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และคุณภาพชีวิตในผู้ป่วยพาร์กินสัน

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The Effect of Thai Dance Exercise Program on Functional Performance  
and Quality of Life in the Patients with Parkinson's Disease

Miss Surasa Khongprasert

A Dissertation Submitted in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy Program in Sports Science

Faculty of Sports Science

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Thesis title           The Effect of Thai Dance Exercise Program on  
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Field of Study         Sports Science

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สุรสา ไค้งประเสริฐ: ผลของโปรแกรมการออกกำลังกายแบบรำไทยที่มีต่อความสามารถในการเคลื่อนไหว และคุณภาพชีวิตในผู้ป่วยพาร์กินสัน. (The Effect of Thai Dance Exercise Program on Functional Performance and Quality of Life in the Patients with Parkinson's Disease.) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ.ดร.วิจิต หนึ่งสุขเกษม, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: รศ.นพ.รุ่งโรจน์ พิทยศิริ, 179 หน้า.

การวิจัยนี้ทำการศึกษา 2 ครั้ง การศึกษาแรกมีวัตถุประสงค์เพื่อศึกษาความเป็นไปได้และการยอมรับได้รวมถึงศึกษาผลของรูปแบบโปรแกรมการที่มีต่อความสามารถในการเคลื่อนไหวและคุณภาพชีวิตของผู้ป่วยพาร์กินสัน การศึกษาที่ 2 มีวัตถุประสงค์เพื่อศึกษาผลของรูปแบบโปรแกรมการออกกำลังกายในช่วงเวลาที่ยาวออกฤทธิ์และหมดฤทธิ์ รวมถึงผลของการคงอยู่หลังหยุดฝึกออกกำลังกายเป็นเวลา 2 เดือน รูปแบบโปรแกรมมี จำนวน 36 บทเรียน คัดเลือกมาจากท่ารำไทยพื้นฐาน (แม่ท่า) และถูกออกแบบให้เหมาะสมกับความบกพร่องของผู้ป่วยพาร์กินสัน กลุ่มตัวอย่างคือผู้ป่วยพาร์กินสันที่ศูนย์รักษาโรคพาร์กินสัน รพ.จุฬาลงกรณ์ สภาการศึกษาไทย แบ่งออกเป็น 2 กลุ่ม ตามสมัครใจ ได้แก่ กลุ่มรำไทย และกลุ่มควบคุม ผู้เข้าร่วมการวิจัยทั้งหมดเข้ารับการทดสอบดังนี้ ตรวจประเมินทางพาร์กินสัน ด้านกิจวัตรประจำวันและด้านการเคลื่อนไหว (Unified Parkinson's disease Rating Scale, UPDRS II,III) แบบประเมินคุณภาพชีวิต (Eight-item Parkinson's disease questionnaire) ความสามารถในการเดิน (The Timed Up and Go Test) การทรงตัว (The Berg Balance Score) การหมุนตัว (360 degree Turning) การวิเคราะห์การเดิน (computerized GAITRite walkway) การศึกษาแรกทำการทดสอบ 2 ครั้ง ภายใน 1 สัปดาห์ ก่อนได้รับการฝึกรำไทย และหลังได้รับการฝึกรำไทย การศึกษาที่สอง ทำการทดสอบ 3 ครั้ง ดังนี้ ก่อนได้รับการฝึกรำไทย หลังได้รับการฝึกและติดตามผลหลังฝึกเป็นเวลา 2 เดือน ทั้ง 3 ครั้ง ทำการทดสอบในช่วงยาวออกฤทธิ์และยามหมดฤทธิ์ กลุ่มรำไทยได้รับการฝึกการออกกำลังกายแบบรำไทยเป็นเวลา 12 สัปดาห์ ละ 3 วันๆ ละ 1 ชั่วโมง ในขณะที่กลุ่มควบคุมไม่ได้รับการฝึกการออกกำลังกายแบบรำไทย

จากผลการศึกษาแรกพบว่า ผู้ป่วยพาร์กินสัน จำนวน 20 คน (กลุ่มละ 10 คน) กลุ่มที่ได้รับการรำไทยมีการพัฒนาที่ดีขึ้นอย่างมีนัยสำคัญทางสถิติ ( $p < 0.05$ ) ทั้งความสามารถในการเคลื่อนไหวและคุณภาพชีวิต หลังได้รับการฝึกการรำไทยเป็นเวลา 12 สัปดาห์ ทำการทดสอบโดยสถิติเปรียบเทียบรายคู่ (paired t-test) ในขณะที่กลุ่มควบคุมไม่มีการพัฒนาทั้งความสามารถในการเคลื่อนไหวและคุณภาพชีวิต นอกจากนี้ กลุ่มที่ได้รับการฝึกรำไทยมีการพัฒนาของความสามารถในการเคลื่อนไหวและคุณภาพชีวิตที่แตกต่างกับกลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ ทำการทดสอบโดยการวิเคราะห์ความแปรปรวนร่วม (ANCOVA) ผลการศึกษาที่สอง พบว่า ผู้ป่วยพาร์กินสัน จำนวน 20 คน (กลุ่มรำไทย จำนวน 11 คน และกลุ่มควบคุม จำนวน 9 คน) ทำการทดสอบแบบวัดซ้ำ (repeated measures ANOVA) กลุ่มที่รำรำไทยมีการพัฒนาความสามารถในการเคลื่อนไหวและคุณภาพชีวิตที่ดีขึ้น (ในช่วงยาวออกฤทธิ์) อย่างมีนัยสำคัญหลังได้รับการฝึกและยังคงมีการพัฒนาอย่างมีนัยสำคัญในการประเมินทางพาร์กินสันด้านการเคลื่อนไหว ความสามารถในการเดิน การทรงตัว ช่วงก้าว (ขาขวา) ความเร็วในการเดิน และคุณภาพชีวิต ในช่วงติดตามผล 2 เดือน ในขณะที่กลุ่มควบคุมไม่มีการเปลี่ยนแปลงอย่างมีนัยสำคัญใดๆ ทั้งในช่วงยาวออกฤทธิ์และหมดฤทธิ์ การทดสอบในช่วงยามหมดฤทธิ์พบว่า ในกลุ่มรำไทยพบการเปลี่ยนแปลงอย่างมีนัยสำคัญทางแบบประเมินทางพาร์กินสันด้านการเคลื่อนไหว ทั้งในช่วงเวลาหลังการฝึกและช่วงติดตามผล 2 เดือน จากการศึกษาสามารถสรุปได้ว่าโปรแกรมการออกกำลังกายแบบรำไทยสามารถช่วยให้ผู้ป่วยพาร์กินสันมีพัฒนาการที่ดีขึ้นทั้งทางด้านการเคลื่อนไหวและคุณภาพชีวิต รวมถึงสามารถนำไปปฏิบัติได้ในทุกๆ ที่โดยไม่จำเป็นต้องมีอุปกรณ์ทั้งแบบส่วนตัวและแบบฝึกเป็นกลุ่ม

สาขาวิชา วิทยาศาสตร์การกีฬา.....ลายชื่อนิสิต.....  
ปีการศึกษา .....2554.....ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก.....  
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# # 5178962139: MAJOR SPORTS SCIENCE

KEYWORDS: PARKINSON'S DISEASE/ QUALITY OF LIFE/ THAI DANCE

SURASA KHONGPRASERT: THE EFFECT OF THAI DANCE EXERCISE PROGRAM ON FUNCTIONAL PERFORMANCE AND QUALITY OF LIFE IN THE PATIENTS WITH PARKINSON'S DISEASE. ADVISOR: ASSOC. PROF. VIJIT KANUNGSUKKASEM, Ed.D. CO-ADVISOR: ASSOC. PROF. ROONGROJ BHIDAYASIRI, M.D., FRCP., 179 pp.

The objectives of this study were to explore the feasibility and acceptability of Thai dance exercise program as well as its impact on the Parkinson's disease patients (study 1) and to assess the impact of Thai dance exercise program and its retention between on time and off time in the Parkinson's disease (PD) patients (study 2). A series of 36 Thai dance sessions, each lasting 60 minutes, was designed for the study. Basic movements (mae tha) of Thai classical dance were specifically selected to meet the therapeutic needs of people with Parkinson's disease whose movements were impaired by the disease. Functional mobility and quality of life were assessed by administering the Unified Parkinson's disease Rating Scale (UPDRS) subscales II and III, Timed Up and Go Test (TUG), Berg Balance Score (BBS), 360 turning and the 8-item Parkinson's disease questionnaire (PDQ8). Gait parameters (step length, stride length, velocity and cadence) were assessed by walking along the carpet and computerized GAITRite walkway. In study 1, all parameters were assessed (on time) before and after the 12-week program while in study 2, all parameters were assessed (on and off time) before and after 12-week program and also at 2 months followed-up. Patients receiving care at the Center of Excellence for Parkinson's Disease and Related Disorders, Chulalongkorn Hospital were recruited for the study. They were divided into Thai dance group (TG) and control group (CG) by voluntary enrollment. The patients in TG attended the Thai dance exercise program 3 times a week for 12 weeks whereas the CG did not attend the Thai dance exercise program. The results of study 1 (only 20 completed patients, TG=10 and CG=10) indicated that, there were significant improvements in all of the functional mobility and quality of life parameters in TG as calculated by the paired t-test. Moreover, there were significant differences between TG and CG in all of the parameters as calculated by the analysis of covariance (ANCOVA). The results in study 2 (only 20 completed patients, TG=11 and CG=9), There were significant improvements in all parameters of the Thai dance group (on time) after participating in specifically designed Thai dance exercise program and there were also significant differences in UPDRS subscale III, TUG, BBS, PDQ8, stride length (Lt.) and gait velocity at 2 months follow-up while step length (Rt.) was decreased significantly from post-test value. In Thai dance group (off time) was found that there was only significant difference among baseline, post-test and 2-month follow-up in UPDRS III. No significant differences were found in the other parameters. The overall results in Control group (on and off time) indicated that there were no significant differences in any parameters. When practiced regularly, Thai dance could lead to improvements in motor functions and quality of life of the participants. Furthermore, dance-based exercise is reported to be enjoyable and may be performed alone or in a group without any special equipment.

Field of Study: Sports Science Student's Signature.....

Academic Year: 2011 Advisor's Signature.....

Co-advisor's Signature.....

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# CHAPTER I

## Background and Rationale

*“Dance is a song of the body. Either of joy or pain”*

*MARTHA GRAHAM (1893-1992)*

### **Introduction to Parkinson’s disease**

Parkinson’ disease (PD) is a chronic progressive neurodegenerative disorder that causes significant disability and reduces quality of life (1-2). It was first described by Dr. James Parkinson in 1817 and in his “Essay in the shaking Palsy” he wrote: Involuntary tremulous motion, with lessened muscular power, in parts not in action and even when supported with a propensity to bend the trunk forwards and to pass from a walking to a running pace: the senses and intellects being uninjured (3-4).

PD is the second most common neurodegenerative disorder after Alzheimer’s disease (5). There are approximately 5 million people with Parkinson’s disease throughout the world (6) and there are 60,565 registered people with PD in Thailand (7). PD is a chronic, progressive, neurodegenerative disorder that causes disability and generally has a negative impact on the quality of life (8). The prevalence of PD increases with age, affecting approximately 1% of the population over the age of 65 years and 2% of the population over 80 years of age (9). The four main motor symptoms of PD are resting tremor, bradykinesia, rigidity, and postural instability (10). These impairments lead to a decline in functional status such that people with PD have difficulty with task such as walking and rising from a chair (11). This decrease in functional status often results in a loss of independence and a decline in quality of life

(QOL). In addition to the motor symptoms that decrease the quality of life of the patients, a variety of non-motor symptoms include psychiatric symptoms (depression, anxiety), autonomic dysfunctions, sleep disturbances, sensory disturbances and dementia are lessen the patient's quality of life as well (12). Patients with PD experience progressive disability and reduce quality of life due to both motor and non-motor complications. The progressive nature of PD and its increasing prevalence have resulted in a substantial economic burden to society, health care providers, individual patients and their families (13-14). The cost of illness escalates as PD progresses, for example there were 58,600 PD patients in the UK and total cost using this approach was £449 million annually (15). Costs of PD as calculated from the societal perspective amounted to EUR 11,020 per patient over the 12-month period (16). The rate of progression varies widely among the PD population, ranging from 2-30 years until severe disability or death (17). To ensure best value in outcomes and resource utilization, clinicians should focus on management strategies that maximize quality of life while minimizing the impact of disease progression. This can be achieved by optimizing therapies to treat motor symptoms and recommending interventions for non-motor complications, such as depression, where appropriate (14). The medical literature has shown that medication alone is not adequate treatment for this disease and that rehabilitation therapy is an important adjunct to medical treatment (18-19).

Medical management may reduce rigidity and bradykinesia but does not directly address other physical effects of PD such as range of motion, strength and endurance nor the progression of the disorder. Optimal therapy requires both pharmacologic treatment (usually dopamine replacement therapy) and regular physical activity (20). Regular exercise must be included in an active lifestyle and continue throughout the life of people with PD for the best outcomes (21). Exercise

regimens should emphasize safe and functional movements and ideally include strength, flexibility, endurance, and balance activities (22).

Thai Classical Dance (*nata*) is a living art and has been a vital part of the life of the Thai people for generations. It is a cultural activity but it also can be a good method of exercise for people with PD because traditional forms of Thai Classical dance require whole body coordination with music, involving both upper and lower body movements and it involves many types of movements that are beneficial for them by promoting flexibility, strength training, balance and coordination. It is a combination of rhythmic auditory cue, music therapy and dance/movement therapy. Thai classical dance may improve PD symptoms because it has the specific movements incorporated in the program and has many functional movements that PD patients may struggle with, including walking backwards and turning, especially when they focus on walking steps with the rhythm of Thai traditional music. Traditionally, there were 108 basic movements (*mae tha*) in Thai Classical Dance (23). In addition, traditional Thai music can be used as a rhythmic auditory cue (24). Studies have not been done on Thai classical dance exercise in the PD literature. Therefore, the objectives of this study were to explore the feasibility, acceptability of a Thai dance exercise program, which was specifically designed and choreographed by selecting some basic movements in Thai classical dance and modified to meet the therapeutic needs of people with Parkinson's disease whose movements were impaired by the disease, and to assess the impact of a Thai dance exercise program on their functional performance and quality of life.

### **Research question**

**Primary research question:** Does the Thai Dance exercise program have impact on the functional performance

and quality of life in PD patients who have trained in the Thai dance exercise program?.

**Secondary research question:** Do the functional mobility and quality of life in Parkinson's disease patients who have trained in the Thai dance exercise program differ from those who have not trained?.

## **Objectives**

### **Study 1**

1. To assess the feasibility and acceptability of a Thai dance exercise program for people with Parkinson's disease.
2. To determine its impact on the functional mobility and quality of life of the people with Parkinson's disease.

### **Study 2:**

1. To study the impact of the Thai dance exercise program on functional mobility between on time and off time of people with Parkinson's disease.
2. To study the retention of the exercise program.

## **Hypothesis**

### **Study 1:**

1. There were significant differences in functional performance and quality of life between baseline and post-test in Thai dance group.
2. Functional mobility and quality of life in Thai dance group differed from control group.

### **Study 2:**

1. There were significant differences in functional performance and quality of life between baseline and post-test (on time) in Thai dance group.

2. There were changes in functional performance and quality of life between baseline and post-test (off time) in Thai dance group.
3. There were changes of functional performance and quality of life between on time and off time after 2 months follow-up in Thai dance group.

### **Scope of research**

This study was designed to study the effect of Thai dance exercise program on the patients with Parkinson's disease.

### **Basic assumption**

The 36 sessions in Thai dance exercise program were specifically designed and choreographed to address the impairment of people with PD in their functional mobility.

### **Definition**

#### 1. Basic movement in Thai dance exercise program

There were 7 basic movements as follow;

- 1.1 *Sod soi ma la*
- 1.2 *Chang pra san nga*
- 1.3 *Ram sai*
- 1.4 *Prom si na nok yoong fon hang*
- 1.5 *Lor kwaew*
- 1.6 *Pit sa mai reang morn*
- 1.7 *Prom ni mit*

#### 2. Parkinson-plus syndrome

A group of neurodegenerative diseases featuring the classical features of Parkinson's disease (tremor, rigidity, akinesia/bradykinesia, postural instability) with additional features that distinguish them from simple idiopathic Parkinson's disease. Alzheimer's disease is considered to be in this group as well.

#### 3. Functional mobility

The ability of performance to be evaluated by using these parameters:

- 3.1 The Unified Parkinson's Disease Rating Scale (UPDRS) subscale II and III
- 3.2 The Timed Up and Go test (TUG)
- 3.3 The Berg Balance Score (BBS)
- 3.4 360 degree turning
- 3.5 Step length and stride length
- 3.6 Gait velocity
- 3.7 Cadence

#### 4. Quality of life

Quality of life was evaluated by using the 8-item Parkinson's disease questionnaire (PDQ8), which involve in mobility, activities of daily living, emotional well-being, social support, cognition, communications, bodily discomfort, and stigma.

#### 5. The Unified Parkinson's Disease Rating Scale (UPDRS)

The most well established scale for assessing disability and impairment for PD patients.

- 5.1 UPDRS subscale II concerns motor experiences of daily living.
- 5.2 UPDRS subscale III is retained as the motor examination.

#### 6. The Timed Up and Go test (TUG)

The ability to perform sequential locomotor tasks that incorporate standing up, walking, turning and sitting down.

#### 7. The Berg Balance Score (BBS)

It was used to identify and evaluate balance impairment in this study. The scale consists of 14 tasks common in every life.

#### 8. 360 degrees turning

Subjects would be asked to turn 360 degrees as fast as possible.

9. Cadence  
The number of steps per minute
10. Step length  
The distance from initial contact of one foot to the following initial contact of the other foot.
11. Stride length  
The distance between successive points of initial contact of the same foot.
12. Velocity  
The product of cadence and step length, is expressed in units of distance per time.
13. On time  
After 1 hour of medications.
14. Off time  
Thirty minutes before next dose of medications.

### **Research benefits**

1. The information obtained from this study were beneficial to create guideline in exercise program for rehabilitation of patient with Parkinson's Disease.
2. To acquire the appropriate exercise program in Thai dance for PD patients.
3. Construct the strategies to draw attention from the PD to be more interested in exercise.
4. To acquire the effects of exercise program in Thai dance on functional performance and quality of life.

## **CHAPTER II**

### **Review Literature**

#### **Description of Parkinson's disease**

Parkinson's disease (PD) is a degenerative disorder that presents with a constellation of symptoms and signs known as parkinsonism. However, parkinsonism is not the only feature of patients with PD, or specific for PD. An accurate history and a thorough physical examination are still of paramount importance in correctly classifying patients with parkinsonism. According to current diagnostic criteria, patients can be considered to have PD when they have bradykinesia and at least one of the following: rigidity, tremor, or postural instability with no known other causes, and do not have any of the signs considered atypical for PD (Table 1). However, because no diagnostic biologic marker is available, the diagnosis of PD requires frequent clinical reassessment. Additional diagnostic requirements used by some authors in protocolized studies are evidence of a progressive disorder, and asymmetric onset of symptoms or signs. Apart from parkinsonism, other features of patients with PD include cognitive disorders, olfactory dysfunction, seborrheic dermatitis, sleep disorders, autonomic dysfunction, etc (25).

Parkinson's disease commonly presents with impairment of dexterity or, less commonly, with a slight dragging of one foot. The onset is gradual and the earliest symptoms might be unnoticed or misinterpreted for a long time. Fatigue and stiffness are common but non-specific complaints. Work colleagues or family member might notice a lugubrious stiff face, a hangdog appearance, a flexion of one arm with lack of swing, a monotonous quality to the speech, and an extreme slowing down. These changes are rarely noticed by the patient. The early physical signs are often erroneously and a lag of 2-3 years from the first symptoms to diagnosis is not unusual (26).

**Table 2.1** Signs that would not favor the diagnosis of idiopathic PD (25)

Signs that would make the diagnosis very improbable
Absence of response to L-Dopa treatment at a dose of up to 1g/d.
Oculogyric crisis
Supranuclear palsy of horizontal or downwards ocular movements
Cerebellar or pyramidal signs not explained by vascular lesions
Early noticeable autonomic nervous system involvement
Early postural instability and frequent falls
Dementia
Signs of motoneuronal disease
Signs that would make the diagnosis doubtful
Neuroleptic treatment during the previous year
More than one family member affected with similar symptoms and signs
Acute onset of symptoms
Intermittent course
Stepwise progression
Rapid progression
Wheelchair bound in spite of levodopa treatment
Marked dysarthria or dysphagia
Disproportionate anterocollis
Tremor not regular
Raynaud's phenomenon
Predominating gait disturbance with no or little limb bradykinesia

## **Epidemiology of Parkinson's disease**

### **Incidence**

Incidence refers to the number of new cases of a disease per unit of time, usually 1 year. The incidence of Parkinson's disease has been difficult to ascertain with a high degree of certainty, but more accurate estimates have become available

with the advent of better diagnostic guidelines. A recent study by de Lau and colleagues found that incidence rates increase after the age of 50, especially in men, and rapidly increase over the age of 75 (27). The risk of developing any parkinsonian features between the ages of 55 and 85 years is 8.5% for men and 7.7% for women. Between the ages of 75 and 85, the incidence rate is 6.8 for men and 4.5 for women per 1000 person/years. Beyond age 85, it escalates to 12.1 and 10.2 for men and women, respectively. This and other studies thus suggest that men have a higher risk for developing Parkinson's disease compared with women (28).

