, stooped posture, reduced range of motion in the lower extremities, slow gait speed, reduced step size and low ground clearance. Falls are particularly dangerous to PD patients due to their increased gait and balance difficulties that clearly limit their functional mobility. Non-motor symptoms are quite variable, but the common symptoms include cognitive impairment, depression, apathy, impaired speech, olfactory dysfunction and sleeping disorders such as insomnia, excessive sleepiness, restless legs syndrome and rapid eye movement (REM) sleep behavior disorder. Approximately 50% of PD patients suffer from insomnia and 25–50% suffer from REM sleep behavior disorder [3]. Insomnia causes fatigue in up to two thirds of this population, often worsening motor symptoms. This condition leads to a decline in the functional status of a person, who becomes unable to perform common tasks such as walking, rising from a chair or moving in bed, thus resulting in the loss of autonomy and a decline in quality of life. Conventional PD treatment options include medication, surgery or a combination of both. Pharmacological therapy

involves the use of dopaminergic drugs, including levodopa, decarboxylase inhibitors, dopamine agonists that bind to dopamine receptors and mimic their action, anticholinergics that relax smooth muscles and decrease tremors, monoamine oxidase type B (*MAO-B*) and catechol-O-methyl transferase (*COMT*) inhibitors to block the enzymatic breakdown of dopamine. Although these drugs are able to improve motor function, their effectiveness decreases over time and their side effects become intolerable as the disease progresses [4]. Available surgical interventions are unilateral and bilateral pallidotomy on specific brain regions involved in controlling movement, and deep brain stimulation therapy (*DBS*). Side-effects of these interventions may include bleeding, infection, headaches, seizures, stroke, weakness, impaired vision and speech, and confusion. *DBS* is based on the use of an implanted pacemaker-like medical device that creates electrical stimulation in specific brain regions. Thus, additional side-effects may arise due to hardware complications. In addition, *DBS* is a cost-effective intervention used to minimize *PD* symptomatology. This procedure does not cure the disease and is unsuccessful in some patients [5,6]. Considering the high level of incidence, the long-life span after diagnosis, the progressive nature of the disease and the short period of medication effectiveness, the search for complementary interventions is essential to improve quality of life and minimize the burden on family, as well as on health care system [1]. Evidence-based treatment strategies used in the management of some aspects of the disease include different forms of exercise, such as cycling [7,8], walking, strength, balance and flexibility routines [9], as well as physiotherapy [2]. Indeed, a growing body of evidence supports the role of exercise, among which are dancing, Qigong and Taijiquan, to improve both motor and non-motor symptoms in *PD* patients [10–12]. Indeed, physical exercise has been shown to improve not only balance, gait, mobility and reduction of falls, but also apathy, fatigue, depression, sleep disturbance and cognitive impairment. Nevertheless, long-term effects seem to be related to a minimum period of practice of 4 weeks for gait training, 8 weeks for balance training and 12 weeks for strength training, aerobic training, Tai Chi or dance [11].

Qigong is a mind–body approach rooted in traditional Chinese medicine, which, according to the National Center for Complementary and Alternative Medicine (*NCCAM*), is among the so-called complementary and alternative medicine (*CAM*) modalities. It can be used as a self-regulation practice, known as internal Qigong, or as a mediated healing intervention, known as external Qigong [13–15]. In the first case, several types of exercises can be prescribed according to the person condition, and then performed with a proper periodicity. In the second case the practitioner uses the so called “qi emission” to restore balance in the patient, requiring the practitioner to manipulate the patient’s qi at a distance by focusing on the energetic properties of the patients’ channels, collaterals and points, as well as internal organs [16]. It can be considered a traditional vegetative biofeedback therapy that uses concentrative motion and postures combined with breathing exercises [17] to activate natural physiological and psychological mechanisms of repair and recovery. These effects are measurable while in a focused and relaxed state [18]. Certain types of Qigong systems are slow, coherent and aerobic low-intensity exercises that can relax body and mind [19]. This effect in the body and mind induces pleasure, recharging metabolism, improving heart functions, slowing heart rate and reducing blood pressure. These exercises are traditionally understood as a way to control the qi-flow in the meridian system of the body [19]. The qi itself, often referred to as energy cannot be seen, whereas the effects of qi may be seen in the functional physiological changes that occur during Qigong practice, such as the changes of the skin temperature accessed by infrared thermography and the changes in the electrical potential of acupoints [20–22].