### **Prevalence of PD**

Prevalence denotes the total number of cases of disease (old and new). Currently, no proper large-scale databases exist to evaluate the prevalence of Parkinson's disease. As the elderly population increases in size, prevalence increases, further making prevalence studies difficult. Previous reports described prevalence values that varied considerably, likely due to different international populations being studied, suboptimal diagnostic criteria being used, and under-diagnosis in many countries being common. It was estimated the prevalence of Parkinson's disease to be anywhere between 31 and 328 persons per 100,000 persons (28).

Bhidayasiri and co-workers, have started the Parkinson's disease registry in Thailand project in July 2008 and as of March 2011, the Thailand PD Registry had identified 40,049 PD patients. Employing log-linear modeling, the CRM analysis based on the three data sets estimated underreporting of 20,516 cases. The revised estimated total is thus 60,565 cases, resulting in a crude and age-adjusted prevalence of 95.34 and 424.57 PD cases/100,000 populations, respectively. The prevalence of PD was 126.83/100,000 in urban areas and 90.82/100,000 in rural areas ( $p < 0.001$ ). Preliminary regional comparisons revealed a

higher prevalence of PD in residents of the central plain valley of Thailand, an area with a large amount of pesticide use (7).

### **Clinical feature**

There are four cardinal features of PD that can be grouped under the acronym TRAP: Tremor at rest, Rigidity, Akinesia (or bradykinesia) and Postural instability. In addition, flexed posture and freezing (motor blocks) have been included among classic features of parkinsonism, with PD as the most common form (29).

#### **Resting Tremor**

Tremor is usually the first symptom noticed by patients or their family members. It occurs in the resting position and disappears or diminishes on hand motions, especially in the early stages of the disease. The frequency is typically slow, about 4–7 Hz, in addition to abnormal increases in amplitude and regularity (30-31). Hands are the most common anatomical sites with tremor. It appears unilaterally in the distal portions of the limb, and the most recognized form is "pill-rolling" (supination and pronation) of the hand (29). In addition, legs, chin, mouth, and tongue may also be affected. It often starts on one side of the body and gradually involves the other side as the disease progresses. Flexion of the fingers and rotation of the wrist joint during tremor are characteristic. Amplitude will vary, and will become more pronounced when the patient is under stress (32-33). In some patients, after a short disappearance of their tremor when their hands held in the front of body, a postural tremor with the same frequency as their resting tremor may appear. This is called "re-emerging tremor" and is characteristic of PD (34). There are anecdotal reports that physical therapy interventions such as relaxation and directing attention toward minimizing tremor may have short term beneficial effects on the severity of resting tremor. However, these effects are only transient. Tremor severe enough to be

considered socially unacceptable by the person with the disease. Surgical interventions such as thalamotomy, pallidotomy, and deep brain stimulation may be best treated (35).

### **Bradykinesia or akinesia**

Bradykinesia is often used synonymously with two other terms: akinesia and hypokinesia. Strictly speaking, bradykinesia describes the slowness of a performed movement whereas akinesia refers to a poverty of spontaneous movement (e.g. in facial expression) or associated movement (e.g. arm swing during walking). Other manifestations of akinesia are freezing and the prolonged time it takes to initiate the movement. Hypokinesia refers to the fact that, in addition to being slow, the movements are also smaller than desired as in the micrographia of patients' handwriting (36). People with hypokinesia typically have an expressionless, mask-like face and walk with reduced trunk rotation, short steps, and diminished arm swing, which is more pronounced on one side than the other. Although PD-related movement disorders characteristically occur bilaterally, movement disorders such as bradykinesia are asymmetrical in their severity (35). Of the three classic features of PD, bradykinesia is, in most cases, the most disabling. Patients often use the term "weakness" to describe this symptom, by which they mean that they cannot get their muscles to obey the commands of their mind. When pronounced, slowing of movement can become akinesia, the total loss of voluntary willed movement. Few things are more terrifying to patients with PD than true akinesia. In this state, they are helpless to do anything for themselves and may beg their relatives to take them to a hospital for emergency care. Bradykinesia or akinesia is often the key feature of parkinsonian off-state, periods when brain levels of dopamine are inadequate. Sometime, crushing substernal chest pain accompanies these reactions, leading to urgent evaluation for myocardial infarction (37).

### **Rigidity**

Rigidity is an important clinical sign of PD, correlating with limb stiffness. Rigidity is defined as a velocity-independent increase in passive tone in a limb. This is differentiated from spasticity, which is a length and velocity-dependent form of hypertonia. The term “lead-pipe rigidity” was coined to connote the key feature of this sign, which is a constant resistance to passive movement that varies little with the extent or speed of limb excursion. Many descriptions of rigidity in PD use the term “cogwheeling” to signify the jerky quality of the hypertonia felt when moving the limb. Cogwheeling is due to the superimposition of tremor (which may not be visible) on the increased tone of the limb

In addition to being a useful sign of PD, rigidity is a common cause of the limb pain some patients experience. Rigid limbs are due to simultaneous contraction of agonist and antagonist muscles, which can lead to muscle fatigue and myalgia, nonsteroidal anti-inflammatory drugs and range-of-motion exercise may be useful adjuncts to typical antiparkinsonian drugs (38).

### **Postural instability**

Postural instability is one of the cardinal features of advanced Parkinson’s disease (2) in many cases leading to falls (39) and one of the main causes of hospitalization in patients (40). Moreover, balance impairment often induces psychological reactions characterized by fear of future falling. This fear of falling may be protective if it interferes only with hazardous activity and increases caution during performance in all other daily living tasks, but it can be maladaptive when it compels patients to restrict their mobility, independence and social participation, leading to further deconditioning, functional decline, and poorer quality of life (38).

### **Postural deformities**

Rigidity of the neck and trunk (axial rigidity) may occur, resulting in abnormal axial postures (eg, anterocollis, scoliosis). Postural deformities resulting in flexed neck and trunk posture and flexed elbows and knees are often associated with rigidity. However, flexed posture generally occurs late in the disease. Striatal limb deformities (e.g. striatal hand, striatal toe) may also develop in some patients. Striatal hand is characterised by ulnar deviation of the hands, flexion of the metacarpophalangeal joints and extension of the proximal and flexion of the distal interphalangeal joints. Striatal foot is characterised by extension or flexion of the toes (41-42). Other skeletal abnormalities include extreme neck flexion (“dropped head” or “bent spine”), truncal flexion (camptocormia) and scoliosis (42-44). Camptocormia is characterised by extreme flexion of the thoracolumbar spine.

### **Nonmotor symptoms**

The non-motor symptom (NMS) complex is a key part of Parkinson’s disease (45) non-motor signs and symptoms may accompany motor parkinsonism. These include autonomic (gastrointestinal dysfunction, cardiovascular dysfunction with orthostatic hypotension, urinary and sexual dysfunction, hyperhidrosis), sleep (impaired sleep initiation and maintenance, rapid eye movement behavior disorder, excessive daytime sleepiness), sensory (pain, hyposmia, visual dysfunction), and/or neuropsychiatric (anhedonia, depression, anxiety and panic attacks, dementia and psychosis) disturbances (46).

Non-motor symptoms correlate with advancing age and disease severity, although some non-motor symptoms, such as olfactory problems, constipation, depression, and rapid eye movement disorder, can occur early in the disease (47). As the average age and life expectancy of the population increases, the non-motor features of Parkinson’s disease become increasingly important (47-48).

**Table 2.2** Nonmotor features of Parkinson's disease (49)

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Nonmotor features of Parkinson's disease	
Neuropsychiatric Dysfunction	Mood disorders Apathy and anhedonia Frontal executive dysfunction Dementia and psychosis
Sleep Disorders	Sleep fragmentation and insomnia REM sleep behavior disorder (RBD) Periodic limb movements in sleep
Autonomic Dysfunction	(PLMS)/Restless legs syndrome (RLS) Excessive daytime somnolence
Sensory symptoms and Pain	Orthostatic hypotension Urogenital dysfunction Constipation Olfactory dysfunction Abnormal sensation pain

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**Table 2.3** Parkinson's disease symptoms (29)

Motor symptoms	Non-motor symptoms
Tremor, bradykinesia, rigidity, postural instability Hypomimia, dysarthria, dysphagia, sialorrhoea Decreased arm swing, shuffling gait, festination difficulty arising from chair, turning in bed Micrographia, cutting food, feeding, hygiene, slow activities of daily living Glabellar reflex, blepharospasm, dystonia, striatal deformity, scoliosis, camptocormia	Cognitive impairment, bradyphrenia, tip-of-the-tongue (word finding) phenomenon Depression, apathy, anhedonia, fatigue, other behavioural and psychiatric problems Sensory symptoms: anosmia, ageusia, pain (shoulder, back), paresthesias Dysautonomia (orthostatic hypotension, constipation, urinary and sexual dysfunction, abnormal sweating, seborrhoea), weight loss Sleep disorders (REM behaviour disorder, vivid dreams, daytime drowsiness, sleep fragmentation, restless legs syndrome)

### **Assessment Tool for Parkinson's Disease**

#### **Hoehn and Yahr Staging Scale of Parkinson's Disease**

A number of rating scales are used for the evaluation of motor impairment and disability in patients with PD, but most of these scales have not been fully evaluated for validity and reliability (50-51). The Hoehn and Yahr scale is commonly used to compare groups of patients and to provide gross assessment of disease progression, ranging from stage 0 (no signs of disease) to stage 5 (wheelchair bound or bedridden unless assisted). The Hoehn and Yahr scale was found to be

highly correlated with the “Up & Go” and “Steps X Seconds” (walk 4 meters) tests with Spearman rank correlation coefficient of 0.74 and 0.71, respectively ( $p < 0.001$ ) (52).

**Table 2.4** The Modified Hoehn and Yahr Staging Scale of Parkinson’s Disease (53)

<b>stage</b>	<b>symptoms</b>
Stage 0	No signs of disease
Stage 1	Unilateral symptoms only
Stage 1.5	Unilateral and axial involvement
Stage 2	Bilateral symptoms. No impairment of balance
Stage 2.5	Mild bilateral disease with recovery on pull test
Stage 3	Balance impairment. Mild to moderate disease
Stage 4	Physically independent Severe disability, but still able to walk or stand unassisted
Stage 5	Needing a wheelchair or bedridden unless assisted

### **The Unified Parkinson’s Disease Rating scale (UPDRS)**

The Unified Parkinson’s Disease Rating scale (UPDRS) is the most well established scale for assessing disability and impairment (50, 54). It is used in clinical research and drug trials to follow the longitudinal course of PD. Its major strength is that it provides a detailed and accurate assessment of PD in different aspects (55). It is divided into 4 sections: Part I concerns “non motor experiences of daily living,” Part II concerns “motor experiences of daily living,” Part III is retained as the “motor examination,” and Part IV concerns “motor complication.

### **Berg Balance Scale (BBS)**

The BBS is an objective measure of balance abilities. It has been used to identify and evaluate balance impairment. The scale consists of 14 tasks common in everyday life. The items test a subject's ability to maintain positions or movements of increasing difficulty by diminishing the base of support from sitting and standing to single-leg stance. One's ability to change positions is also assessed (56). Each item is scored on a five-point ordinal scale ranging from 0 (unable to perform) to 4 (normal performance). Higher scores denote better balance.

BBS is typically used in older populations (57) as a reliable tool for measuring functional stability (58) because it has a strong association with well established measurement instruments for people with PD, such as the motor subscale of the Unified Parkinson's Disease Rating Scale (UPDRS), and the modified Hoehn and Yahr (H&Y) Staging Scale (56).

### **The 8-item Parkinson's disease questionnaire (PDQ8)**

The 8-item Parkinson's disease questionnaire (PDQ8) is a briefer version of the 39-item Parkinson's disease questionnaire (PDQ39) which measure the HRQoL of PD patients over the past month. It has 8 specific PDQ39 items, with each item representing one PDQ39 dimension, i.e. mobility, activities of daily living, emotional well-being, social support, cognition, communications, bodily discomfort, and stigma. A summary index (PDQ-8SI) can be calculated from score of 8 PDQ-8 questions and standardized on a scale from 0-100, with lower scores indicating better HRQoL. Higher PDQ-8SI scores indicate worse quality of life (59).

### **Timed up and go test (TUG)**

The Timed up and go test (TUG) is used to measure the ability of patients to perform sequential locomotor tasks that incorporate walking and turning. TUG is useful for

measurement of mobility in people with mild to moderate Parkinson's disease because it fulfills these requirements. It can also be used to detect differences in performance between people with PD and elderly people without PD (60). The task consisted of the participant standing up from a sitting position in an armless chair with a seat height of 46.5 cm, walking a distance of 3 m, then passing around a cone, returning, and sitting back down in the chair. Each participant was instructed to perform the task as quickly as possible, but without running. At least one practice trial was offered to the participants at the beginning of the procedure so that they could become familiar with it. Three trials were performed for testing purposes, and the time to perform the task was measured in seconds. Time was recorded from the instant the person's buttocks left the chair until the next contact with the chair. The mean value of the three trials was considered for statistical analysis (61).

The TUG assesses a series of functionally important tasks related to daily living activities and independent mobility: sitting to standing, gait initiation, walking, turning and sitting (62) to detect changes in mobility in PD patients (60) and to quantify the effects of an intervention program (63).

### **360 Turning**

Turning around while walking or standing is one of the most problematic tasks for PD patients who experience episodes of freezing. Usually, elders take fewer than 6 steps to complete a 360-degree turn during walking. In contrast, those PD patients take up to 20 step to turn (64). Therefore the 360 degree turning is the assessment of turning. Subjects would be asked to turn 360 degrees as fast as possible when the tester said "Ready, Go". Time in seconds and the number of step were recorded. The test was repeated three times (65).

### **The GAITRite gait analysis system**

The GAITRite gait analysis system, which employs a pressure-sensitive walkway to record gait variations, is more convenient than 3-D gait analysis. Its validity and reliability have been proved in various patient populations (66-68). McDonough and co-worker (66) analysis showed the GAITRite system to be a valid and reliable tool for measuring selected gait components: spatial parameters (step and stride lengths), temporal parameters (step lengths). This system can evaluate the efficacy of L-dopa treatment of parkinsonian, bradykinesia and also compared the correlation of gait parameters with UPDRS part III (the motor component) and timed-test variables. Velocity: distance walked per second (cm/s); cadence: steps per minute (steps/min); stride length: heel-to-heel distance of the same lower limb in the gait cycle (cm). The GAITRite quantitative gait analysis system is an efficient and effective device in evaluating to monitor the Parkinson disease progression and efficacy of interventions (69).

### **Dance of Thailand (23)**

Thai Dance (*natin*) has been vital parts of Thai life from the beginning of its history to the present day. This is due largely to their close relationship with Buddhism, the national in those ceremonies, traditions, and customs so important to the lives of the people. Thai Dance may be divided into two major groups: folk dance (*rabum phun muang*) and classical dance (*natin*). Each of four regions of Thailand has its own indigenous folk dances usually associated with agricultural and social activities, such as rice planting, harvesting, festivals, and religious celebrations. The styles of these regional dances are unique to the localities and temperament of the local people.

The northern dance, called *fon*, is slow and graceful with simple hand, arm, and leg movement. It is accompanied by an ensemble of the gong (*khong*), drum (*klong*), oboe (*pi*), and

cymbals (*chap*), resembling Burmese, Tibetan, and southern Chinese music.

The northeastern dances, called *soeng*, are somewhat faster in step and tempo. Hand and leg movements remain simple with the addition of hip shaking and swaying in a rather sensual manner. The major instruments accompanying these dances are the pipe flute (*khaen*), drum, and gong. Sometimes a kind of wooden xylophone, called the *ponglang*, is used.

The folk dances of central Thailand are more refined, such as *ram srinuan*, *ram prop kai*, and later on during World War II, *ram wong*, an innovation of Premier Phibunsongkhram's government to counteract Western ball-room dancing which was sweeping the nation at the time.

Southern dances are closer in origin to Indian and Ceylonese *Kandyan* dance both in their fast rhythm and swift hand and leg movements. The southern style of dancing is called *ram sat* such as *ram sat chatri*, accompanied by the oboe (*pi*), a pair of drums (*klong tuk*), gong (*mong*), small cymbals (*ching*), a pair of single-faced drums (*thap or thon*) and bamboo stick castanets (*krap*). The movements of the body, arms, hands, and legs are sensual, almost erotic, imitating the natural movements of mating birds and animals. Dancers of the north and south usually attach long, curved bronze fingernails.

Thai classical dance (*nata sin*) developed from the basic movements in these folk dances and later incorporated the elaborate hand gestures, arm and leg movements of the Indian *Bharata Natayasastra*, either directly or through the ancient Mons and Khmers. However, *nata sin* differs markedly from Indian classical dance and maintains its own national characteristics.

Thai dancers, in both the folk and classical styles, hold their bodies straight from the neck to the hips in the vertical axis and move their bodies up and down with knees bent, stretching to the rhythm of the music. Indian dancers, on the other hand, move their bodies often in an s-curve. The arms and hands in

Thai dancing are kept in curves, or *wong*, at different levels, high, medium, and low, and the legs are bent with the knees opening outward to make an angle with the legs called *liem*. The grace and beauty of the dancer depends on how well these curves and angles are maintained in relationship and proportion to the whole body. The symbolic hand gesture of Indian dance are simplified to a few basic hand gestures such as the chip (closed the thumb and index, and opened other fingers). Foot movement is also slower in Thai dancing with the toes mostly curved upward or kept flat at an angle with the legs, but never pointed as in Indian dance or western ballet. The head and neck movement are slight, while the shoulders remain straight as a result of their being at different angles to the body. The body moves in diagonal lines to the left and right and is rarely twisted in curves except in the southern dance-dramas (*nora chattri*). These rules can be more or less applied to most of Thai dance styles.

The development of *natastin* can be traced as far back as the thirteenth and fourteenth centuries in the Sukhothai period. The term *rabam* (choreographed dances for specific functions and occasions), *ram* (dancing with emphasis on the hand movements), and *ten* (dancing with emphasis on the foot movements) are mentioned in the first stone inscription of the reign of King Ramkhamhaeng the Great (1279-1300). According to scholars, *ten* probably refers to masked dance-drama (*khon*) and shadow puppet dance-drama (*nang*), because these two sister arts both use feet movements in a martial style.

Traditionally, there were 108 basic movements (*mae tha*) in *natastin* for the characters of refined male heroes (*phra*) and refined female heroines (*nang*). They have now been reduced to 68 movements in the major chapter (*mae bot yai*) and 18-20 movements in the minor chapter (*mae bot lek*).

### **The divine sounds of Thai music (70)**

Thai music is melodious and sweet, filled with yearning and joy, satisfying the expectations of both musicians and listeners. It is a music which reflects the soul and philosophy of the Thai people. Their gentle and relaxed attitude towards life is centred on peace and happiness, flavoured with love and desire, with sadness and joy.

### **Thai musical inheritance from generation to generation (70)**

It is believed that Thai music was developed during the Sukhothai period, approximately 800 years ago. The people of Sukhothai were creators, musicians and also appreciative audiences. They started by playing a lone instrument of choice, then expanded their virtuosity by including other instruments in their performance. Soon bands consisting of a mixture of instruments such as the *Pi-ie* (flute), *Klong* (gong), *Tapone* (two-sides horizontal drum), *Glong Taad* (large upright drum) and *Ching* (castanets), were created and became known as *Kruang Haa* or Five Piece Ensemble.

The first ensemble was so successful that four additional instruments were added, the *pin* (one-stringed gourd fiddle), *Grajaab Pi-ie* (lyre), *Saw Saam Sai* (3-stringed fiddle) and *Tup* or *Tone* (a small one-sided drum). This ensemble became known as the *Wong Mahoree* or grand orchestra.