Positive effects of Qigong have been reported in chronically ill patients and on gait imbalance in the elderly [23–25]. In addition, Qigong practice has been shown to improve psychological health, to reduce high blood pressure and pain and to modulate neurohormone and immune systems [15,26–32].

According to the 2007 National Health Interview Survey (*NHIS*), in the US, approximately 38% of adults and approximately 12% of children are using some form of *CAM* modality [33]. In Europe the statistics vary considerably by country, with values ranging from 10% in Hungary to almost 40% in Germany. On average, 25.9% of the general population had used some sort of *CAM* during the

last 12 months [34]. CAM encompasses several therapies, including the use of natural products, deep breathing, meditation, massage, Yoga, progressive relaxation, guided imagery, Tai Chi and Qigong, just to mention a few. Indeed, the use of natural products and massage are the most used CAM modalities in the US and Europe, respectively, however, the use of mind–body therapies is more expressive in both populations [33] Those include Qigong, whose percentages as a standalone practice are not high in these surveys, however, according to some authors, several mind–body exercises like Yoga, guided imagery and deep breathing exercises can be considered to be types of Qigong, and from this point of view, the whole contribution to the statistics is higher [35]. Among CAM users, neurology patients often ask their doctors for information on the effectiveness of these therapies and how to integrate them in their treatments [36]. Indeed, according to Subramanian et al. (2017), a worldwide increasing interest in the use of CAM in patients with PD has been noticed. As shown by the same author, in some countries, the percentage of PD patients using CAM as a therapeutic approach is expressed as follows: United States, 40% in 2001; Singapore, 61% in 2006; Dublin, Ireland, 60% in 2008; Argentina, 38% in 2010; Korea, 76% in 2012 and India, 46% in 2016 [37]. These values show that the search for efficient non-pharmacological approaches in addition to drug treatment is considerable. Among these approaches, exercise interventions have been pointed out as a useful tool to improve quality of life of PD patients even though, in some cases, there is a lack of statistically clinical relevance. The international clinical guidelines on PD management point towards the benefits of being active and practicing aerobic exercises, especially in the early stages of the disease. These guidelines are still considered, even with the weak evidence provided by the few studies investigating the effects of physical training [1].

For these reasons, we performed this literature review to find out if Qigong has therapeutic value in the management of PD.

2. Materials and Methods

During March 2018, two computerized databases, PubMed and B-On were assessed using the following keywords and their combinations: (Qigong OR Qi Gong OR Chi Kung OR Kiko) AND Parkinson. In addition, all reference lists were analyzed for further relevant articles.

Inclusion and Exclusion Criteria

This review included studies using internal Qigong or qi training (as opposed to external Qigong), with objective parameters as outcome measures and published in English or with, at least, the abstract in English. Studies testing Tai Chi, external Qigong and qi therapy or qi emission were excluded.

3. Results

The database search yielded 15 articles. From the 15 articles, six were randomized controlled trials in parallel with a control group; one was a randomized clinical trial without control group; one was a randomized controlled trial with a crossover design; one was a case report of a male and a female patient and six were systematic reviews. Four studies cited in the systematic reviews are also referred to in the present work. From the 15 articles, four of them did not allow us to obtain any results. In addition, the full text of one study was not assessable.

One random clinical trial was excluded from this work because the experimental group practiced Tai Chi, while the control group practiced routine exercises. The article came up as part of the search output because it mentions that Tai Chi is “an important component of traditional Chinese Qigong exercises” [38].

The systematic review carried out by Subramanian (2017) integrates four studies analyzing the influence of Qigong in nonmotor symptoms such as sleep, fatigue, depression and cognition, as well as the responses to the Parkinson’s Disease Questionnaire 39 (PDQ-39) (bodily discomfort, mobility, activities of daily living, emotional wellbeing, communication, cognitive impairment, stigma and social support) [37]. The main outcomes of that review are shown in Table 1.

Table 1. Studies included in the review authored by Subramanian (2017), assessing Qigong effects on nonmotor symptoms of Parkinson's disease (PD) patients.