During the Ayudhya period, approximately 600 years ago, the Five Piece Ensemble remained very popular. Toward the end of the era, the *Ranaad* was brought in to join the ensemble, and the ensemble became known as *Wong Pi-ie Part Kruang Haa* or Five Piece Ensemble of wood and percussion instrument. With the addition of other stringed and wind instruments such as the various *Saw* (fiddles), *Jakay* (horizontal lyre), *Klui* (flute), *Tone* (one-sided drum) and *Ching* (castanets), the ensemble became known as the *Wong Kruang Sai* or Mixed-String Orchestra.

From the beginning of the *Rattanakosin* era, the present dynasty which began in 1782, Thai music reached its peak, especially during the reign of King Rama II. The three types of orchestras continued to be popular but were expanded and improved adding a variety of tones by including the *Ranaad Ek* or soprano xylophone and *Ranaad Toom* or alto xylophone.

### **Traditional Thai Music and Thai Society**

Indubitably to many Thais, traditional Thai music is a priceless and meaningful national legacy. Thai music is a reflection of the way of life and the rich cultural traditions created by a strong, kind and peaceful nation. Those traditions, principles, ingenuity and beliefs have been passed on to today's generation with the hope that they too will pass on this rich cultural heritage.

The Thai, like many people of other nations, play music as a means to express the happiness and joy, and the sadness and grief of the players themselves and in some ways of the community in which they live. Thus the beauty of the traditional Thai musical instruments and their sounds somehow represent the fundamental characteristics of being Thai.

Thai music represents the soul of the Thai people, reflecting the way of life of a people with unique culture and exotic traditions. Echoes of beautiful music created by different regions continue to resound throughout the kingdom.

The beauty of Thai music is indescribable. Traditional Thai music is science and art blended together and a reflection of the skill and lifestyle of the Thai people, covering their history, religion, art, society, legends, science and language.

## **Dance/Movement Therapy**

*“To dance is to give oneself up to the rhythms of all life.”*

*Dr.MAYA V.PATEL, b.1943*

Dance movement therapy (DMT) (or dance/movement Therapy as it is known in the USA) is the youngest of the arts therapies disciplines to be established as a distinctive modality. The studies that have been included refer to DMT work with clients with chronic and severe disabilities and mental health issues. A particular effect upon reducing anxiety has been reported. In the UK, small-scale qualitative research studies have been completed with a number of client groups (e.g. mothers and toddlers, adolescents with challenging behavior, survivors of sexual abuse, people with dementia and Parkinson’s disease, chronic pain, brain injury and eating disorder) (71).

Dance/movement therapy is defined as the “psychotherapeutic use of movement as a process which furthers the emotional, cognitive, social and physical integration of the individual”. The dance/movement therapist helps the client express emotions through various movements in a comforting environment that allows exploration of the inner workings of life struggles. Dance/movement therapy has been applied to a number of mental and physical conditions, such as eating disorders (72) test anxiety (73) breast cancer (74) torture survival (75) and neurological insult (76).

Dance/Movement Therapy can take advantage of the physical and mental potential (77) of the elderly and can provide both an enjoyable escape and a source of interpersonal contact. Improved memory, alertness, reality orientation, judgment, stability, anxiety, personal insight, acceptance, mobilization and self-esteem have all been associated with DMT with older individuals (78).

Dance is a pleasurable activity for older people and it may be a way to encourage sedentary older persons to take the first step to increase their physical activity. Verbally express that they felt happier after performing the dancing exercise program than they did before (79).

Hopkins et al. studied a group of sedentary older women and found that dancing improved cardiorespiratory endurance, balance, lower limbs strength and endurance, body agility and flexibility, and decreased body fat (80). A study from Japan showed that a 12-week dance-based aerobic exercise program improved selected components of balance and agility in healthy older women (81). In addition to physiological benefits, dancing was also shown to elevate mood, increase sense of self-esteem and well being, and increase social contact in healthy adolescent females (82-83).

In 2006, Haboush et al. (84) used ballroom dance lessons as a treatment for geriatric depression. The “treatment” consisted of one 45-min private ballroom dance lesson each week, for an 8-week period, for a total of eight dance lessons. Twenty depressed, community-dwelling older adults completed a pilot study. All participants received eight ballroom dance lessons from a selection of six dances (foxtrot, waltz, rumba, swing, cha-cha, and tango) from the National Dance Council of America’s syllabus in the post-treatment questionnaire, 18 participants provided answers to the question “what was the most beneficial aspect of the treatment?” Fourteen participants said that they enjoyed the dance lessons immensely and found pleasure learning that they were able to dance. Two participants commented that the lessons were the only thing that they had to look forward to during their week and would not have left the house otherwise. Two participants said that the exercise was best and two said they enjoyed the music. Most of the participants had no suggestions when asked the second question, “how could the treatment be improved?” Three participants suggested that the study include group lessons, three suggested

providing written material to assist in remembering the dance steps, and four suggested that there should be more lessons

In 2008, Eyigor et al. (79) investigated the effects of group-based Turkish folkloric dance on physical performance, balance, depression and quality of life (QoL) in 40 healthy adult elderly females over the age of 65 years. Subjects were randomly allocated into Group 1 (folkloric dance-based exercise) and Group 2 (control). An 8-week dance-based exercise program was performed. Outcome measures included a 20-m walk test, a 6-min walk test, stair climbing and chair rise time, Berg balance scale (BBS), the Medical Outcomes Study (MOS) 36-item short form health survey (SF-36), and geriatric depression scale (GDS) questionnaires. In the Group 1, statistically significant improvements were found in most of the physical performance tests (6-min walk, chair rise, and stair climbing), BBS and some SF-36 subscales (physical functioning, general health, mental health) after the exercise. ( $p < 0.05$ ) while no significant improvement was noted in GDS score. In the Group 2, compared to the first assessment, there was a significant decrease in the general health score of SF-36 ( $p < 0.05$ ) with no significant changes in other variables. When the groups were compared, significant improvements in favor of Group 1 have emerged in most of the functional performance tests (6-min walk, chair rise, stair climbing), in some of the SF-36 subscales (physical functioning, general health, mental health) and BBS score ( $p < 0.05$ )

In 2009, Mavrovouniotis et al. (85) examined the effects of Greek traditional dances on old people's quality of life. One hundred and eleven members volunteered (75 women and 36 men) were divided into an experimental (Group A) ( $n=76$ ) and a control group (Group B) ( $n=35$ ), the subjects of the experimental group received one-hour preparatory session, on methods of heart rate (HR) measurement and procedural details. In continuity, the subjects of the experimental group participated in a group program of Greek traditional dances performance.

The performed Greek traditional dances were from different areas of Greece. In order to begin to dance the subjects were holding each other from the hands, creating a hemi-cycle. The performed dances included a variety of simple kinetic patterns with music accompaniment. The dances intensity ranged from low to moderate, with frequent rhythm alternations, so that the subjects could keep dancing continuously throughout the dance session. Essential breaks of approximately 10 s in between dances in order to change dance were made. The duration of each dance was about 2.53 min. The session duration was 60 min in total. The subjects of the control group, on the other hand, were asked to stay in a room all together, free to discuss with each other or watch television. The discussing and watching TV session duration was 60 min in total. The results overall indicated that Greek traditional dances possess properties improving old people's psychosomatic state, More specifically, in this study it was found out that Greek traditional dances increased well-being, as well as decreased stress, and anxiety of old participants. Moreover, it had been found out that the old people who participated in Greek traditional dances programs had a better picture for their body limbs and functions, as well as bigger satisfaction than their age peers that did not participate in similar programs In conclusion, Greek traditional dances of moderate intensity, with music accompaniment, could lead to significant improvements in old people's psychological and physical well-being. Consequently, Greek traditional dances, as a form of aerobic activity, could produce not only physical but also mental benefits, and should constitute a part of exercise programs that aim both to the improvement of old people's psychological state and quality of life.

Recently, several studies reported the effects of dance on function performance in PD patients. Hackney et al. have studied the effects of dance on motor function since 2007. They reported a preliminary study in 2007, about effect of Tango on functional mobility. Nineteen PD patients were randomly

assigned to a tango group or exercise group. Subjects completed a total of 20 tango or exercise classes and were evaluated the week before and the week following the intervention. Both groups showed significant improvement in overall UPDRS score. The tango group showed significant improvement on BBS and showed a trend toward improvement on TUG that the exercise group did not improve on this measure (86).

In 2008, Hackney et al. studied Tai Chi on balance and mobility in PD patients. The Tai Chi group, which participated in 20-1hour long training sessions within 10-13 weeks; whereas, the control group had two testing sessions between 10 and 13 weeks apart without intervention. The Tai Chi group improved more than the control group on BBS, UPDRS, TUG, tandem stance test, six-minute walk, and backward walking. Moreover all Tai Chi participants reported satisfaction with the program and improvements in well-being (87).

In 2009, Hackney et al. (88) study the effects of short duration, intensive tango lessons on functional mobility in people with Parkinson disease. Fourteen people with idiopathic Parkinson disease participated ten 1.5 h-long progressive Argentine tango dance sessions were completed in 2 weeks. Participants significantly improved on the Berg Balance Scale, Unified Parkinson Disease Rating Scale Motor Subscale III, and percent of time spent in stance during forward walking. Non-significant improvements were noted on the Timed Up and Go and 6 min walk. In the same year, they studied the effects of dance on movement control in Parkinson's disease: a comparison of argentine tango and American ballroom. Fifty-eight people with mild-moderate Parkinson's disease were randomly assigned to tango, waltz/foxtrot or no intervention (control) groups. Those in the dance groups attended 1-h classes twice a week, completing 20 lessons in 13 weeks. Balance, functional mobility, forward and backward walking were evaluated before and after the intervention. Both dance groups

improved more than the control group, which did not improve. The tango and waltz/foxtrot groups improved significantly on the Berg Balance Scale, 6-minute walk distance, and backward stride length. The tango group improved as much or more than those in the waltz/foxtrot group on several measures (89).

In 2011, Heiberger (90) investigated the short-term effects of dance (i.e., the effect immediately after the dance class) on motor control in individuals with PD and the long-term effects of 8 months of participation in the weekly dance class on the quality of life of the PD patients and their caregivers. Eleven people with moderate to severe PD (58–85 years old) were subjected to a motor and quality of life assessments. With respect to the motor assessments the unified Parkinson disease rating scale III (UPDRSIII), the timed up and go test (TUG), and the Semi tandem test (Se Ta) before and after the dance class were used. With respect to the quality of life and well-being we applied quality of life scale (QOLS) as well as the Westheimer questionnaire. Additionally, they asked the caregivers to fill out the Questionnaire for caregivers. They found a significant beneficial short term effect for the total score of the UPDRS motor score. The strongest improvements were in rigidity scores followed by significant improvements in hand movements, finger taps, and facial expression. No significant changes were found for TUG and for Se Ta. The results of the questionnaires showed positive effects of the dance class on social life, health, body-feeling and mobility, and on everyday life competences of the PD patients. Beneficial effect was also found for the caregivers. The findings demonstrate that dance has beneficial effect on the functional mobility of individuals with PD. Further, dance improves the quality of life of the patients and their caregivers.

In 2012, Li and co-worker (91) determined whether a tailored tai chi program on postural control in patients with idiopathic Parkinson's disease. 195 patients with stage 1 to 4 to one of three groups: tai chi, resistance training, or stretching.

The patients participated in 60-minute exercise sessions twice weekly for 24 weeks. The primary outcomes were changes from baseline in the limits-of-stability test (maximum excursion and directional control; range, 0 to 100%). Secondary outcomes included measures of gait and strength, scores on functional-reach and timed up-and go tests, motor scores on the Unified Parkinson's Disease Rating Scale, and number of falls. The results showed that the tai chi group performed consistently better than the resistance-training and stretching groups in maximum excursion (between-group difference in the change from baseline). The tai chi group also performed better than the stretching group in all secondary outcomes and outperformed the resistance training group in stride length and functional reach. Tai chi lowered the incidence of falls as compared with stretching but not as compared with resistance training. The effects of tai chi training were maintained at 3 months after the intervention.

Practice in multitasking situations can improve performance (92). Since dance incorporates several aspects of movement as well as a multitasking activity, PD patients showed improve their performance by participating in dance.

### **Cueing in Parkinson's disease**

There have been numerous studies related to the application of cueing for improving mobility in patients with PD. Both auditory and visual cues have been described to assist or improve gait in people with Parkinson's disease.

Evidence is accumulating that people with PD can move more easily when external cues are available to guide their performance. External cues can be visual, auditory, or proprioceptive in type. Auditory cues appear to be particularly useful for people with gait akinesia and freezing, whereas visual cues are most useful for people with gait hypokinesia (11, 93).

Rhythmical sensory cues, such as rocking the body from side to side, may sometimes be useful in assisting the initiation of movements such as walking or rolling over in bed (94). External cues may assist people with PD to move more easily because they utilize the intact premotor cortex of the brain rather than the defective BG-SMA circuits to control movement (95). Clinical studies have shown that externally cued practice over more extended periods (3–6 weeks) show significant benefits of training with a range of different external cues on gait, balance and transfers (96-99). Cued training has also been shown to be more effective than other interventions such as non-cued exercise (100).

An alternative explanation is that external cues may simply focus the person's attention on critical aspects of the movement that need to be regulated, such as stride length (101) weight transference to unload the leg, or axial motion to assist in turning (64). Both of these explanations are compatible with the idea that the ability to move is not lost in people with PD, rather the person is dependent on cortical mechanisms to activate and sustain movement.

Rhythmic somatosensory cueing (RSC) was another form of auditory cueing used to study gait in PD patients. Wegen et al. (102) investigated 17 patients with PD adapting their walking pattern using RSC (a miniature vibrating cylinder attached to the wrist). Subjects walked on the treadmill under conditions of changing walking speed and the presence of potentially distracting visual flow while walking on a treadmill under 4 conditions in a random order: (a) no cue, no visual flow, (b) no cue, visual flow, (c) cue, no visual flow and (d) cue, visual flow. During the treadmill protocol two variables were manipulated: rhythmic somatosensory cueing and visual flow. Visual flow was manipulated by means of a 2.2 m rear-projection screen positioned in front of the treadmill: in conditions where visual flow was offered a 'Virtual' corridor was projected that 'moved' at the speed of the treadmill, providing the illusion that the

subject walks through the corridor. RSC was manipulated by means of a miniature vibrating cylinder attached under a wristband and connected via a wire running through the sleeve to a prototype cueing device. The frequency of the RSC was 10% below baseline stride frequency at each speed. The subjects were given the instruction to “step on the rhythm of the vibration”. The entire protocol took about 1.5 h, including adequate rest periods between conditions. Stride frequency was assessed using peaks in the trajectories of thigh sagittal plane segmental angles. Walking with RSC resulted in lower stride frequencies, and thus larger step lengths ( $p$ -values  $<0.05$ ), regardless of walking speed. The presence of visual flow did not impair the use of RSC, as evidenced by the lack of differences between conditions 3 and 4 ( $p > 0.05$ ).

Thaut et al. (96) used auditory stimulation to provide rhythmic cues as a pacemaker during movement in a 3 week home-based gait-training. Electromyographic and stride patterns were assessed. Rhythmic auditory stimulation improved gait velocity, cadence, and stride length significantly as well as altering the electromyographic patterns of the tibialis anterior and vastus lateralis muscles. In addition, some features of electromyographic gait-cycle profiles normalized. Long-term effects and influence on quality of life were not investigated.

Jiang and Norman (103) evaluate the effects of auditory and visual cues on gait initiation in 14 PD. Following the baseline trials, the subject completed 10 trials for each cue condition. The order of cue conditions was randomized: 8 subjects performed the auditory cue condition before the visual cue condition, and 6 subjects performed them in the reverse order. The auditory cue was created by a Piezo buzzer connected to a stimulator which produced a highpitched beep of approximately 40 ms duration. The cue was continuously audible throughout the 10 trials. Subjects were recommended to start walking on any beep they chose following the verbal encouragement to go, and to keep walking regardless of whether

they thought they were successfully matching their step timing to the cues. The visual cue was a series of four strips 1.9 cm in width taped to the walkway. The first strip was placed at the same distance as the average first step length of each subject obtained in the walking trials in the corridor. The subsequent strips were placed with an inter-strip distance of 40% of the subject's height. The results showed that the magnitudes of first and second step lengths, of push-off force and of overall gait velocity were significantly greater in the visual cue condition than in the baseline condition, whereas there was no significant effect of auditory cue on these measures. Neither cue had any significant effect on the timing of key events in gait although transverse line visual cues enable people with Parkinson's disease to begin walking with longer steps, greater push-off force and higher velocity. But auditory cues that others have shown to improve aspects of gait in people with Parkinson's disease and do not appear to have any systematic effect on the first two steps of gait initiation.

The auditory cues are commonly rhythmic cues generated by a metronome or equivalent, sometimes embedded in music (24). Training with rhythmic auditory stimulation has also been associated with increases in velocity, cadence and stride length (104).

## **Music therapy**

*The power of music to integrate and cure...it is quite fundamental. It is the profoundest nonchemical medication.*

*Sachs (105)*

Within the evolution of arts therapies, music therapy (MT) was one of the first disciplines to form a professional body. Ancient practices, Eastern medicine, and nonconventional treatments, including music as therapy and as medicine, are being reexamined for the wisdom that they can contribute to

modern methods of enhancing health. By introducing the Western approaches of alternative, complementary, and mind-body medicine, the Eastern approaches of traditional Chinese medicine and Ayurvedic medicine, and worldwide practices in shamanism, this article offers a model for the integration of music therapy into integrative medicine.

Listening to recorded music is a receptive music experience that can aid with exercise. Different research studies have shown that recorded music listening can increase motivation to exercise, can increase repetition frequencies during physical therapy rehabilitation exercise (106), and can increase distances walked (107). Broadly defined, music therapy is the use of musical or rhythmic interventions to improve physical health and/or emotional health. Music may be used as a physical and emotional stimulus as well as a symbolic language. It provides creative relaxation techniques, coping strategies, self-expression, awareness, mastery, presence, community, relationships, and social support, among others. In addition, it can evoke a peak experience or spiritual encounter that sometimes goes beyond and deeper than traditional talk therapies (108). This relationship between music and health is both intimate and ancient. Since the beginning of time, music has played a significant role in the healing practices of most cultures. For thousands of years, indigenous healers throughout the world have used songs and chants as well as whistles and drums, rattles, gongs, and flutes to restore health and vitality to their patients (109).

The research by Droh and Spintge (110) has shown that music significantly reduces pulse rate and plasma levels of epinephrine, norepinephrine, and cortisol in patients undergoing medical and dental procedures, demonstrating the existence and causation of psychosomatic illness in the past (111). Music therapy may play a key role in reducing stress by increasing the relaxation response (112). It may foster aspects of the social dimension in those who suffer from feelings of isolation and being out of

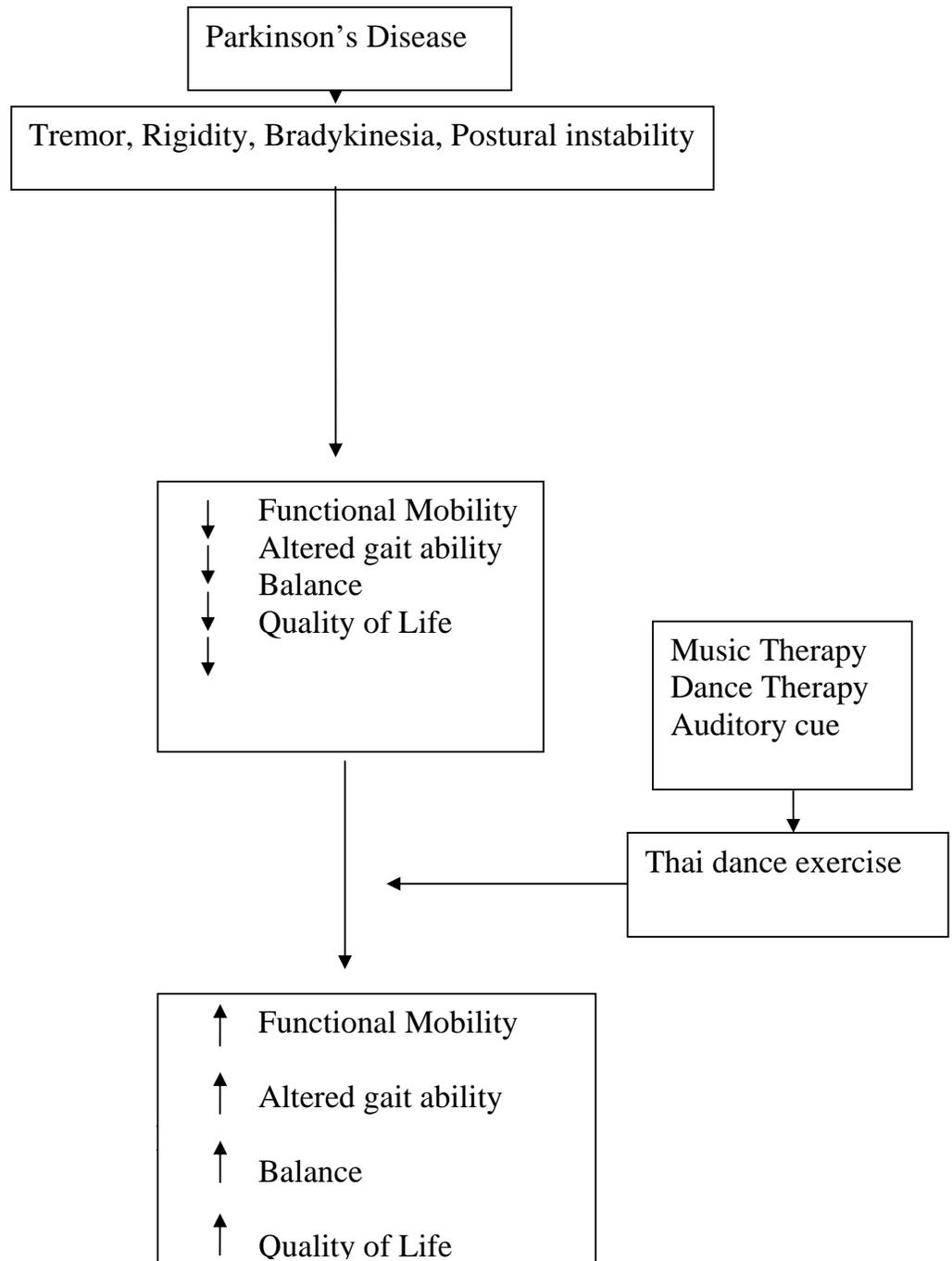
control emotionally, mentally, and in the behavioral aspects of life (113).

### **Music therapy in Parkinson's Disease**

Music can affect a patient's mood, causing depression, anxiety and even social isolation. Participating in music therapy groups, including therapeutic drumming groups, dance and movement groups, and music therapy support groups, can provide an outlet for self expression and a closer connection to others. Active music therapy can aid in promoting both physical and emotional health and well-being (114).

Swallow (115) showed in a small group of Parkinson's patients that music, in conjunction with physiotherapy and speech therapy, can regularize walking patterns, prevent akinetic freezing, improve speech, promote relaxation, and improve posture and control of upper limb movement. In this case report, music therapy was provided predominantly in the form of singing used to improve speech, breathing, and posture. The music was matched to the patient's own rhythm of movement and then changed periodically to let the patient match the music pattern in an effort to maximize movement control. The effect was short (less than 24 hours), but in some cases it was possible to prolong the benefit by consciously recalling musical associations. This technique, called rhythmic auditory stimulation or cuing, has been shown to be effective even in disease-free individuals. The proposed mechanism by which music therapy work is by exciting and shaping activity in the motor system of the brain, which helps organize and integrate complex movement. When muscle activity is synchronized to auditory rhythm, it becomes more regular and efficient, regardless of the type of music that is been used (116).

## Conceptual framework



# CHAPTER III

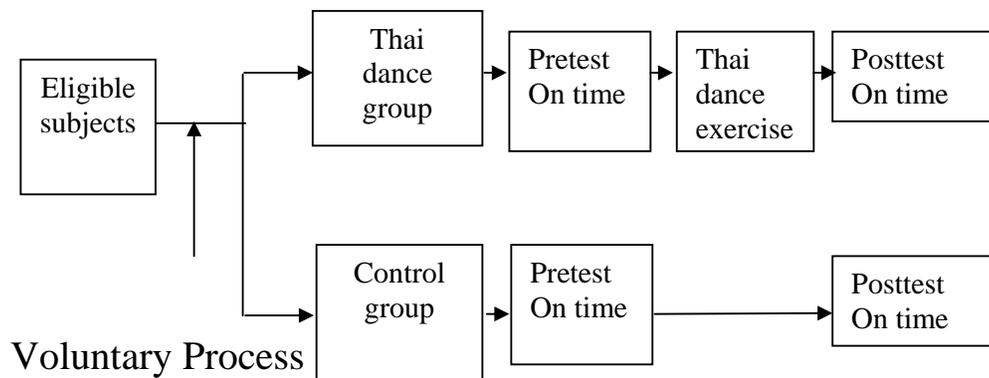
## Research methodology

### Research Design

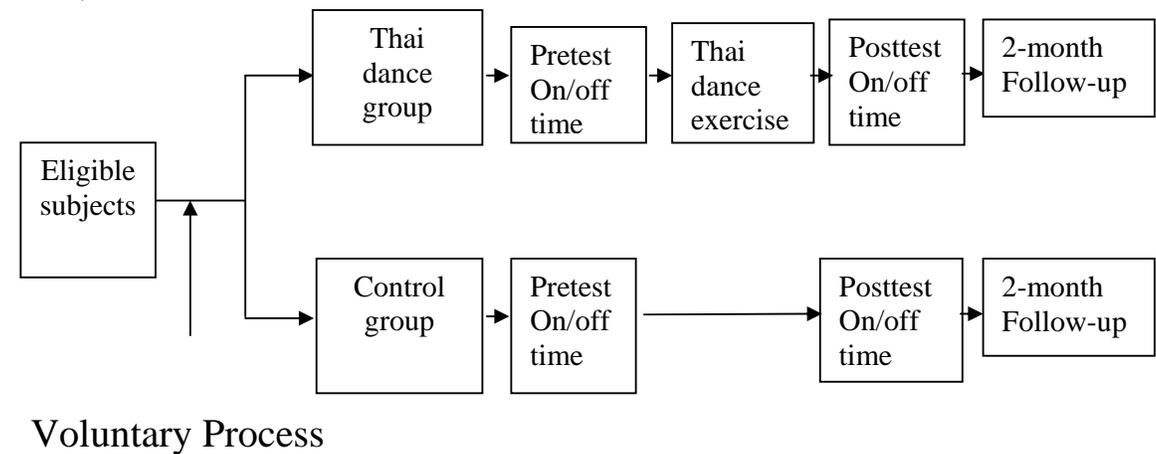
This study was the quasi pretest-posttest nonequivalent groups design.

### Research Design Model

#### *Study 1*



#### *Study 2*



## **Population and Sample**

### *Population*

Patients with Parkinson's disease at outpatients department of Chulalongkorn Comprehensive Movement Disorders Center, King Chulalongkorn Memorial Hospital.

### *Samples*

Study1: Twenty-four patients who had been diagnosed as Parkinson's disease by Neurologist voluntarily participate in the study. Patients disability were rated according to the Hoehn and Yahr Scale (53). Twenty patients completed the program.

Study 2: Twenty-eight patients who had been diagnosed as Parkinson's disease by Neurologist voluntarily participate in the study. Patients disability were rated according to the Hoehn and Yahr Scale. Twenty patients completed the program.

## **Eligible criteria**

### *Inclusion criteria*

1. Present clinical diagnosis of PD in the stages from 1 to 3 assessed by the Hoehn and Yahr Scale.
2. Patients who could stand, walk with or without an assistive device.
3. Patients must be on stable drug regime.
4. Patients must understand and be able to follow simple directions.
5. Patients who were able to the hospital and exercise class for assessment and exercise.

### ***Exclusion criteria***

1. Present indication of dementia, stroke, history of neurological deficit other than PD or Parkinson-plus syndrome.
2. Present orthopedic problems that would affect mobility.

### **Procedures**

#### ***Procedures consisted of three parts:***

1. Designing the Thai dance exercise program
  - 1.1. The symptoms of people with Parkinson's disease and the forms of Thai dance were studied.
  - 1.2. The exercise program in Thai dance concerned these particular components such as stretching, balance, strengthening, range of motion, mobility and coordination were designed. Various Thai traditional music were selected to meet the impairments commonly experienced by PD patients.
  - 1.3. Thai dance exercise program was used to train people with Parkinson's disease in pilot study and performance will be observed during the pilot study.

The duration of intervention was 6 weeks, with a total of 18 sessions. Subjects in the Thai dance group participated in three 60-minute sessions per week. Each session consisted of 10 minutes of warm up, 40 minutes of dance with brief rests in between, followed by 10 minutes of cool down.

1.4. Thai dance exercise program was modified.

The duration of intervention was 12 weeks, with a total of 36 sessions.

## **2. Test of Item Objective Conguence Index (IOC)**

2.1 Contents validity was tested by 5 experts in the following areas: basic movements, rhythm of music, duration, intensity, benefits and safety. (appendix B and C). value of IOC = 0.76

2.2 Thai dance exercise program was modified.

## **3. Experimental maneuver**

### *Sample collection*

The patients with PD from outpatient department of Chulalongkorn Comprehensive Movement Disorders Center at King Chulalongkorn Memorial Hospital who had eligible criterion were invited to participate in this study and were informed about the benefits of the exercise and the information about this project. If they agreed to join, the informed consent form would be signed up.

### *Measurement*

#### **Demographic Variables**

- Age
- Duration of disease
- Height

- Weight
- Body Mass Index
- Disability stage (Hoehn & Yahr)
- Daily dosage of levodopa

### ***Primary Outcomes Variable***

- Unified Parkinson's Disease Rating Scale (UPDRS) subscale II and III

### ***Secondary Outcomes Variables***

- The Timed up and Go test (TUG)
- Berg Balance Score (BBS)
- 360 degree turning test
- The 8-item Parkinson's disease questionnaire (PDQ8)
- Gait assessment (the following gait velocity; stride length, step length; cadence were studied by the GaitRITE).

### **Data collection**

Each patient's demographic information such as years of diagnosis, disability stage, weight, height and medications were taken from the medical records and patients interviews. In study 1, all assessments were conducted in the "on" state (after 1 hour medications) and one week prior to the initiation of training one week following the completion of 36 training sessions. In study 2, all assessments were conducted in the "on" state (after 1 hour medications) and "off" state (30 minutes before next dose) , one week prior to the initiation of training, one week following the completion of 36 training sessions and one week after 2-month follow-up. During each assessment, subjects were first evaluated by using the Unified Parkinson's Disease Rating Scale

(UPDRS) part 2 and 3. Quality of life was evaluated by using the 8-item Parkinson's disease questionnaire (PDQ8), balance was assessed by using the Berg Balance Score (BBS), functional mobility was assessed by using the Timed Up and Go Test (TUG), following the 360 turning test. Finally, gait assessment was measured by walking along the carpet and computerized GAITRite walkway. The subjects were asked to walk "as fast as possible" along a 10-m hallway for three times. The gait variables recorded were velocity, step length and stride length.

### **Intervention**

**Control group** : Patients in this group would not participate in the Thai dance exercise program.

**Thai dance group** : Patients were trained in the Thai dance exercise program for 12 weeks.

The Thai dance exercise program was composed of 36 lessons. The duration of the intervention was 12 weeks, with 60 minute sessions three times per week, for a total of 36 sessions. Each session included five parts: 1) relaxation & breathing exercise (five minutes), 2) warm-up (five minutes), 3) Thai dance stretching (five minutes), 4) Thai dance (forty minutes) and 5) cool-down (five minutes).

### **Data analysis**

#### **Demographic Variables**

All data were presented as mean and standard deviation and independent t-test for comparing between groups at baseline.

#### **Outcome Variables**

Study 1, the results were analyzed by using the Statistical Package for Social Sciences (SPSS) version 17.0 software

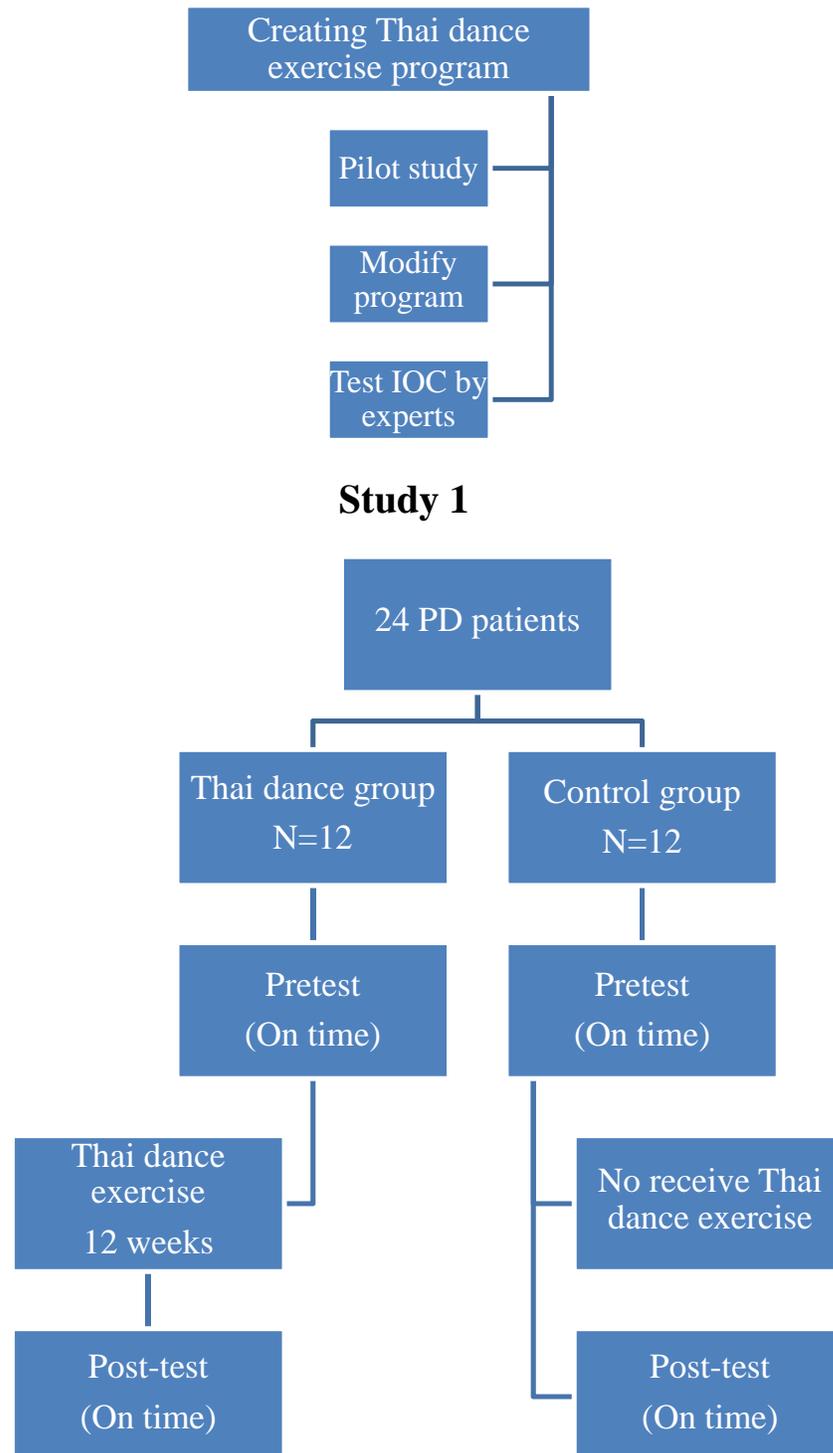
system for window. In study 1, the paired t-test was used to compare between baseline and post-test and the analysis of covariance (ANCOVA) was used to compare the change (difference between baseline and post-intervention) variables at post-intervention between two groups. Values of  $p < 0.05$  were considered as statistically significant.

Study 2, the repeated measure of ANOVA was used to compare the variables among baseline, post-test and 2-month follow-up within the group. The analysis of covariance (ANCOVA) was used to compare variables at post-test and 2-month follow-up (base line was used to be covariate) between groups. Value of  $p < 0.05$  was considered as statistically significant.

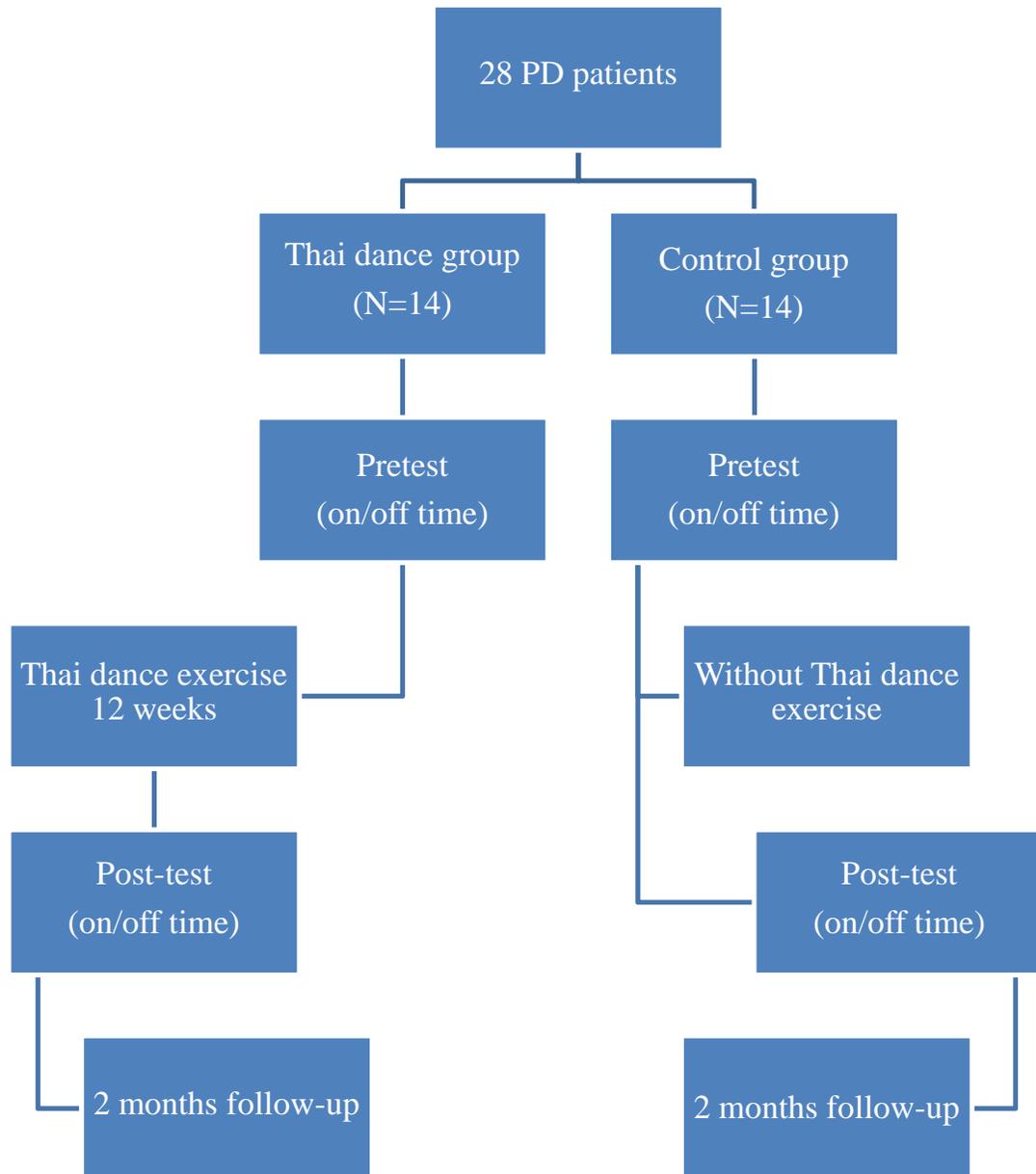
### **Ethical Consideration**

All eligible patients received details of the study protocol and researcher explained the protocol thoroughly to the patients or patient family. Informed consent was obtained from all patients prior to the study and the study was approved by the Ethics Committee of the Faculty of Medicine, Chulalongkorn University.

## Procedure Chart



## Study 2



## **CHAPTER IV**

### **Results of the study**

This chapter of results composed of two parts which were study 1 and study 2. Each part was listed in following:

#### **Part 1: Study 1**

: Demographics of Parkinson's disease patients were presented as mean and standard deviation

: Results of the effects of Thai dance exercise program on functional performance and quality of life in "on time", evaluations were performed at baseline and post-intervention. The paired t-test was used to compare between baseline and post-test and the analysis of covariance (ANCOVA) was used to compare the change (difference between baseline and post-intervention) variables at post-intervention between two groups. Values of  $p < 0.05$  were considered as statistically significant.

#### **Part 2: Study 2**

: Demographics of Parkinson's disease patients were presented as mean and standard deviation

: Results of the effects of Thai dance exercise program on functional performance and quality of life in "on time", "off time", evaluations were performed at baseline post-intervention and after 2 months. The repeated measure of ANOVA was used to compare the variables among baseline, post-test and 2-month follow-up within the group. The analysis of covariance (ANCOVA) was used to compare variables at post-test and 2-month follow-up (base line was used to be covariate) between groups. Value of  $p < 0.05$  was considered as statistically significant.