Author, Year	Participants, Sample Size	Intervention	Control	Outcome Measures	Results
Schmitz-Hubsch et al., 2006	56 patients (32 intervention; 24 control).	90 min Qigong sessions over 6 months (2 months interval between the interventions).	No treatment	MADRS, PDQ-39.	No improvements in MADRS and in PDQ-39. Improvement in day-time sleepiness and constipation in the Qigong group.
Burini et al., 2006	26 patients under stable medication.	AT1 + QG2: 20 aerobic training sessions followed by 20 QG sessions with 2 months interval between the interventions.	QG1 + AT2: the same treatments performed with an inverted order.	UPDRS, BDS, 6MWT, Borg scale for breathlessness, BDI and PDQ-39, CPET. All measures immediately before and at the completion of each treatment phase.	Significant increase in 6MWT and a larger decrease in Borg score after aerobic training. Significant improvement in cardiorespiratory parameters after aerobic training. No differences seen in BDI, in fatigue, or in PDQ-39.
Xiao and Zhuang, 2016	100 patients.	Four times a week, 45 min Qigong plus walking over 6 months.	Walking.	PDSS, PFS-16.	Improvement in PDSS but not in the PFS-16.
Wassom et al., 2015	7 patients.	6 week Qigong intervention.	Pre and post-test comparison.	Sleep scale, PDQ-39, EWB, digit span, verbal fluency, stroop test, trails A and B.	Mild change in sleep scale but not in PDQ-39, EWB, digit span, verbal fluency, stroop test, or trails A and B.

List of abbreviations: MADRS (Montgomery–Asberg Depression Rating Scale); PDQ-39 (Parkinson's Disease Questionnaire 39); AT1 + QG2 (Aerobic Training + Qigong); QG1 + AT2 (Qigong + Aerobic Training); QG (Qigong); UPDRS (Unified Parkinson's Disease Rating Scale); BDS (Brown's Disability Scale); 6MWT (6 min Walking Test); BDI (Beck Depression Inventory); CPET (Spirometry test and maximum cardiopulmonary exercise test); PDSS (Parkinson's Disease Sleep Scale); PFS-16 (Parkinson's Disease Fatigue Scale); EWB (Emotional well-being score).

The previous studies are also mentioned in other reviews, and since they are randomized clinical trials, their results will be further analyzed in this work.

The randomized parallel clinical trial conducted by Hass in 2006, in which 23 PD patients participated, is included in the review performed by Lee and Ernst (2009). This trial considered an intervention group that practiced Qigong during 60 min sessions, two times a week for 16 weeks, as well as a control group that practiced Tai Chi with a similar routine. These authors found no effects of Qigong on locomotor ability when compared to Tai Chi. The same review reports a nonrandomized parallel clinical trial performed by Yu (2009), on the effects of Qigong on PD symptomatology. In that study, 83 patients were randomly distributed to the intervention and control groups. The intervention group practiced Qigong in 30 min sessions, twice a week and the control had medication. The results show that Qigong had positive effects on PD symptomatology as compared to the control group.

A review on mind–body interventions in the neurology field, covering several diseases and symptoms including PD, was published in 2008. Qigong was among the mind–body techniques used in the intervention groups. The authors concluded that no randomized controlled trial for mind–body interventions in people with PD was ever published. They also found that in a small pilot program with eight PD patients, those persons had a physical benefit, mainly an improvement in balance, attributed to Taijiquan practice. In addition, in another small uncontrolled study with 17 community-dwelling adults with PD, significant pretest-posttest changes in three physical performance measures were noticed after completing a 5 day, 90 min/day Taijiquan practice [36].

Yang et al. (2015) performed a systematic review and meta-analysis of 15 trials aiming to evaluate the effectiveness of traditional Chinese medical exercises in PD management. The 15 trials were separated and analyzed according to the involved practice, Taijiquan or Qigong. Even though the methodological aspects of the Qigong studies were insufficiently described or even absent, the results of these studies will be referred in the present article. Therefore, two trials reported that Qigong plus medication showed better effects on the Webster Scale (comprehensive scale accessing clinical

symptoms, quality of life and motor function in patients with PD). Small but not statistically significant effects were found with medication only. Using the Unified Parkinson's disease rating scale—motor section (UPDRS-III) as an evaluation tool, one study reported that Qigong plus medication had better effects than medication alone, nevertheless without statistically significant differences; another study reported that Qigong plus medication was not much different than medication alone in gait velocity or step length; and a third study assessing the quality of life in patients using the PDQ-39 instrument, reported that Qigong plus medication showed better effects than aerobic exercise plus medication [39].