### Part 1:

The study 1 was conducted during July 2010 to January 2011. Twenty-four patients receiving care at the Center of Excellence for Parkinson's Disease and Related Disorders, Chulalongkorn Hospital were recruited for this study by inclusion criteria. All patients were evaluated H&Y stage by neurologists with expertise in Parkinson's disease. Only 20 patients completed the study. Four participants did not complete the program: one patient withdrew at week 2 because of falling down stairs at his home, one patient completed the program but was not available for the post-treatment evaluation, and the others had transportation problem.

## **Demographics of Parkinson's disease patients**

The details of demographic data of Parkinson's disease patients were displayed in table 1. In Thai dance group, 5 male patients and 5 female patients with age varied from 51 to 78 years with mean value and standard deviation of  $64.1 \pm 8.40$  years. Duration of disease varied from 1 to 22 years with mean value and standard deviation of  $6.2 \pm 6.37$  years. Average Hoehn and Yahr stage was  $2 \pm 0.78$  as well as average levodopa was  $442.86 \pm 97.59$  mg/day.

In control group, eight male patients and two female patients with age varied from 55 to 80 years with mean value and standard deviation of  $66.3 \pm 7.47$  years. Duration of disease varied from 1 to 15 years with mean value and standard deviation of  $6.1 \pm 4.6$  years, average Hoehn and Yahr stage was  $2 \pm 0.58$  as well as average levodopa was  $643.75 \pm 358.01$  mg/day.

## **Outcomes of functional mobility and quality of life**

Values of the Unified Parkinson's Disease Rating Scale (UPDRS) subscales II and III, the Times up and Go test (TUG), the Berg Balance Score (BBS), 360 turning test, the 8-item Parkinson's disease questionnaire (PDQ8) and Gait parameters at baseline and post-test and values for change score (post-test values were subtracted from baseline values) of post-test and baseline of each parameter of Thai dance group were shown in table 2, and control group were shown in table 3.

In table 4.1, values results from the performed analysis of the computed t-independent were shown.

## Demographic and patients characteristics

**Table 4.1** Demographics of Parkinson's Disease Participants

Parameters	Thai dance group	control group	<i>p-value</i>
	Mean $\pm$ SD	Mean $\pm$ SD	
M/F ratio	5/5	8/2	
Age (years)	64.1 $\pm$ 8.40	66.3 $\pm$ 7.47	0.54
Height (cm)	161.1 $\pm$ 7.67	162.6 $\pm$ 6.17	0.64
Weight (kg)	59.3 $\pm$ 11.26	61.7 $\pm$ 10.58	0.63
Body Mass Index (kg/m <sup>2</sup> )	22.57 $\pm$ 3.67	23.31 $\pm$ 3.86	0.67
Duration of disease (year)	6.2 $\pm$ 6.37	6.1 $\pm$ 4.6	0.97
Hoehn and Yahr stage	2 $\pm$ 0.78	2 $\pm$ 0.58	1.0
Daily dosage of levodopa	442.86 $\pm$ 97.59	643.75 $\pm$ 358.01	0.17

There were no significant differences between groups in any of the demographics or outcome variables at Baseline.

**Table 4.2** The comparison between baseline and post-test in Thai dance group

Parameters	Baseline Mean $\pm$ SD	Post-test Mean $\pm$ SD	Change score Mean $\pm$ SD
UPDRS (II)	7.6 $\pm$ 6.40	4.7 $\pm$ 4.69*	2.9 $\pm$ 2.18
UPDRS (III)	21.1 $\pm$ 14.29	14.1 $\pm$ 8.76*	7 $\pm$ 5.79
TUG (sec)	13.26 $\pm$ 3.17	9.6 $\pm$ 1.09*	3.65 $\pm$ 2.64
BBS	49.80 $\pm$ 5.03	55.20 $\pm$ 1.14*	-5.4 $\pm$ 4.27
360 Turning (sec)	6.41 $\pm$ 2.49	4.32 $\pm$ 0.83*	2.09 $\pm$ 2.05
PDQ8	9.2 $\pm$ 7.13	3.6 $\pm$ 3.31*	5.6 $\pm$ 4.9
Step length (cm) (Left side)	51.55 $\pm$ 7.05	58.51 $\pm$ 5.17*	-6.96 $\pm$ 4.06
Step length (cm) (Right side)	53.03 $\pm$ 7.61	59.65 $\pm$ 4.88*	-6.63 $\pm$ 4.67
Stride length (cm) (Left side)	104.96 $\pm$ 14.40	118.77 $\pm$ 10.12*	-13.81 $\pm$ 8.72
Stride length (cm) (Right side)	105.27 $\pm$ 14.76	118.53 $\pm$ 9.85*	-13.27 $\pm$ 8.95
Velocity (cm/sec)	91.13 $\pm$ 10.21	114.68 $\pm$ 9.48*	23.56 $\pm$ 12.79
Cadence	105.15 $\pm$ 7.59	117.12 $\pm$ 10.93*	11.97 $\pm$ 6.82

\* $p < 0.05$

From baseline to 12 weeks, the subjects in the Thai dance group showed significant changes in all parameters as follow: UPDRS subscale II ( $p = 0.002$ ), UPDRS subscale III ( $p = 0.004$ ), TUG ( $p = 0.002$ ), BBS ( $p = 0.003$ ), 360 Turning ( $p = 0.010$ ), PDQ8 ( $p = 0.004$ ), step length (Lt.) ( $p = 0.000$ ), step length (Rt.) ( $p = 0.002$ ), stride length (LT.) ( $p = 0.001$ ), stride length (RT.) ( $p = 0.001$ ), gait velocity ( $p = 0.000$ ) and cadence  $p = 0.000$ ).

**Table 4.3** The comparison between baseline and post-test in the control group

Parameters	Baseline Mean $\pm$ SD	Post-test Mean $\pm$ SD	Change score Mean $\pm$ SD
UPDRS (II)	9.00 $\pm$ 3.71	10.10 $\pm$ 3.96	-1.1 $\pm$ 1.73
UPDRS (III)	18.20 $\pm$ 7.24	19.70 $\pm$ 7.56*	-1.5 $\pm$ 1.84
TUG (sec)	11.09 $\pm$ 1.86	13.36 $\pm$ 2.56*	-2.3 $\pm$ 1.08
BBS	52.50 $\pm$ 3.24	52.20 $\pm$ 3.22	0.3 $\pm$ 1.16
360 Turning (sec)	5.80 $\pm$ 1.46	6.61 $\pm$ 1.63*	-0.8 $\pm$ 0.97
PDQ8	9.30 $\pm$ 4.57	11.80 $\pm$ 4.44*	-2.5 $\pm$ 1.43
Step length (cm) (Left side)	56.46 $\pm$ 5.45	52.95 $\pm$ 5.47*	3.51 $\pm$ 2.87
Step length (cm) (Right side)	55.50 $\pm$ 3.94	52.13 $\pm$ 3.97*	3.37 $\pm$ 2.33
Stride length (cm) (Left side)	111.33 $\pm$ 8.89	105.59 $\pm$ 8.91*	5.74 $\pm$ 5.24
Stride length (cm) (Right side)	112.36 $\pm$ 9.05	105.54 $\pm$ 8.74*	6.96 $\pm$ 4.76
Velocity (cm/sec)	104.24 $\pm$ 9.35	95.35 $\pm$ 10.13*	8.9 $\pm$ 5.98
Cadence (step/min)	110.68 $\pm$ 7.03	106.59 $\pm$ 9.24*	4.09 $\pm$ 3.37

\* $p < 0.05$

From baseline to 12 weeks, the subjects in the control group showed significant changes in UPDRS subscale III ( $p = 0.030$ ), TUG ( $p = 0.000$ ), 360 Turning ( $p = 0.028$ ), PDQ8 ( $p = 0.000$ ), step length (Lt.) ( $p = 0.004$ ), step length (Rt.) ( $p = 0.001$ ), stride length (LT.) ( $p = 0.007$ ), stride length (RT.) ( $p = 0.001$ ), gait velocity ( $p = 0.001$ ) and cadence ( $p = 0.004$ ). The UPDRS subscale II and BBS showed no significant change.

**Table 4.4** The comparison of change score between Thai dance group and control group

Parameters	Change score (mean $\pm$ SD)		F value	<i>p</i> value
	Thai dance	Control		
UPDRS (II)	2.9 $\pm$ 2.18	-1.1 $\pm$ 1.73	34.90	0.000*
UPDRS (III)	7 $\pm$ 5.79	-1.5 $\pm$ 1.84	44.31	0.000*
TUG (sec)	3.65 $\pm$ 2.64	-2.3 $\pm$ 1.08	40.18	0.000*
BBS	-5.4 $\pm$ 4.27	0.3 $\pm$ 1.16	18.32	0.001*
360 Turning (sec)	2.09 $\pm$ 2.05	-0.8 $\pm$ 0.97	28.25	0.000*
PDQ8	5.6 $\pm$ 4.9	-2.5 $\pm$ 1.43	66.72	0.000*
Step length (cm) (Left side)	-6.96 $\pm$ 4.06	3.51 $\pm$ 2.87	37.08	0.000*
Step length (cm) (Right side)	-6.63 $\pm$ 4.67	3.37 $\pm$ 2.33	49.93	0.000*
Stride length (cm) (Left side)	-13.81 $\pm$ 8.72	5.74 $\pm$ 5.24	39.57	0.000*
Stride length (cm) (Right side)	-13.27 $\pm$ 8.95	6.96 $\pm$ 4.76	44.90	0.000*
Velocity (cm/sec)	23.56 $\pm$ 12.79	8.9 $\pm$ 5.98	28.04	0.000*
Cadence (step/min)	11.97 $\pm$ 6.82	4.09 $\pm$ 3.37	43.97	0.000*

\**p* < 0.05

From baseline to 12 weeks, the subjects in the Thai dance group had a mean (SD) of UPDRS subscale II decreased to  $2.9 \pm 2.18$  points, UPDRS subscale III decreased to  $7 \pm 5.79$  points. TUG decreased to  $3.65 \pm 2.64$  seconds, 360 turning also decreased to  $2.09 \pm 2.05$  seconds and PDQ 8 decreased to  $5.6 \pm 4.9$  points. On the other hand BBS had a mean (SD) increased to  $5.4 \pm 4.27$  points.

In gait parameters, step length (left, right) had a mean (SD) increased to  $6.96 \pm 4.06$  cm and  $6.63 \pm 4.67$  cm. Stride length (left, right) had also a mean (SD) increased to  $13.81 \pm 8.72$  cm and  $13.27 \pm 8.95$  cm. Velocity had a mean (SD) increased to  $23.56 \pm 12.79$  (cm/sec) and cadence had a mean (SD) increased to  $11.97 \pm 6.82$  (step/min).

The subjects in the control group had a mean (SD) of UPDRS subscale II increased to  $1.1 \pm 1.73$  points, UPDRS subscale III increased to  $1.5 \pm 1.84$  points. TUG increased to  $2.3 \pm 1.08$  seconds, 360 turning also increased to  $0.8 \pm 0.97$  seconds and PDQ 8 increased to  $2.5 \pm 1.43$  points. On the other hand, BBS had a mean (SD) decreased to  $0.3 \pm 1.16$  points

In gait parameters, step length (left, right) had a mean (SD) decreased to  $3.51 \pm 2.87$  cm and  $3.37 \pm 2.33$  cm. Stride length (left, right) had also a mean (SD) decreased to  $5.74 \pm 5.24$  cm and  $6.96 \pm 4.76$  cm. On the other hand, velocity had a mean (SD) increased to  $8.9 \pm 5.98$  (cm/sec) and cadence had a mean (SD) increased to  $4.09 \pm 3.37$  (step/min).

The analysis of covariance (ANCOVA) showed statistically significant difference between groups in all parameters.

**Part 2:**

The study 2 was conducted during March 2011 to February 2012. Twenty-eight patients receiving care at the Center of Excellence for Parkinson's disease and Related Disorders, Chulalongkorn Hospital were recruited for this study by inclusion criteria. All patients were evaluated H&Y stage by neurologists with expertise in Parkinson's disease. Only 20 patients completed the study and the other 8 patients were excluded from data analysis due to natural disaster.

**Demographic and patients characteristics**

The details of demographic data of parkinson's disease patients were displayed in table 4.5. In Thai dance group, six (54.55%) male patients and five (45.45%) female patients with age varied from 48 to 80 years with mean value and standard deviation of  $63.09 \pm 10.44$  years. Duration of disease varied from 1 to 22 years with mean value and standard deviation of  $7.27 \pm 6.54$  years. Average Hoehn and Yahr stage was  $2.36 \pm 0.78$  and average levodopa was  $413.64 \pm 234.62$  mg/day.

In control group, eight (55.55%) male patients and four (44.44%) female patients with age varied from 48 to 80 years with mean value and standard deviation of  $69 \pm 9.43$  years. Duration of disease varied from 1 to 20 years with mean value and standard deviation of  $6.61 \pm 5.83$  years. Average Hoehn and Yahr stage was  $2.17 \pm 0.75$  and average levodopa was  $483.33 \pm 200$  mg/day.

**Table 4.5** Demographic and patients characteristics

Parameters	Thai dance group Mean $\pm$ SD (N=11)	Control group Mean $\pm$ SD (N=9)	<i>p-value</i>
M/F ratio	6/5	5/4	
Age (years)	63.09 $\pm$ 10.44	69 $\pm$ 9.43	0.41
Height (cm)	159.73 $\pm$ 7.47	164.33 $\pm$ 8.26	0.63
Weight (kg)	54.36 $\pm$ 9.53	59.33 $\pm$ 13.5	0.27
Body Mass Index (kg/m <sup>2</sup> )	21.24 $\pm$ 2.84	21.84 $\pm$ 3.77	0.27
Duration of disease (year)	7.27 $\pm$ 6.54	6.61 $\pm$ 5.83	0.63
Hoehn and Yahr stage	2.36 $\pm$ 0.78	2.17 $\pm$ 0.75	0.85
Daily dosage of levodopa	413.64 $\pm$ 234.62	483.33 $\pm$ 200	0.55

There were no significant differences between groups in any of the demographics at baseline.

**Table 4.6** The comparison of mean in the Thai dance group (on time)

Parameters	Baseline	Post-test	2 -month follow-up
UPDRS (II)	10.91 ± 8.89	7.18 ± 8.06*	8.09 ± 7.44
UPDRS (III)	19.18 ± 2.38	13.55 ± 2.13*	14.82 ± 2.37*
TUG (sec)	17.12 ± 10.81	15.19 ± 9.79*	15.47 ± 9.81*
BBS	49 ± 6.54	53.36 ± 4.32*	52.09 ± 5.79*
360 Turning (sec)	8.23 ± 7.85	5.45 ± 5.69*	8.34 ± 16.02
PDQ8	11.36 ± 6.10	5.82 ± 3.57*	7.73 ± 5.92*

\* $p < 0.05$  compared with baseline

Repeated measures ANOVA showed significant difference among all of parameters between post-test and baseline. UPDRS subscale II showed significant improvement ( $p = 0.003$ ) between post-test and baseline. UPDRS subscale III showed significant improvement between post-test ( $p = 0.000$ ) with baseline and 2-month follow-up ( $p = 0.013$ ) with baseline. TUG showed significant improvement between post-test ( $p = 0.001$ ) with baseline and 2-month follow-up ( $p = 0.008$ ) with baseline. BBS also showed significant improvement between post-test ( $p = 0.005$ ) with baseline and 2-month follow-up ( $p = 0.001$ ) with baseline. 360 turning showed significant difference between baseline and post-test ( $p = 0.039$ ). PDQ8 showed significant improvement between post-test ( $p = 0.003$ ) with baseline and 2-month follow-up ( $p = 0.009$ ) with baseline.

**Table 4.7** The comparison of mean of gait parameters in the Thai dance group (on time)

Parameters	Baseline	Post-test	2 -month follow-up
Step length (cm) (Left side)	47.84 ± 9.63	59.60 ± 8.25*	55.48 ± 13.91
Step length (cm) (Right side)	49.01 ± 10.86	60.70 ± 9.18*	54.85 ± 12.75 <sup>T</sup>
Stride length (cm) (Left side)	94.83 ± 24.05	120.66 ± 17.51*	112.01 ± 26.05*
Stride length (cm) (Right side)	95.10 ± 23.99	120.73 ± 17.27*	110.98 ± 25.39
Velocity (cm/sec)	86.87 ± 25.22	119.64 ± 20.33*	107.03 ± 30.41*
Cadence (step/min)	106.46 ± 17.76	119.25 ± 10.00	114.35 ± 14.35

\* $p < 0.05$  compared with baseline

<sup>T</sup> $p < 0.05$  compared with post-test

Repeated measures ANOVA showed significant differences among almost all of parameters between post-test and baseline except cadence. Step length (Lt., Rt.) showed significant difference in post-test ( $p = 0.000$ ,  $p = 0.000$ ) and step length (Rt.) also showed significant difference between post-test and 2-month follow-up ( $p = 0.011$ ). Stride length (Lt., Rt.) showed significant difference in post-test ( $p = 0.000$ ,  $p = 0.000$ ) and stride length (Lt.) also showed significant difference between baseline and 2-month follow-up ( $p = 0.048$ ). Velocity showed significant differences between post-test ( $p = 0.000$ ) with baseline and 2-month follow-up ( $p = 0.009$ ) with baseline. No significant change was found in cadence.

**Table 4.8** The comparison of mean in the Thai dance group (off time)

Parameters	Baseline	Post-test	2 –month follow-up
UPDRS (III)	25.82 ± 2.99	16.55 ± 2.41*	19.55 ± 2.89* <sup>T</sup>
TUG (sec)	16.44 ± 8.82	13.56 ± 8.73	15.95 ± 15.15
BBS	48.64 ± 6.53	53.27 ± 4.29	50.73 ± 6.50
360 Turning (sec)	9.69 ± 7.85	7.40 ± 9.28	7.20 ± 7.99

\* $p < 0.05$  compared with baseline

<sup>T</sup> $p < 0.05$  compared with post-test

Repeated measures ANOVA showed significant changes only UPDRS (III) among post-test ( $p = 0.000$ ) and 2-month follow-up ( $p = 0.004$ ) with baseline and 2-month follow-up ( $p = 0.036$ ) with post-test.

**Table 4.9** The comparison of mean of gait parameters in the Thai dance group (off time)

Parameters	Baseline	Post-test	2 –month follow-up
Step length (cm) (Left side)	45.17 ± 14.26	60.64 ± 11.4	53.01 ± 13.76
Step length (cm) (Right side)	46.02 ± 14.32	59.25 ± 11.43	53.42 ± 14.21
Stride length (cm) (Left side)	91.40 ± 28.52	118.95 ± 21.36	104.81 ± 31.76
Stride length (cm) (Right side)	91.8 ± 28.53	116.86 ± 22.12	106.83 ± 27.96
Velocity (cm/sec)	79.96 ± 30.55	117.74 ± 22.63	102.60 ± 33.81
Cadence (step/min)	103.85 ± 17.63	119.71 ± 10.40	113.38 ± 15.25

Repeated measures ANOVA showed no significant differences among baseline, post-test and 2-month follow-up of all parameters.

**Table 4.10** The comparison of mean in the control group (on time)

Parameters	Baseline	Post-test	2 -month follow-up
UPDRS (II)	$8.67 \pm 5.27$	$8.78 \pm 4.38$	$8.33 \pm 4.97$
UPDRS (III)	$16.44 \pm 5.55$	$18.78 \pm 13.78$	$15.56 \pm 5.92$
TUG (sec)	$12.75 \pm 1.69$	$14.77 \pm 7.67$	$12.10 \pm 1.21$
BBS	$54 \pm 3.77$	$48.89 \pm 5.6$	$49.67 \pm 4.87$
360 Turning (sec)	$4.75 \pm 0.90$	$5.70 \pm 2.07$	$4.79 \pm 0.77$
PDQ8	$10.44 \pm 9.46$	$10.56 \pm 8.93$	$11.33 \pm 8.38$

Repeated measures ANOVA showed no significant differences among baseline, post-test and 2-month follow-up of all parameters.

**Table 4.11** The comparison of mean of gait parameters in the control group (on time)

Parameters	Baseline	Post-test	2 -month follow-up
Step length (cm) (Left side)	55.08 ± 7.04	52.37 ± 7.09	56.45 ± 7.03 <sup>T</sup>
Step length (cm) (Right side)	55.12 ± 6.76	53.57 ± 7.06	56.67 ± 7.95
Stride length (cm) (Left side)	110.50 ± 13.43	106.37 ± 13.73	113.60 ± 14.78
Stride length (cm) (Right side)	110.56 ± 13.72	106.72 ± 13.87	113.51 ± 14.85
Velocity (cm/sec)	103.23 ± 11.92	97.89 ± 12.87	112.02 ± 15.93
Cadence (step/min)	113.26 ± 12.81	111.19 ± 9.29	119.25 ± 12.73

<sup>T</sup> $p < 0.05$  compared with post-test

Repeated measures ANOVA showed significant difference between post-test and 2-month follow-up of step length (Lt.).