Song et al. (2017) showed that Taijiquan and Qigong may improve the motor function, balance, timed up and go, 6 min walk, falls, as well as depression and quality of life in individuals with PD, however these authors highlight the fact that additional large-scale trials are needed [10].

Two studies involving specific Qigong interventions are cited in a review about the effects of physical activity on the overall state of patients with depression and PD. The major conclusions of this study were that physical activity might alleviate the degeneration of motor skills and the onset of depression, as well as increase the quality of life of patients suffering from this condition. Supported by the findings of Schmitz-Hubsch et al. (2006), the authors mention that Qigong could decrease the symptoms of depression (Montgomery–Asberg Depression Rating Scale (MADRS)), improve UPDRS-III and daily life activities. On the other hand, the work of Burini et al. (2006) report that Wu and colleagues found a significant increase in the 6 min walking test, a decrease in the Borg Score and a reduction of breathlessness and breathing difficulties in the Qigong group [40].

Alamo and colleagues (2013) conducted a randomized clinical trial to analyze the effect of Tai Chi on gait initiation and performance in PD patients. This study had a Qigong control group, however, considering that the study was mainly on Tai Chi, the Qigong results were limited and had no statistical significance in any variable of interest [41].

The systematic review carried out by Subramanian et al. (2017) included a study conducted by Schmitz-Hubsch that considered an experimental Qigong group and a control group with no additional intervention, both involving a total of 56 PD patients. Participants with previous experience in Qigong, a planned change of medication or signs of central nervous system disease other than PD, such as aphasia or dementia, were excluded from this study. Subjects who met the inclusion criteria were advised to continue adjunct treatments such as physiotherapy or massage if these treatments were used regularly before enrolment. Indeed, this occurred in 46% of the subjects in the treatment group and 50% in the control group at the baseline assessment. Participants were randomly distributed into treatment ($n = 32$) and control ($n = 24$) groups, matched for clinical manifestation, disease severity and presence or absence of dyskinesia. The intervention was based on a weekly 60 min Qigong practice guided by an experienced teacher over 8 weeks. Lessons were held in groups of 16 patients each, and comprised three opening exercises, three exercises from the “frolic of the crane” system, all eight exercises from the “the eight brocades” system and closing exercises. The exercises were carried out standing or optionally in a sitting position according to each patient's physical abilities. The importance of home self-exercise was continuously highlighted during the intervention.

Baseline evaluation was carried out before randomization and included UPDRS-III, PDQ-39 and MADRS tests to evaluate motor symptoms, quality of life and depressive symptoms, respectively. The presence of nonmotor symptoms such as sleep disturbance, daytime sleepiness, dizziness, urinary and sexual dysfunctions, constipation, loss of appetite, nausea and pain, was assessed in a structured interview developed for this purpose. For the treatment group follow-up, a questionnaire concerning the acceptance of Qigong practice was performed 3, 6 and 12 months later. Evaluations were carried out at similar moments of the day to minimize the effects of motor fluctuations. Although patients were informed to refrain from changes on medication, 26% in the treatment and 40% in the control groups did report increases of dosage at the 6 month follow up. Surprisingly, in most of the cases, such increases resulted in the deterioration of motor scores, and therefore all the patients were included in the analysis. The Qigong group had the best marks in UPDRS-III at 3 and 6 months, but no significant differences were noticed at 12 months. The worst results were obtained in the control group, even

though they had a lower level of significance. Exploratory analysis of changes in single UPDRS-III items revealed a remarkable between-group difference for postural stability. Regarding this item, at 6 months, the Qigong group had a reduction in scores higher than the control group. Depressive symptoms were assessed with MADRS considering a cut-off of 9 and 18 for mild and moderate depressions respectively. The prevalence of mild or moderate depression at the baseline was 48% and 41% in the treatment and control groups, respectively, as compared to 33% in both groups at 6 months. However, due to the variability between groups at the baseline of this study, the results concerning depressive symptoms remain inconclusive. PDQ-39 assessed at the 3 and 6 month follow-ups showed no significant differences despite the improvement tendency in daily living activities in the treatment group. Moreover, the therapy group showed a sustained benefit for constipation, reflected by a decreased use of laxatives, as well as a reduction of pain complaints. A reduction in sleep disturbances was only reported during therapy. In contrast, daytime sleepiness decreased in the Qigong group [23].