**Table 4.12** The comparison of mean in the control group  
(off time)

Parameters	Baseline	Post-test	2 -month follow-up
UPDRS (III)	23.00 ± 10.26	23.78 ± 15.71	23.89 ± 10.33
TUG (sec)	14.49 ± 2.64	13.74 ± 3.10	19.56 ± 18.11
BBS	48.33 ± 5.00	46.78 ± 9.52	47.56 ± 7.06
360 Turning (sec)	6.88 ± 3.20	11.36 ± 16.49	5.64 ± 1.57

Repeated measures ANOVA showed no significant differences among baseline, post-test and 2-month follow-up of all parameters.

**Table 4.13** The comparison of mean of gait parameters in the control group (off time)

Parameters	Baseline	Post-test	2 –month follow-up
Step length (cm) (Left side)	50.92 ± 16.30	48.93 ± 15.11	48.81 ± 13.86
Step length (cm) (Right side)	51.60 ± 17.43	49.80 ± 17.43	49.83 ± 14.46
Stride length (cm) (Left side)	103.02 ± 33.5	99.21 ± 32.47	99.15 ± 28.36
Stride length (cm) (Right side)	103.13 ± 33.87	99.27 ± 32.25	99.22 ± 28.17
Velocity (cm/sec)	94.91 ± 38.26	94.44 ± 36.39	97.51 ± 26.95
Cadence (step/min)	104.07 ± 32.10	112.40 ± 15.87	119.60 ± 13.72

Repeated measures ANOVA showed no significant differences among baseline, post-test and 2-month follow-up of all parameters.

**Table 4.14** The comparison of mean at post-test (on time) between Thai dance group and control group

Parameters	Thai dance	Control group	F value	p value
	group			
	(mean $\pm$ SD)			
UPDRS (II)	7.18 $\pm$ 8.06	8.78 $\pm$ 4.38	4.580	0.047*
UPDRS (III)	13.55 $\pm$ 2.13	18.78 $\pm$ 13.78	5.356	0.033*
TUG (sec)	15.19 $\pm$ 9.79	14.77 $\pm$ 7.67	2.327	0.146
BBS	53.36 $\pm$ 4.32	48.89 $\pm$ 5.6	13.422	0.002*
360 Turning (sec)	5.45 $\pm$ 5.69	5.70 $\pm$ 2.07	7.482	0.014*
PDQ8	5.82 $\pm$ 3.57	10.56 $\pm$ 8.93	16.934	0.001*
Step length (cm) (Left side)	59.60 $\pm$ 8.25	52.37 $\pm$ 7.09	35.979	0.000*
Step length (cm) (Right side)	60.70 $\pm$ 9.18	53.57 $\pm$ 7.06	33.432	0.000*
Stride length (cm) (Left side)	120.66 $\pm$ 17.51	106.37 $\pm$ 13.73	23.412	0.000*
Stride length (cm) (Right side)	120.73 $\pm$ 17.27	106.72 $\pm$ 13.87	22.735	0.000*
Velocity (cm/sec)	119.64 $\pm$ 20.33	97.89 $\pm$ 12.87	47.402	0.000*
Cadence (step/min)	119.25 $\pm$ 10.00	111.19 $\pm$ 9.29	8.408	0.010*

\* $p < 0.05$

Analysis of Covariance (ANCOVA) showed significant differences of all parameters at post-test (on time) between Thai dance group and control group except TUG.

**Table 4.15** The comparison of mean at 2-month follow-up (on time) between Thai dance group and control group

Parameters	Thai dance	Control group	F value	p value
	group (mean $\pm$ SD)			
UPDRS (II)	8.09 $\pm$ 7.44	8.33 $\pm$ 4.97	0.890	0.359
UPDRS (III)	14.82 $\pm$ 2.37	15.56 $\pm$ 5.92	2.648	0.122
TUG (sec)	15.47 $\pm$ 9.81	12.10 $\pm$ 1.21	1.600	0.223
BBS	52.09 $\pm$ 5.79	49.67 $\pm$ 4.87	7.365	0.015*
360 Turning (sec)	8.34 $\pm$ 16.02	4.79 $\pm$ 0.77	1.857	0.191
PDQ8	7.73 $\pm$ 5.92	11.33 $\pm$ 8.38	6.649	0.020*
Step length (cm) (Left side)	55.48 $\pm$ 13.91	56.45 $\pm$ 7.03	3.215	0.091
Step length (cm) (Right side)	54.85 $\pm$ 12.75	56.67 $\pm$ 7.95	1.598	0.223
Stride length (cm) (Left side)	112.01 $\pm$ 26.05	113.60 $\pm$ 14.78	2.122	0.163
Stride length (cm) (Right side)	110.98 $\pm$ 25.39	113.51 $\pm$ 14.85	1.718	0.207
Velocity (cm/sec)	107.03 $\pm$ 30.41	112.02 $\pm$ 15.93	1.812	0.196
Cadence (step/min)	114.35 $\pm$ 14.35	119.25 $\pm$ 12.73	0.015	0.904

\* $p < 0.05$

Analysis of Covariance (ANCOVA) showed significant differences in BBS and PDQ8 at 2-month follow-up (on time) between Thai dance group and control group.

**Table 4.16** The comparison of mean at post-test (off time) between Thai dance group and control group

Parameters	Thai dance	Control group	F value	p value
	group			
	(mean $\pm$ SD)			
UPDRS (III)	16.55 $\pm$ 2.41	23.78 $\pm$ 15.71	6.491	0.021*
TUG (sec)	13.56 $\pm$ 8.73	15.24 $\pm$ 5.35	0.000	0.990
BBS	53.27 $\pm$ 4.29	46.78 $\pm$ 9.52	10.158	0.005*
360 Turning (sec)	7.40 $\pm$ 9.28	11.36 $\pm$ 16.49	2.554	0.128
Step length (cm) (Left side)	60.64 $\pm$ 11.4	48.93 $\pm$ 15.11	14.085	0.002*
Step length (cm) (Right side)	59.25 $\pm$ 11.43	49.80 $\pm$ 17.43	15.715	0.001*
Stride length (cm) (Left side)	118.95 $\pm$ 21.36	99.21 $\pm$ 32.47	18.613	0.000*
Stride length (cm) (Right side)	116.86 $\pm$ 22.12	99.27 $\pm$ 32.25	17.183	0.001*
Velocity (cm/sec)	117.74 $\pm$ 22.63	94.44 $\pm$ 36.39	22.159	0.000*
Cadence (step/min)	119.71 $\pm$ 10.40	112.40 $\pm$ 15.87	3.209	0.091

\* $p < 0.05$

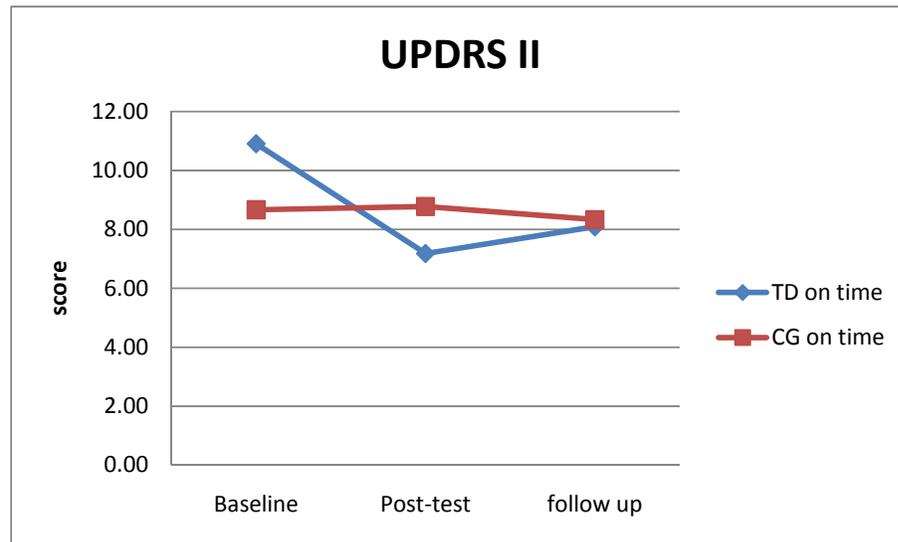
Analysis of Covariance (ANCOVA) showed significant differences in UPDRS subscale III, BBS and all gait parameters except cadence at post-test (off time) between Thai dance group and control group.

**Table 4.17** The comparison of mean at 2-month follow-up (off time) between Thai dance group and control group

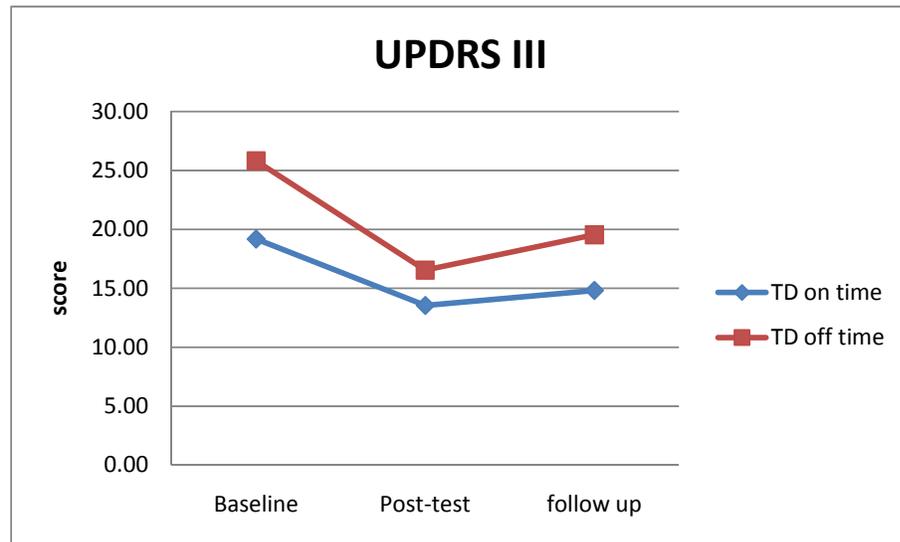
Parameters	Thai dance	Control group	F value	p value
	group			
	(mean $\pm$ SD)			
UPDRS (III)	19.55 $\pm$ 2.89	23.89 $\pm$ 10.33	8.564	0.009*
TUG (sec)	15.95 $\pm$ 15.15	19.58 $\pm$ 16.94	0.156	0.698
BBS	50.73 $\pm$ 6.50	47.56 $\pm$ 7.06	5.313	0.034*
360 Turning (sec)	7.20 $\pm$ 7.99	5.64 $\pm$ 1.57	0.094	0.763
Step length (cm) (Left side)	53.01 $\pm$ 13.76	48.81 $\pm$ 13.86	10.107	0.005*
Step length (cm) (Right side)	53.42 $\pm$ 14.21	49.83 $\pm$ 14.46	8.651	0.009*
Stride length (cm) (Left side)	104.81 $\pm$ 31.76	99.15 $\pm$ 28.36	4.882	0.041*
Stride length (cm) (Right side)	106.83 $\pm$ 27.96	99.22 $\pm$ 28.17	4.319	0.007*
Velocity (cm/sec)	102.60 $\pm$ 33.81	97.51 $\pm$ 26.95	8.342	0.010*
Cadence (step/min)	113.38 $\pm$ 15.25	119.60 $\pm$ 13.72	1.062	0.317

\* $p < 0.05$

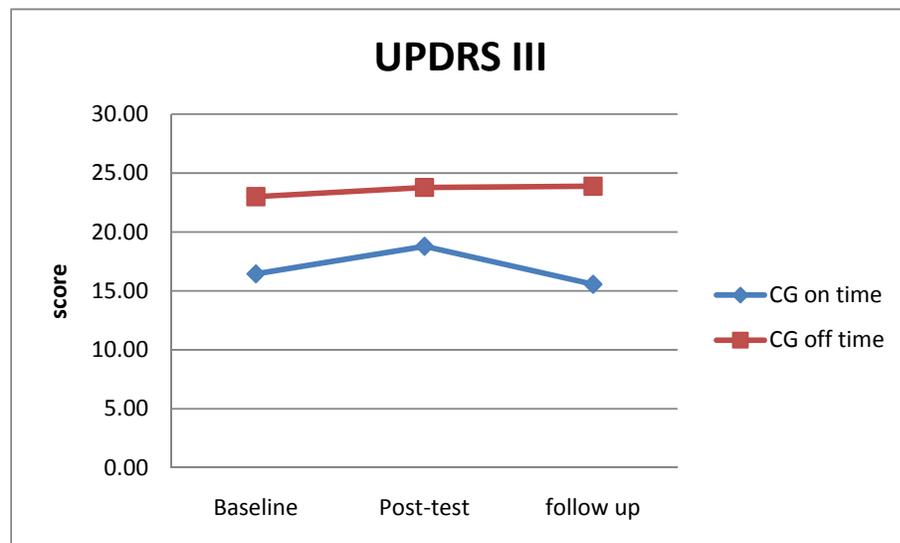
Analysis of Covariance (ANCOVA) showed significant differences in UPDRS subscale III, BBS and all gait parameters except cadence at 2-month follow-up (off time) between Thai dance group and control group.



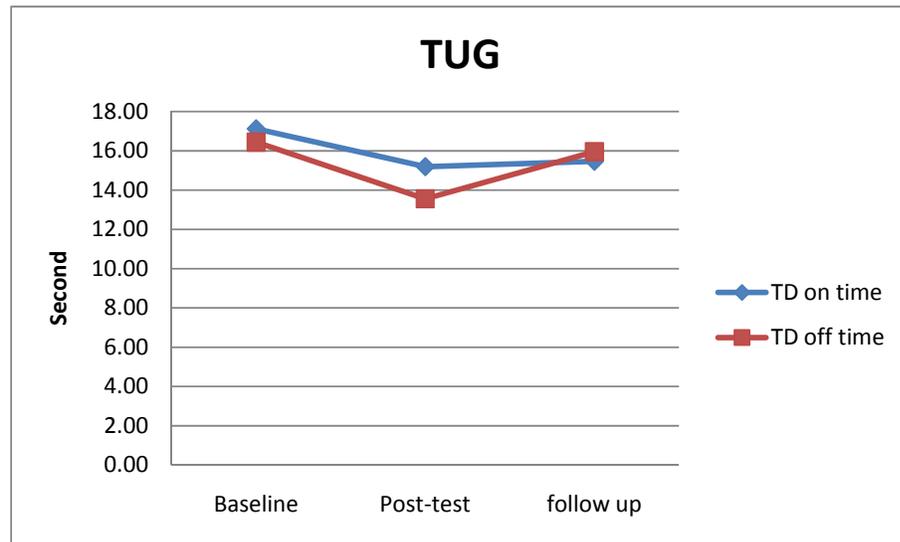
**Fig 4.1** Mean of UPDRS subscale II in both groups



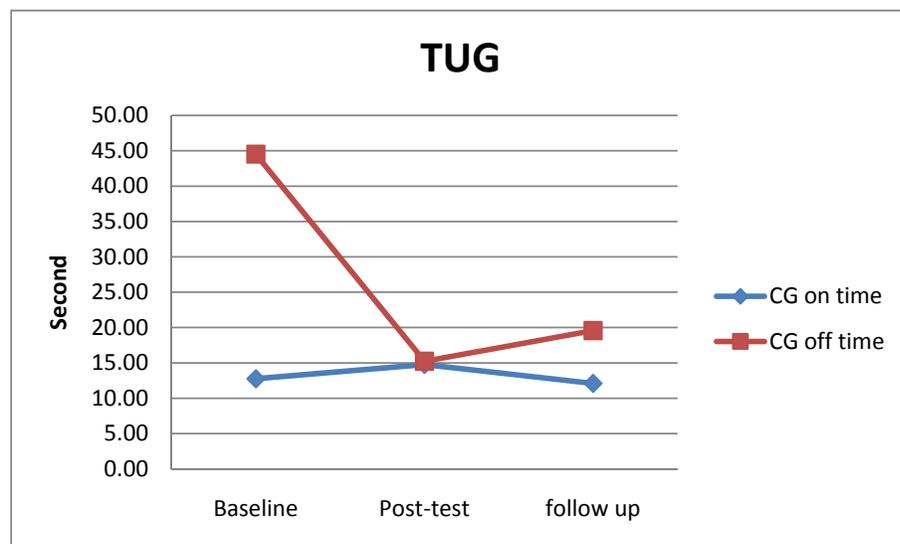
**Fig 4.2** Mean of UPDRS subscale III in Thai dance group



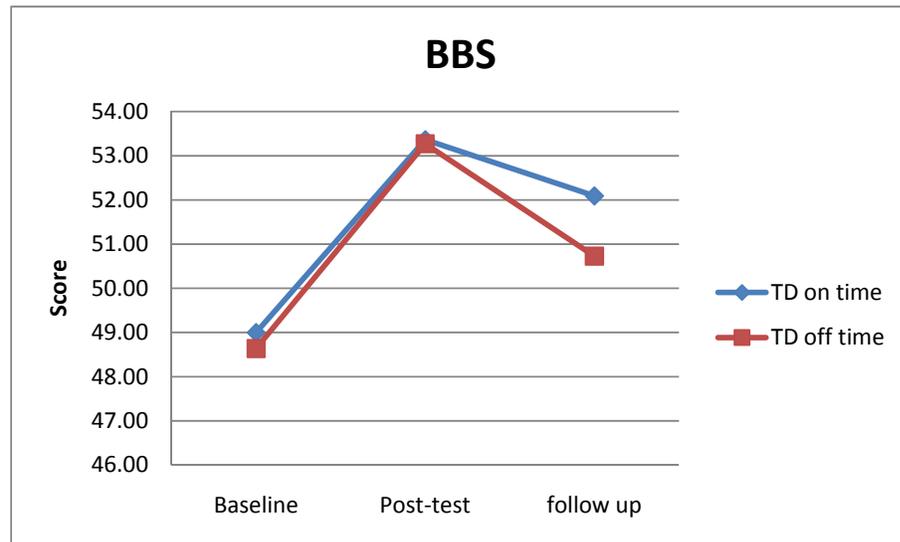
**Fig 4.3** Mean of UPDRS subscale III in control group



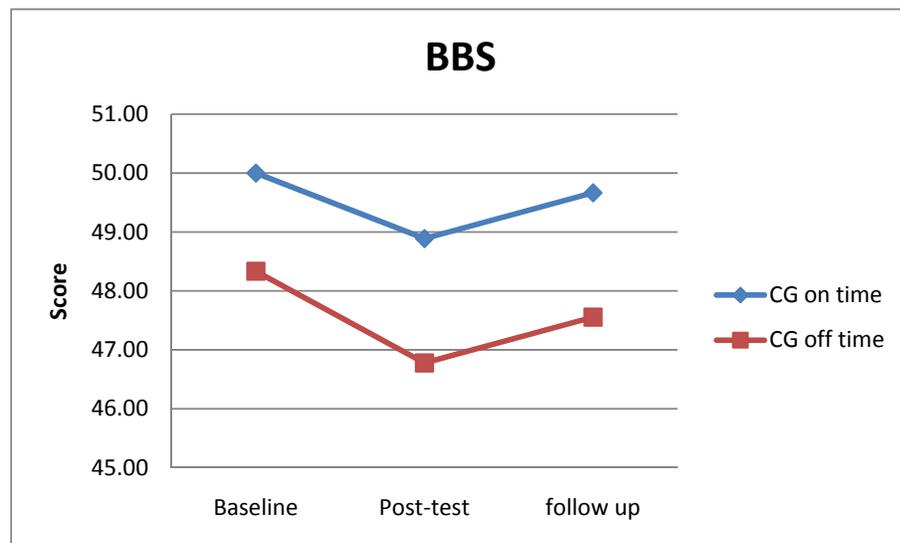
**Fig 4.4** Mean of TUG in Thai dance group



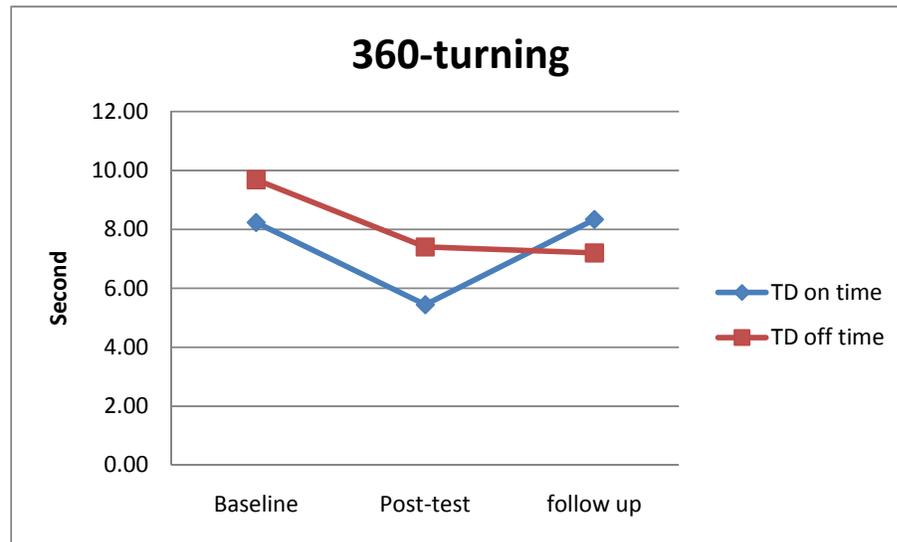
**Fig 4.5** Mean of TUG in control group



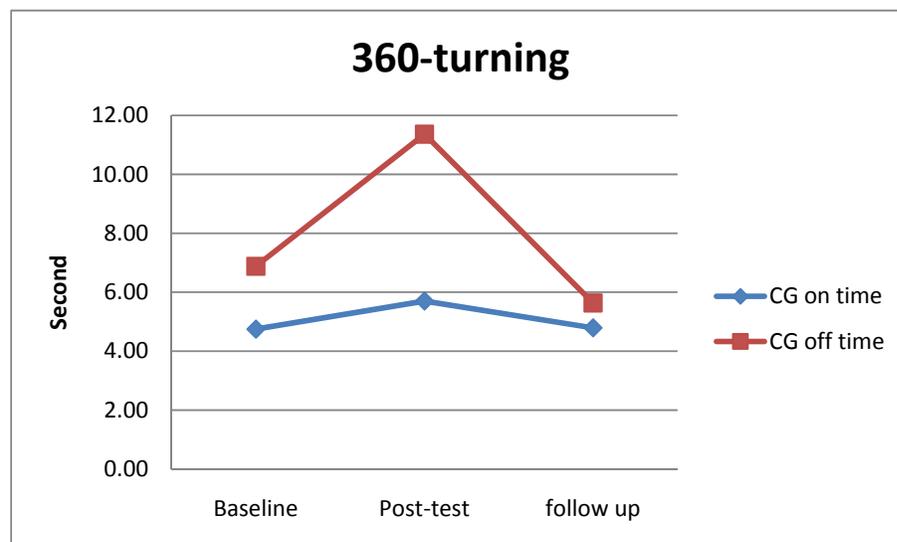
**Fig 4.6** Mean of BBS in Thai dance group



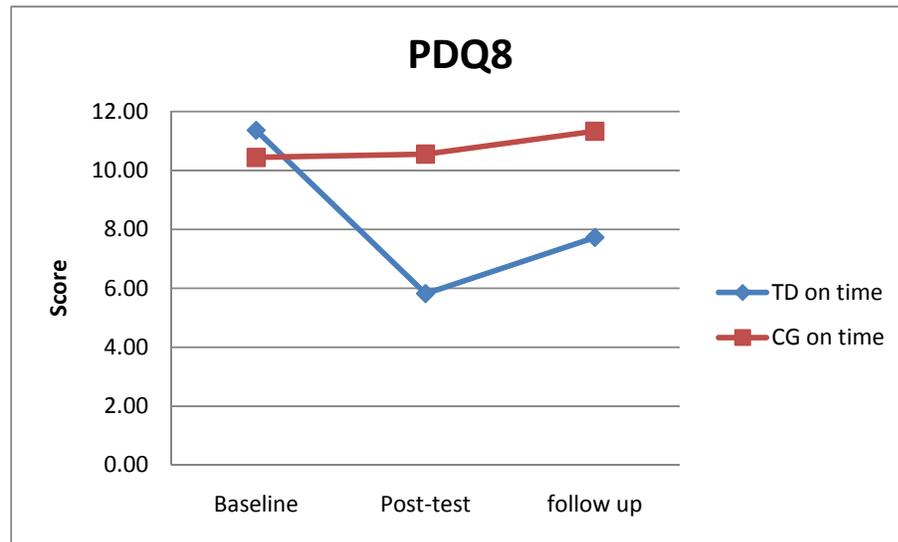
**Fig 4.7** Mean of BBS in control group



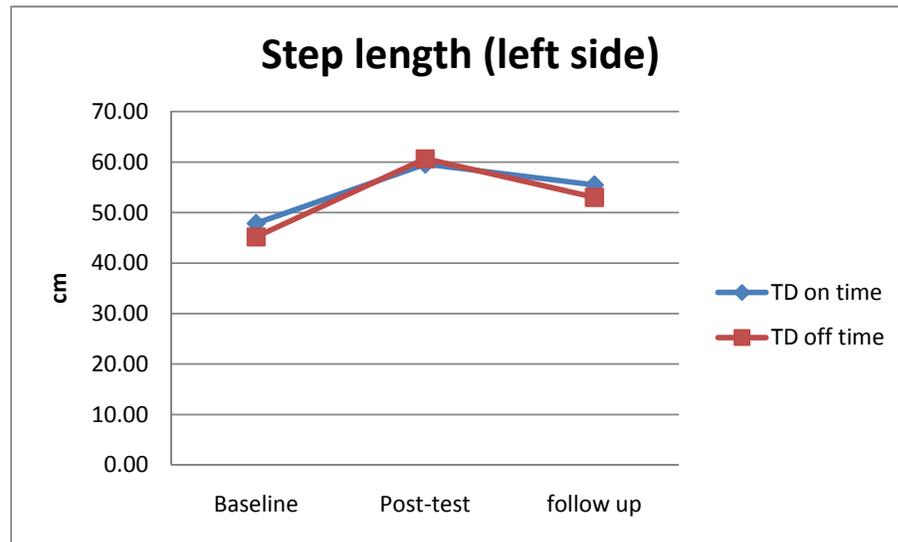
**Fig 4.8** Mean of 360-turning in Thai dance group



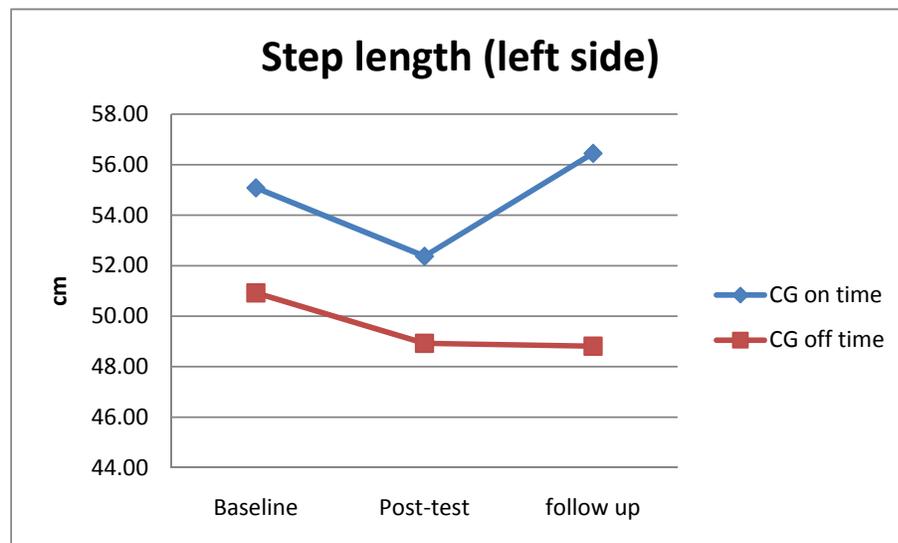
**Fig 4.9** Mean of 360-turning in control group



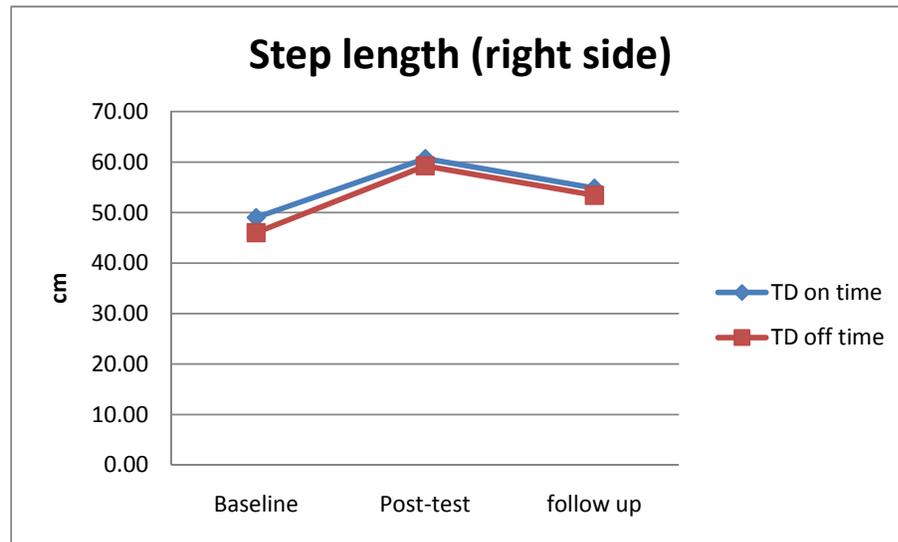
**Fig 4.10** Mean of PDQ8 in both groups



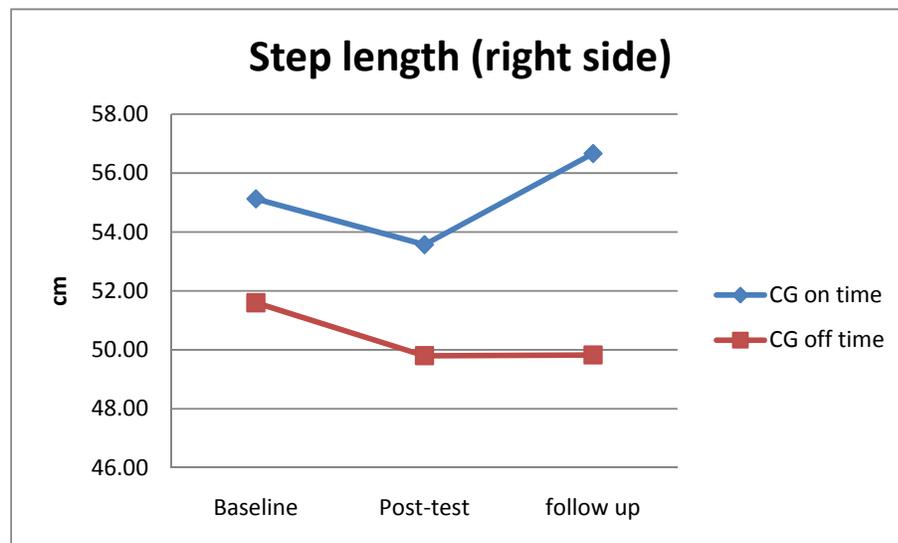
**Fig 4.11** Mean of step length (left side) in Thai dance group



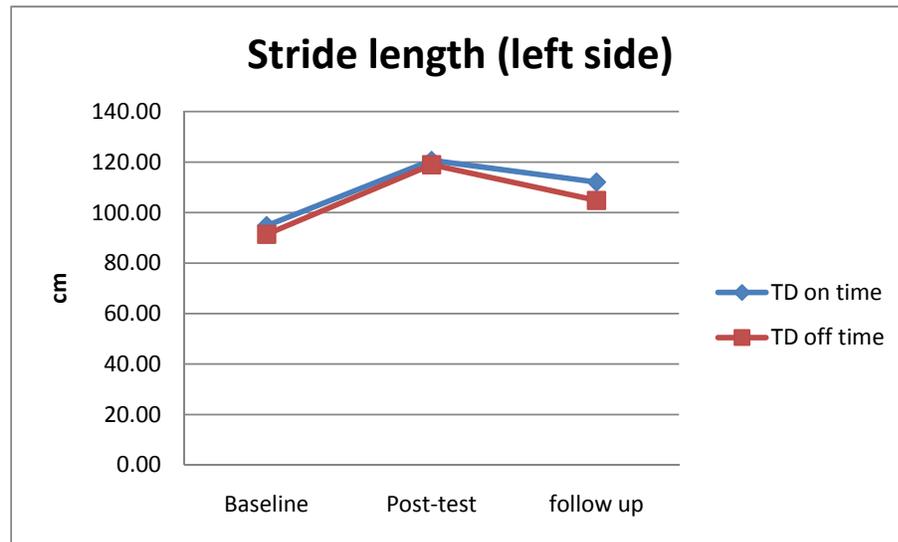
**Fig 4.12** Mean of step length (left side) in control group



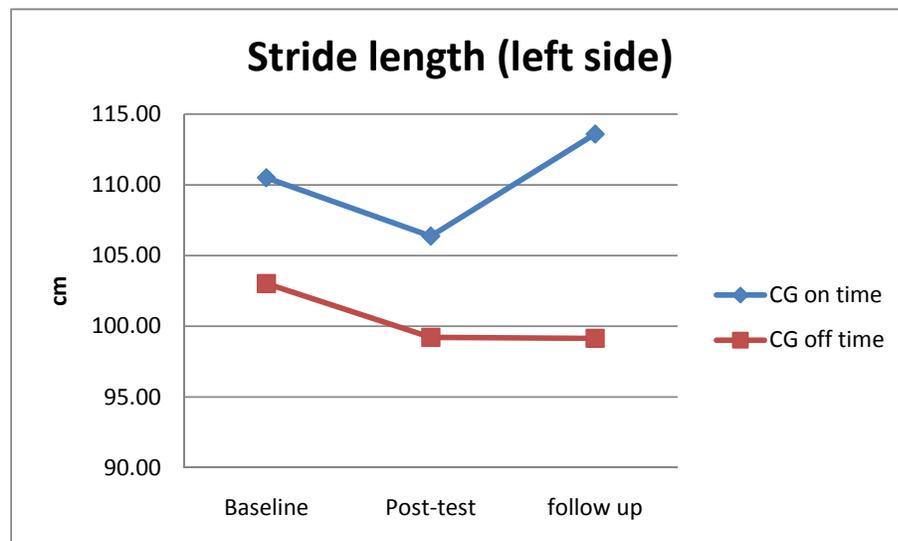
**Fig 4.13** Mean of step length (right side) in Thai dance group



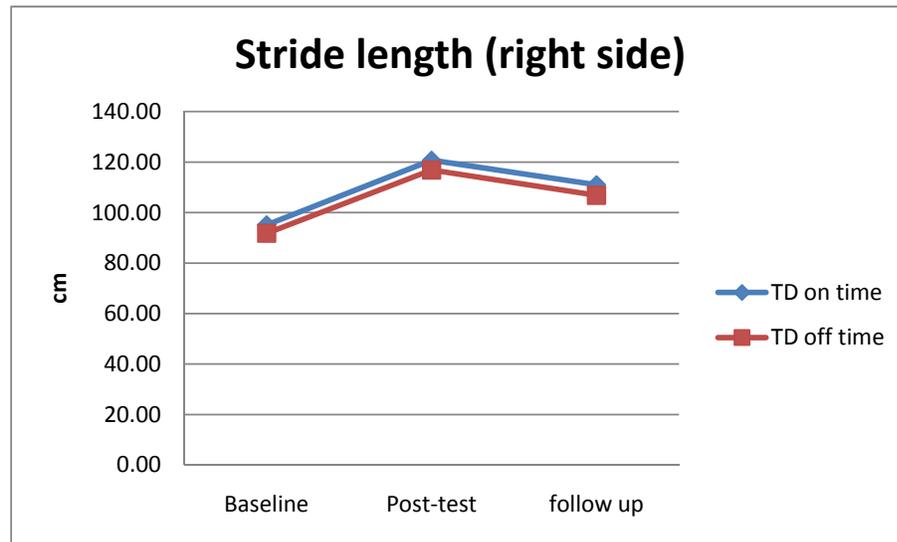
**Fig 4.14** Mean of step length (right side) in control group



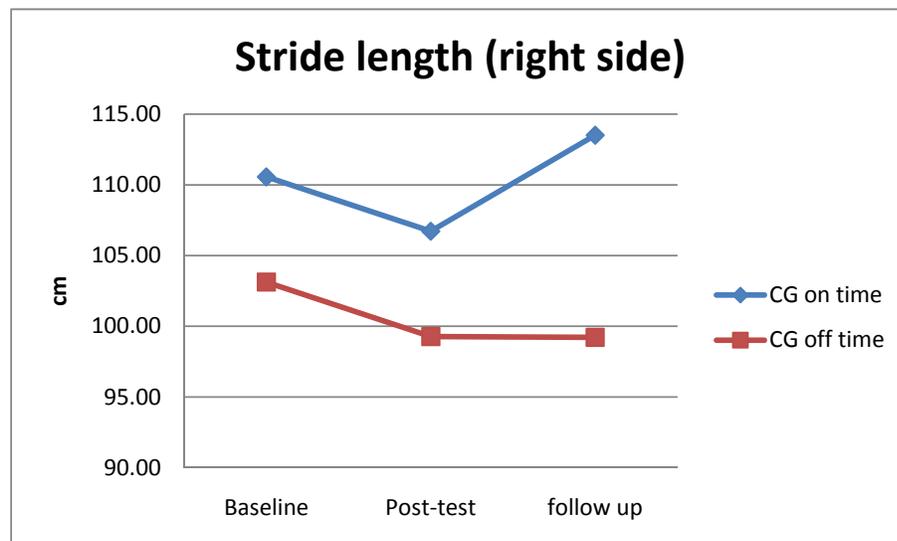
**Fig 4.15** Mean of stride length (left side) in Thai dance group



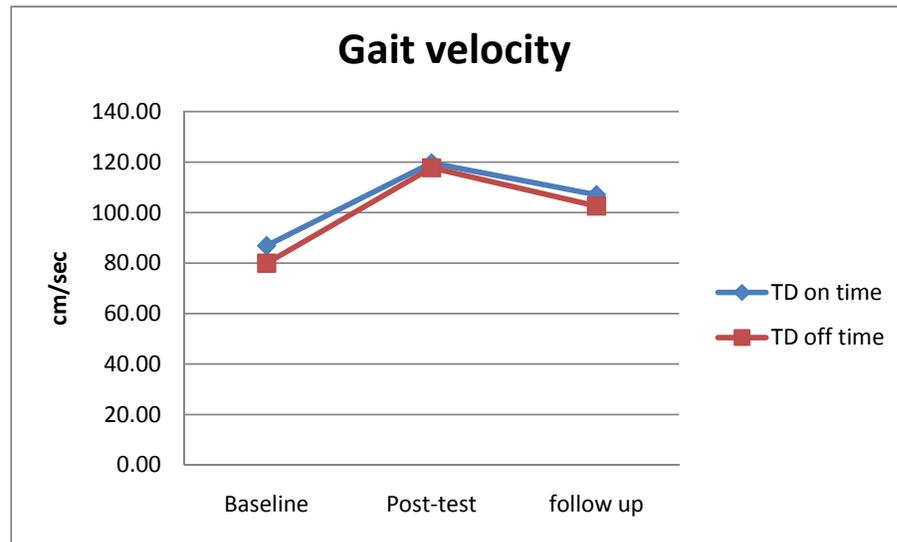
**Fig 4.16** Mean of stride length (left side) in control group



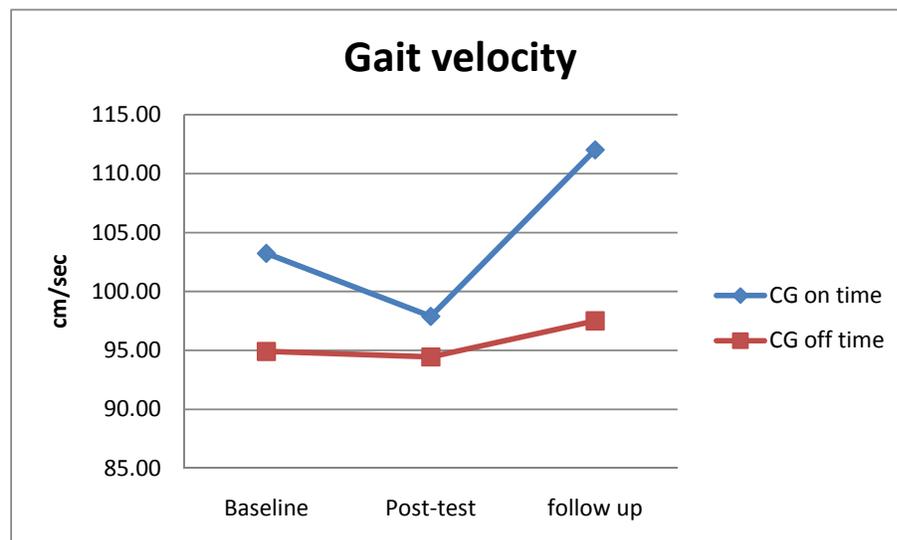
**Fig 4.17** Mean of stride length (right side) in Thai dance group