Burini and co-authors (2006) conducted a randomized controlled trial with a cross over design involving 26 patients. Those were allocated to group AT1 + QG2 receiving 20 aerobic training sessions followed by 20 Qigong sessions with a 2 month interval between interventions; and group QG1 + AT2 performing the same treatments in an inverted sequence [1]. Subjects with severe cognitive impairment, concomitant severe neurologic, cardiopulmonary or orthopedic disorders, specific contraindication to the execution of cardiopulmonary test or aerobic training, and participation during the previous two months in any physiotherapy or rehabilitation program, were excluded from this study. The ones allocated to the aerobic training group were divided into two-person subgroups, using a cycle ergometer for 45 min, three times a week over 7 weeks. Each session consisted of a 10 min low-intensity exercise to warm-up, 30 min of endurance at an intensity of 50% to 60% maximum heart rate and 10 min cool-down including stretching exercises. If the heart rate did not exceed the quoted range for at least to sessions, the workload was increased by 5 W. The subjects allocated to the Qigong group were arranged into three- to four-person classes performing a 50 min routine, three times a week over 7 weeks. Patients were assessed four times: t0 during the week immediately preceding the first intervention; t1 at the end of the first treatment; t2 after a 2 month interval, before the second intervention and t3 at the end of the study. Neurological impairment and mood state, quality of life as well as cardiorespiratory fitness were evaluated in this study. UPDRS-III was used to test the degree and severity of motor impairment and UPDRS-II and BDS (Brown's Disability scale) to measure autonomy in daily living and the burden of care. The 6 min Walking Test (6MWT) was used as a fitness test for daily physical activity rated by the modified Borg Scale. Quality of life was evaluated by PDQ-39 and depression by Beck Depression Inventory (BDI). The cardiorespiratory function was assessed by spirometry and maximum cardiopulmonary exercise test. From the 26 patients enrolled in this study, only 22 completed the program. A significant interaction effect between group and time for the 6MWT and the Borg Scale was noticed regarding the evolution of motor disability and quality of life results. Post hoc analysis looking for time effects showed a significant increase in 6MWT after aerobic training within each subgroup. No significant changes in this parameter were observed during the Qigong intervention. Similarly, a significant larger decrease in the Borg Score was observed after aerobic training than after Qigong. No interaction effects were detected for UPDRS-III, UPDRS-II, BDS, BDI and PDQ-39 [1].

Wassom and colleagues (2015) recruited seven subjects with PD from the University of Kansas Medical Center in order to evaluate if any improvement in sleep, fatigue and gait performance would be detected after a 6 week Qigong intervention. The assessment instruments were the UPDRS for disease level, PDSS-2 (15 item questionnaire covering sleep issues, motor and other symptoms at night) for sleep quality, PFS-16 (Parkinson's fatigue scale) for fatigue; MMSE (Mini-Mental State Examination) for overall cognitive impairment, FAB (Frontal Assessment Battery) for executive dysfunction and TMTA and TMTB (Trail Making Test, parts A and B) for executive function and task-switching abilities. In the test gait, subjects performed 12 trials of walking along an approximately 10 m path, being instructed to walk naturally at a self-selected pace. The Qigong exercise used in this study was the 'six healing sound'. This exercise was chosen because of its simplicity to learn and practice, requiring

minimal physical capacity. The exercise was taught in standing, sitting and supine body positions. During the 6 week intervention, subjects were instructed to perform the 15 to 20 min exercise at home, twice a day, once upon waking and once before going to bed. In addition, subjects met once a week for a group session of 45 to 60 min. In this session, the instructor observed and corrected the performance of each participant, answered questions and encouraged group discussion of relevant issues. Subjects maintained exercise diaries that were reviewed during the weekly group sessions. Pre-intervention tests were performed 2 weeks before the intervention. After the initial assessments, two training sessions were conducted to teach the Qigong exercise. The post intervention test was performed in the week following the intervention. Seven subjects completed the study and the compliance to group sessions was 88%. By analyzing the exercise diaries, compliance with daily exercises was 85.7% in the morning and 82.3% in the evening. Although not statistically significant, overall sleep quality scores were improved at post-test. The evaluation of the subscales for sleep quality showed a significant improvement in motor symptoms at night and an improvement in disturbed sleep. A decreasing tendency of the average score of Parkinson's symptoms at night was noticed. No significant changes were found in UPDRS, MMSE, FAB, TMTA, TMTB and PFS-16. Gait performance and variability showed significant changes after the intervention. The results point towards a significant reduction of 5.27% in stride time, no significant increase of 4.15% in stride length, a significant increase of 8.73% in velocity, a significant reduction of 9.01% in double limb support time, a significant reduction of 36.2% in stride time variability and a non-significant reduction of 17.5% in stride length variability [18].

Xiao and Zhuang conducted a study with 100 patients from the Parkinson's disease and Movement Disorder Center in Beijing. The inclusion criteria comprised diagnosis of Parkinson's; men and women aged between 55–80 years; Hoehn and Yahr stage I–III; ability to walk without assistance for the required gait tasks; stable dose of medication for, at least, 2 weeks before the study; no prior history of Qigong practice; ability to follow simple commands and absence of uncontrolled chronic diseases. The exclusion criteria included a score below 23 in MMSE; a history of other neurological, cardiovascular or orthopedic diseases affecting postural stability; treatment using deep brain stimulation, and on-off motor fluctuation and dyskinesia above grade 3 UPDRS. The participants were equally allocated into the Qigong and control groups and the intervention lasted for 6 months. Subjects allocated to the intervention group received four sessions of 45 min of Baduanjin Qigong, a low-intensity physical activity. A trained practitioner conducted these guided sessions and the self-practice was supported by a home learning audio-visual package. The whole protocol took 12–15 min to be completed. Each patient was free to make the appropriate adjustments to the exercises as a function of each person's physical condition, practicing at least once a day, four times a week. In addition, they were advised to walk daily for not less than 30 min and to continue their prescribed medical treatments. The control group adopted the same procedure. Tests were carried out 12 h after withdrawing the medication, allowing the measurement of the severity of the underlying unmedicated condition. Assessments were made at regular schedules, a week before and a week after the 6 month training program. The level of disease impairment, sleep quality and fatigue was clinically evaluated using the UPDRS, the PDSS-2 and the PFS-16, respectively. In addition, the MMSE for overall cognitive impairment, the BBS (Borg scale) for balance, the TUG (Timed Up and Go) for mobility and the 6MWT for stride time, stride length, double support time and gait velocity were also considered. Participants also completed a freezing of gait questionnaire. From the original 100 patients, only 45 from the intervention group and 44 from the control group were evaluated. At the beginning, no significant changes were found between groups. After 6 months of practice, the intervention group had a significant decrease in the UPDRS-III score and PDSS-2 (total score, motor symptoms at night, Parkinson's symptoms at night and disturbed sleep), contrasting with the control group which remained at the same level. In addition, regarding the functional mobility (BBS and 6MWT) and gait speed, only the intervention group presented significant increases [42].

Xiao et al. (2016) studied the Qigong effects on fall prevention of PD patients. In this study the authors randomized 98 individuals into two groups, the intervention with Qigong, and the control

group with conventional physical therapy [2]. For 6 months, Baduanjin Qigong was practiced four times a week for approximately 60 min (warming-up, 10 min; Qigong system, 45 min; cooling-down, 5 min). The control intervention integrated unbalance stimulus, ball games, strengthening, weight transfer and walking exercises, four times a week during the same period. Measurements were made individually before and after the intervention. The following parameters were considered in this study: BBS, TUG, 6MWT, gait speed, FOG (freezing of gait), knee extension strength, ankle dorsiflexion strength, falls, injuries after fall, repeated falls, fractures, ABC (activity-specific balance confidence scale), PDQL (Parkinson's Disease Quality of Life Questionnaire) and UPDRS-III. At the end, 68 participants completed the study (35 in the Qigong group and 33 in the control group). The results show that after the intervention with Qigong, participants had better BBS, TUG, 6MWT, PDQL scores and greater knee extension strength as compared to the control group [2].

Liu et al. (2016) conducted a study to design a Qigong program for mild to moderate stages of PD. This study enrolled 54 PD patients from the YT Mountain Hospital and after 10 weeks of practice, the effects on function of shaking, muscle hardness and elasticity, balance and activity of daily living were evaluated. Subjects with mild to moderate PD; ability to walk independently; normal state of mental health; ability to follow instructions; absence of other complications and ability to participate in physical exercise were included in this study. Subjects with previous experience in Qigong; recent or planned changes in medication and signs of a central nervous system disease other than PD were excluded. Participants were randomly distributed into two groups: the intervention group with 28 patients, which practiced Qigong for 10 weeks in addition to drug therapy, and the control group with 26 patients that received only drug therapy. No significant differences were noticed between the two groups, regarding both gender and age. Assessments were carried out with a myometer for muscle hardness and elasticity (measured on the left and right pronator teres); BDW-85-II to test physical stability; TUG, eye-hand coordination test (turn-over-jars—timed flip five lined-up jars one at a time) and one-legged blind balance test for balance and physical coordination. Three measurements were conducted for each subject: pretest, 1 week before starting the intervention; interim test, 4 to 5 weeks after intervention had started and posttest, conducted immediately after the intervention. Ten Qigong movements, taking approximately 15 min to perform, were selected and compiled by the main researcher, who had more than 12 years of experience. The intervention took 10 weeks, with 5 days of practice per week, with each session lasting for 60 min (10 min of warming-up exercises, 40 min of Qigong practice and 10 min of relaxation exercises). After 10 weeks, the muscle hardness levels decreased, with a tendency to get even lower as the intervention proceeded, leading the authors to conclude that Qigong can improve the muscle hardness in PD patients by relaxing the body and relieving stiff muscles. In addition, significant results were found in the turn-over-jars test on the left side for the intervention group. Significant differences were also found between the pretest and interim test for the right side of both groups, and between the pretest and posttest for the left side of the intervention group, indicating that Qigong improves the hand-eye coordination in PD patients. In the control group, the TUG test results for the intervention were different between the pretest and the interim test and between the pretest and posttest, showing that Qigong improved the stability and physical coordination and gait in PD patients. No differences were found in the physical stability test for the left and right sides in any test, both for intervention and control groups. Regarding the one-legged blind balance test, the intervention group presented significant differences between the pretest, posttest, left and right side, and between pretest and interim test, right side. These results show that the ability to stand on one foot increased, suggesting that Qigong improves balance in PD patients [19].

Hirofumi (2015) published a case report describing the effects of a program including a weekly 30 min Qigong session and 5 min of self-performed exercises in two PD patients. One of the patients was a 75 year old female suffering from PD for 20 years, who performed all Qigong exercises eagerly. After 6 months, the body balance, stability and ataxia improved significantly. The other patient was a 65 year old male with a 10 year PD clinical history. This subject performed the exercises every week

and afterwards reported an improvement in his daily living activities, especially going to the toilet and bathing. After 4 months he was discharged from the hospital and reported that was able to perform his hobbies such as painting and karaoke at home [43].

4. Discussion

The direct cause of PD is still unknown, however, the disease etiology seems to be related to the combined action of several factors, including genetics, accelerated aging, oxidative stress and toxicological exposure. According to the Chinese medicine view point, PD is closely related to yin deficiency syndrome accompanied by shen (spirit) disturbances, which might result in physical, emotional or psychosomatic illnesses. Although used for millenniums, it was in the last decades that Qigong has been scientifically shown to have positive effects in a wide range of health conditions, including PD. Indeed, considering the classical analysis of Qigong action, this practice prevents or reduces the blockages of qi circulation. Those might cause a relative qi deficiency and the accumulation of “toxic energy” in some parts of the body creating undesirable physiological disturbances, like the ones often seen in PD patients. The so-called balance achieved with the practice of Qigong is often related to a better physical and mental health state, which is characterized by a sense of emotional peace and higher capacity to cope with stress.

The systematic reviews included in the present manuscript were well conducted and we do not have major critical observations regarding the methodology and results of these studies. Nevertheless, in our opinion, Yan’s review would be clearer if it had mentioned, or at least summarized, the experimental procedures adopted in each of the included studies.

It is well known that randomized controlled trials are the gold standard in scientific health care research, providing the highest level of evidence while evaluating the effectiveness of any intervention. Our review shows that there are few rigorous trials studying the effects of Qigong on movement disorders. Indeed, the majority of the study designs are methodologically weak, requiring either blinded approaches and larger samples to increase both reliability and statistical power. The studies included in this paper explored the effects of Qigong on PD, however the evidence is insufficient to suggest that Qigong is an effective standalone modality to treat this sort of condition. Potential gains in PD management seem to be noticeable when Qigong is practiced along with use of medication. In addition, the results of some studies seem to point towards a stabilizing effect of motor symptoms with improvement of muscle hardness, positive results in several frequent and relevant autonomy symptoms, including functional ability to walk, hand–eye coordination and balance, an improvement in sleep quality, gait speed, quality of life, with an overall reduction of the risk of falling. In addition, given the high acceptance and compliance with common therapy, Qigong is a promising cost-effective treatment either when practiced in group or as a self-exercise.

The stabilizing effect of Qigong on motor performance and on nonmotor symptoms seems to be related to a minimum period of practice. According to Schmitz-Hubsch, strong differences on the measured variables are achieved after 3 months of practice, although 12 months are required to get a sustained benefit. These periods of practice have been shown to change from study to study, which might be related not only to the quality of the study design and population, but also to the Qigong system used in the intervention and the instructor’s skills. For example, in the study performed by Liu, an improvement on the left balance ability was noticed in the experimental group after 10 weeks, however these changes were not significant, probably as a consequence of several study constrains such as the low sample size and intervention period, the reliability of the measurement equipment and practice environment. On other hand, aerobic training for a period not less than 7 weeks exerts a significant impact on the ability of PD patients to cope with exercise, even if it does not improve their self-sufficiency and quality of life. In our opinion the intervention strategy adopted by Burini, which combined aerobic training and Qigong, even if in different periods, might have masked or even undermined the effects of Qigong as a standalone practice. The possible benefits of Qigong might have

been suppressed or mitigated by the common effects of aerobic training, such as the increase in 6MWT, a decrease in Borg score and an improvement in cardiorespiratory parameters.

Sleep disorders have a significant impact in PD patients lowering their quality of life. Insomnia, excessive sleepiness, restless legs syndrome and REM sleep behavior disorder are some sleep disorders seen in PD patients. They are related to a worsening of PD symptomatology that might contribute to an earlier institutionalization. As shown by Wassom, some aspects of sleep quality might improve with Qigong practice, however, better, well-designed studies with larger samples are required to sustain those findings.

We do not have relevant criticisms to point out in Xiao's trial. It was a randomized trial with blind assessors, experimental vs. control group and a large sample ($n_{\text{aimed}} = 100$; $n_{\text{initial}} = 96$; $n_{\text{final}} = 89$) [42]. A similar trial with the same experimental design was later conducted by the same authors ($n_{\text{initial}} = 98$; $n_{\text{final}} = 68$) [2].

5. Conclusions

Research has shown that complementary and alternative medicine modalities, and exercise have positive effects in the treatment of PD nonmotor symptoms, however, well-designed, evidence-based studies with larger samples and standardized approaches are still lacking.

As a general remark, studies on this subject should adopt a randomized controlled design with a parallel control group, and the sample size should be adequate to statistically sustain the results. In addition, the intervention period should be at least 6 months, including self-exercise or group sessions once a day, four times a week. If the self-exercise model is chosen, an extra group session for explanation/correction of movements should be considered. The duration of the sessions will vary according to the adopted Qigong system and the adaptation of the exercises to the necessities and limitations of PD patients. The assessments should be carried out in the beginning and at the end of the intervention period; however, follow-up tests should be considered. The measurements should avoid constraints associated with symptom fluctuations, environment control and external factors. In addition, professionals carrying out the measurements should be blinded, having no knowledge of the group's allocation, in order to minimize any tendency during the evaluations. Researchers have to pay special attention to the qualifications of Qigong instructors, as well as to the Qigong systems used in this population. A standardization effort must be made in order to strengthen the results of these studies. Only with these cautions can the results be correctly analyzed and contribute to clarification if Qigong has significant benefits in PD management or not. If so, Qigong could be considered a valid treatment to cope with motor and nonmotor symptoms in PD.

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