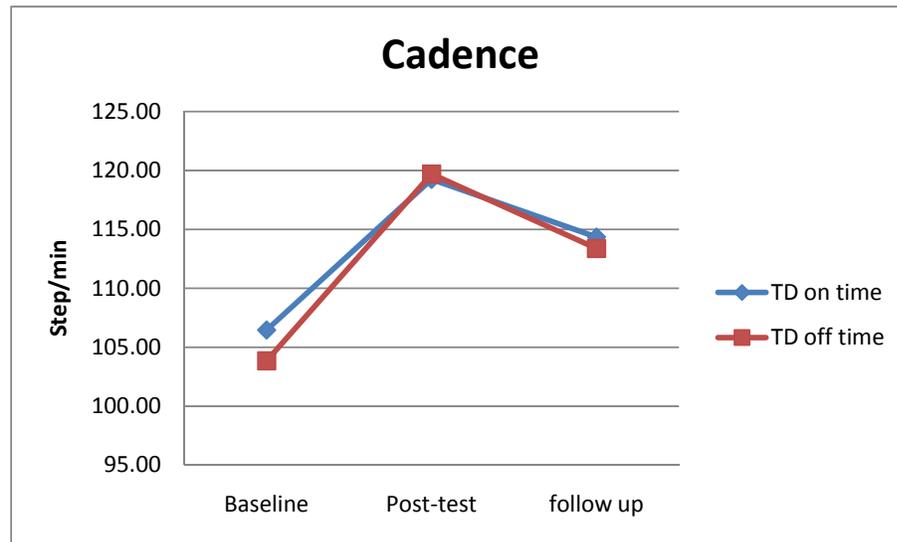
**Fig 4.18** Mean of stride length (right side) in control group



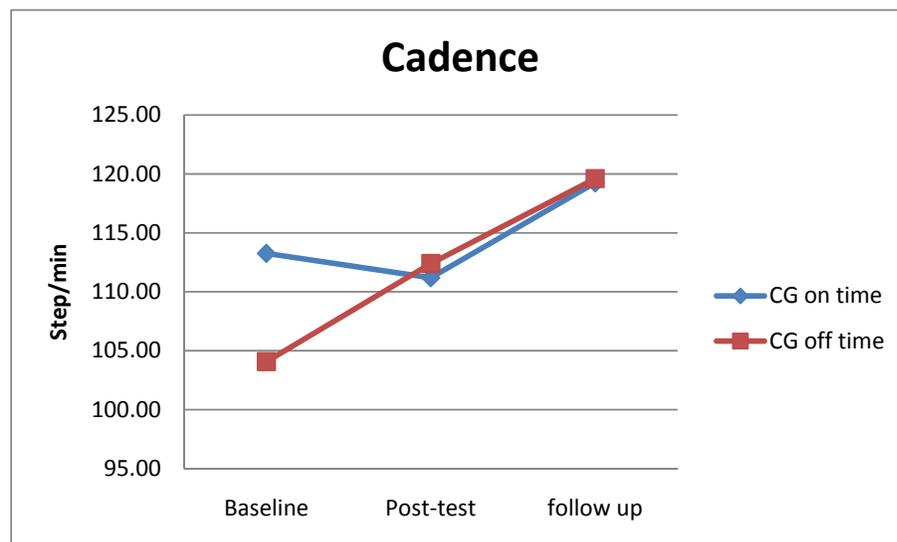
**Fig 4.19** Mean of gait velocity in Thai dance group



**Fig 4.20** Mean of gait velocity in control group



**Fig 4.21** Mean of cadence in Thai dance group



**Fig 4.22** Mean of cadence in control group

## Quality of life of patients in Thai dance group

Besides PDQ8, PD patients also noted their improvement as follow.

### 1. Physical improvement

“...My walk is more energetic, and my steps have more stability. I experience fewer freezing gaits, better stability, and lesser sway. For writing, my hand and fingers work better than before, where I can write longer and better. ...”

Retired doctor age 80

“My daily activities of living have improved after participating in Thai dance class such as being able to take shower, clean my back, move down to cut my feet nail, take less time for dressing and moving to car...”

Retired teacher age 60

“...Thai dance helps me to have better walking and balance. I feel more confident in my walking (because before exercise, my movement was rather slow ...”

Former police officer age 58

“...I used to walk with back bending. Now I feel that I walk with better posture...”

Freelance age 48

### 2. Mental improvement

“...The group makes me feel joyful, less depressed, less mood swing, and less lonely.”

Retired doctor age 80

“...The group is warm and sacrifices to their members. After a while, we are better physically and emotionally. We are happier and more relaxed ...”

Former businessman age 63

“...I used to feel depressed, isolated, and despair. After exercise and meeting and talking with friends who share same experience, I feel better and am encouraged to keep fighting....”

Former police officer age 58

“...My mentality come back to normal...”

Former police and musician age 77

### 3. Social and self-esteem aspect

“...I have better attitude toward Thai dance and I have better relationship with others and opened up my vision in life and social...”

Freelance age 48

“...I have gained happiness in my mind and I can go back to society again ...”

Housewife age 60

“...After participating in this exercise, I can come back to sing a song and play saxophone again...”

Retired police and musician age 77

“...Since lives are so short, there is no reason why we should get depressed and feel suffering all the time. Happiness or suffering is up to your mind. Keep smiling. If we get up and fight with Parkinson disease, Parkinson disease cannot do anything to us. No people in this world are happy all the time. Fate is fair for everybody. Happiness and beauty is everywhere, it is up to us to choose which way to see. ...”

Former businessman age 63

#### 4. Value added of Thai dance

“...I want to say to the world that Thai traditional wisdom and Thai people are capable to create great things that are up to date. We have a lovely researcher who cares for patients and applied Thai traditional wisdom to solve a global problem. We have a great dean with a great vision who supports the program. We have an internationally famous expert in Parkinson’s disease who sees the value of Thai traditional wisdom...”

Housewife age 51

## **CHAPTER V**

### **Discussion and conclusion**

The objectives of the study 1 were to explore the feasibility and acceptability of Thai dance exercise program as well as its impact on the PD patients. A series of 36 sessions were specifically designed and choreographed to address the impairment of the PD patients in their functional mobility and quality of life. The content validity was confirmed by five experts in the following areas: basic movements, rhythm of music, duration, intensity, benefits and safety. The overall results indicated that there were significant improvements in the selected parameters of the Thai dance group after participating in specifically designed Thai dance exercise program and there were significant differences in all parameters between the Thai dance group and the control group after the experiment according to the hypothesis.

The objectives of the study 2 were to assess the impact of Thai dance exercise program on functional mobility between on time and off time and to study the retention of Thai dance exercise program. The overall results were shown in table 5.1.

In addition, feedback from the patients' family indicated that all of them had much improvement in social interaction and it was obvious that there were happier than before.

**Table 5.1** Summary of results in study 2

	Thai dance				Control				Thai dance and control			
	On		Off		On		Off		On		Off	
	P	F	P	F	P	F	P	F	P	F	P	F
UPDRS (II)	*								x			
UPDRS (III)	*	*	*	* T					x		x	x
TUG	*	*										
BBS	*	*							x	x	x	x
360 Turning	*								x			
PDQ8	*	*							x	x		
Step length (Lt.)	*								x		x	x
Step length (Rt.)	*	T							x		x	x
Stride length (Lt.)	*	*							x		x	x
Stride length (Rt.)	*								x		x	x
Velocity	*	*							x		x	x
Cadence												
	Repeated measures ANOVA				Repeated measures ANOVA				ANCOVA			

P = Post-test, F = 2-month follow-up, \* = significant difference within group comparing with baseline

T = significant difference within group comparing with post-test

X = significant difference between group

The overall results indicated that there were significant improvements in the selected parameters of the Thai dance group (on time) after participating in specifically designed Thai dance exercise program and there were also significant differences in UPDRS subscale III, TUG, BBS, PDQ8, stride length (Lt.) and gait velocity at 2 months follow-up while step length (Rt.) was decreased significantly from post-test value. In Thai dance group (off time) was found that there was only significant difference among baseline, post-test and 2-month follow-up in UPDRS III. No significant differences were found in the other parameters.

The overall results in Control group (on and off time) indicated that there were no significant differences in any parameters.

The results of the comparison between groups indicated that there were significant differences in almost all parameters except TUG and cadence at post-test (on time). There were also significant differences in BBS and PDQ 8 at 2 months follow-up. At post-test and 2 months follow-up (off time) was found that there were significant differences in TUG, BBS and all gait parameters except cadence.

### **Thai dance as an alternative form of exercise**

Thai dance could be an another alternative form of exercise for the PD patients with many reasons. Firstly, Thai dance incorporates a variety of movement which the PD patients are require to engage in multitasking activities. It has been known that the PD patients have difficulties in walking while performing a secondary task however practicing in a multitasking activities can improve performance (92).

While practicing Thai dance, the PD patients must participate in a variety of movements such as in the initiative position movement, stretching, strengthening, flexible and rotational motion of trunk and neck, reciprocal and coordinated

movements of arms and legs, erect postural alignment, moving forward and backward, side walking and turning ,for instances. In addition, Thai dance performance is cognitive movements strategies which requires conscious control in all movement sequences. Therefore, Thai dance should be recommended for the patients with PD according to four specific treatment recommendations: cueing strategies to improve gait, cognitive movement strategies to improve transfers, exercises to improve balance, training of joint mobility and muscle power to improve physical capacity (117). Secondly, the usability of auditory cues to facilitate movement is known to be beneficial for the patients with PD. Consequently, Thai traditional music is a good rhythmic auditory cue to facilitate movement and stimulate movement at a variety of speeds. Several studies noted that rhythmic auditory cues enhance walking performance in the patients with PD (96, 118-120) because auditory cues may be able to bypass the defective loop from basal ganglia to the supplementary motor area via the thalamus (24, 97, 121-122) . Moreover, music therapy has been shown to improve motor function, activities of daily living (ADL), mood, and quality of life in PD patients (114). Finally, Thai dance is a social dance that can enhance psychosocial well-being, reduce depression and express emotions through social contact (84, 85, 123) such as participants have the chance to meet individuals confronted with the same health problems, to feel accepted, and understood each other.

### **Possible relations for improvement with Thai dance**

#### *The Unified Parkinson's disease Rating Scale (UPDRS)*

The UPDRS score provides a detailed and accurate assessment of PD disabilities (124). There were significant improvements in both UPDRS subscales (II&III) after participating in 36 sessions of Thai dance exercises. Changes of

three points in UPDRS subscale II and six points in UPDRS subscale III showed the effect of Thai dance that may be related to improve movement in the participants. It could be concluded that they were affected by characteristic movements and gestures in Thai classical dance such as “*chip, lor kweaw*” and “*tang wong*” in relation to finger taps; hand movements, “*chang prasan nga*” and reciprocal movements in “*ram gong yao*” in relation to rapid alternating movement; and tramping with rhythm in Thai traditional music in relation to leg agility. In addition, rigidity could be decreased by stretching moving arm and rotating neck and trunk including performing of basic movements of upper extremities resulting in improving their score in UPDRS subscale III. Heiberger, (90) reported a significant beneficial short-term effect (after 1 hour of dance class) for the total score of the UPDRS subscale III. Most significant was the decrease in the rigidity scores, specifically for arms and legs on the right and left body sides, as well as for finger taps, hand movements and facial expression.

#### *The Timed Up and Go Test (TUG)*

TUG is useful for measurement of mobility in people with mild to moderate PD (125) that incorporate standing up, walking, turning, and sitting down. Bradykinesia or freezing of gait in PD patients may take prolonged time in this measurement. However, bradykinesia may be influenced by training (126). Therefore, after participating in the Thai dance exercise program the participants showed significant improvements of time by 2 seconds of TUG. Hackney et al. (87) reported significant improvements in TUG of about 1 second in PD patients who participated in Tai Chi exercise in 20-1hour long training sessions within 10-13 weeks. Similarly a study by Li, et al. (91) showed a decrease 1 minute of TUG in PD patients who participated Tai Chi exercise in 60-minute exercise sessions twice weekly for 24 weeks. In 2007, a

preliminary study of the effects of Tango showed a trend toward improvements on TUG in PD patients who completed 21 hour progressive Tango sessions within 13 weeks (127). Short duration, intensive Tango did not show significant improvements in the TUG in PD patients attending short duration of an intensive Argentina tango dance course, dancing 1.5 hour per day a week for 2 weeks (88) as well as no significant changes in 11 PD patients who participated regularly for 8 months (25 dance class lessons), once a week. However the TUG showed a trend toward improvement in 9 out of the 11 patients (90).

### *Berg Balance Score (BBS)*

Balance is crucial in activities of daily living (ADL) performance. Mean scores for BBS in pre-intervention was 49 points while post-intervention was 53.36 points. Average Change of 4 point in BBS demonstrated the effect of Thai dance exercise program on the improvement of balance in PD patients. Score changed could be due to slow shift weight in forward, backward, side to side continue to one leg standing with slightly knee flexion while another leg lifting bent with the knee opening outward to make an angle with the leg. In addition, forward-backward and side walking while upper extremities move in Thai dance style may improve balance score as well. Similarly, Hirsh et al. (128) and Toole et al. (129) reported that balance training (where patients were taught to use visual and vestibular feedback) combined with lower limb strength training was effective in improving balance in patients with PD, and more effective than balance exercises alone. Significant improvement balance score was also noted in PD patients who practiced Tai Chi and Tango (87-88, 127).

### *360-Turning*

Making turns while ambulating can be one of the more destabilizing aspects of walking for PD patients (130). Turning around while walking or standing is one of the most common aggravating factors of freezing, which itself can be destabilizing (131). Instability is further compounded with hip abductor strength deficiencies, which are unrelated to PD and are associated with aging and deconditioning (132). Average change of 3 second in 360-turning demonstrated components of exercise in Thai dance can improve strength and stability of lower limbs in PD patients and may be a good beginning for further study of the effect of dance on turning in PD patients because no study have done about turning in PD who participate in any dance.

### *Gait*

Gait disturbance were commonly observed in PD such as reduced stride length velocity, increased stance phase (133-134). However, several studies indicated that those problems were able to be improved if appropriate influences like cues, were used (24, 96, 135-136). The auditory cues were commonly rhythmic cues generated by a metronome or music (24). Traditional Thai music reflects the way of life of a people with unique culture and represents the fundamental characteristics of being Thai. Moreover, unique instruments such as *Pi-ie* (flute), *Tapone* (two-sides horizontal drum) and *ching* (castanets) can be used to be the rhythmic auditory cues.

There was a significant improvement in gait speed (37.72%) and average increase of 24.58 % of step length (left) and 23.85 % of step length (right) as well as average increase of 27.24 % of stride length (left) and 26.95 % of stride length (right). There was no significant change in cadence but showed

a trend toward increase. These increase may reflect improvement of balance (137-138), in congruence with a study of relationships between gait and dynamic balance in people with early PD which demonstrated that walking speed and stride length was significant correlated with balance (138). Thai dance could improve speed and stride length by a variety of movements such as forward backward and side step walking, turning movement and unique characteristic of Thai dance which always lift leg while walking as well as rhythm in the Thai traditional music that gradually speed up by the end of music.

### *Quality of life*

Thai Dance was specifically designed as an exercise program for elderly people may have a positive influence on quality of life (79, 84-85). Several studies reported the benefits of dance to improve functional mobility as well as to improve quality of life (90, 92). This study found that the participants significantly improved on PDQ8 and the first observation from patients was their increased level of enjoyment of the sessions. A wife of one patient who had suffered from PD for 22 years, said that her husband had not interacted with other people and always isolated himself in the bedroom. However, after having participated in Thai dance classes, there were positive changes in emotional and behavioral functions. Similarly, one study (139) demonstrated that Dance/Movement Therapy allowed patients to relate more to their environments, to communicate better and to reduce feeling of isolation. One patient who was about to lose his ability to play the saxophone could play it again after participating in the program for 6 weeks. One lady in the Thai dance group explained to all patients whom she met that “Thai dance exercised every body part and her husband stopped complaining about his robot wife”.

### *Off time period in Thai dance group*

Studies have not been done on dance exercise in off time period. The result of this study found that there was only significant difference among baseline, post-test and 2-month follow-up in UPDRS III. No significant differences were found in the other parameters. However, the value of other parameters tended to improve after 12 weeks and slightly declined at 2 months follow-up.

### *The Control group*

In control group (on time), there was only significant difference between 2-month follow-up and post-test in step length (Lt.). No significant difference were noted in others parameters among baseline, post-test and 2-month follow-up in control group. However, all of mean score of function mobility parameters slightly declined from baseline except quality of life. While all of mean score of function mobility parameters also slightly increased from post-test except quality of life at two months follow-up.

In control group (off time), no significant differences were noted in all parameters among baseline, post-test and 2-month follow-up in control group. However, at post-test, there were a trend decrease in BBS, 360 turning and all gait parameters while TUG strongly improved from baseline. At 2 months follow-up, there were likely to improve in BBS and 360 turning and decrease in TUG but there were no observation in gait parameters.

### **Maintenance of retention**

In Thai dance group (on time), at 2 months follow-up, the PD patients lost their regained parameters from practicing Thai dance, however, the results remained better than baseline value.

It was found that there were significant difference in TUG, BBS, PDQ8, stride length (Lt.) and gait velocity. It was also found that step length (Rt.) was decreased significantly from post-test value.

In Thai dance group (off time) at 2 months follow-up, the PD patients lost their regained parameters from practicing Thai dance, however, the results remained better than the baseline value without any significant differences except UPDRS subscale III which was significantly increased from baseline and decreased from post-test value. There was only one study has on dance exercise in follow-up phase in the PD patients. The result showed that 3-month post-intervention follow-up indicated the outcomes (maximum excursion, directional control, stride length and gait velocity) were maintained in the Tai Chi group (91).

### **Limitation of study**

This study has some limitations. Firstly, there was no randomization of patients so it was open to bias because the patients in Thai dance group might have good attitude in exercise more than control group. Secondly, the researcher could not control activity of both groups so it was open to bias. Thirdly, the scale might not be sensitive enough to quantify the different areas of improvement by Thai Dance, not all patients have prior experience so some participants might find Thai Dance more difficult than others. Finally, this study needs to conduct a larger-longer prospective randomized trial.

### **Suggestions in this study**

1. The results in study 2 showed significant differences in on time more than off time so it may be concluded that Thai dance exercise program is supplemental effect and PD patients need to take medication with exercise throughout their lives.

2. This study showed adherence to treatment of PD patients (e.g. patient rarely skip class), it may be concluded that Thai dance exercise program have positive effect to attract patients.

3. To maintain the retention, PD patients should be set up in group in order to continue exercising.

4. The concerned health organization should apply this kind of new treatment to PD patients.

### **Future directions**

Future work should include larger samples and compare benefits of dance with other treatments. Study should examine the short term effect of Thai dance after 1 hour a dance class and should examine optimal dosing of Thai dance intervention with respect to frequency, duration and intensity.

### **Conclusion**

The Thai dance exercise program designed to be a therapeutic exercise technique for people with Parkinson's disease. The results demonstrated the feasibility and acceptability of this program to patients with PD. Moreover, it is a good alternative form of exercise and can lead to improvements in motor function and quality of life in people with PD. Furthermore, dance-based exercise approaches can make exercise more enjoyable and can be performed alone or in a group without any equipment.

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## **APPENDICES**

## Appendix A: Thai dance exercise program

### Session 1: Warm up training

#### Objectives

1. Relaxation
2. Breathing exercise
3. Stretching exercise
4. Upper limbs movement

#### Exercise description

1. Sit on a chair, instructor brief the Thai dance exercise program.
2. Breathing exercise is taught as follow: please relax on the chair with closed eyes and deep breath. Then, open eyes and draw both hands up with breath in and draw down with breath out.
3. PD patients perform breathing exercise with music “*dung dok mai ban*” while instructor is performing in the front of the patients.
4. Instructor briefs the warm-up activities while PD patients sitting and trying to perform:
  - 4.1 Both hands perform “*chip*” at pelvic level and slowly move up in 8 levels. Then, move down the same way and repeat it for 4 times
  - 4.2 Both hands perform “*wong*” at pelvic level and slowly move up in 8 levels. Then, move down the same way and repeat it for 4 times
  - 4.3 “*Ram sai*” is performed until the music stop
  - 4.4 PD patients stand up and tramp with music “*soeng tung wai*”
5. Perform 4.1-4.3 with music

6. Stretching exercise are performed as follow:
- 6.1 Shoulder flexion at 90 degrees and extend arm wrist & fingers with another hand, repeat on other side.
  - 6.2 Shoulder flexion at 90 degrees with internal rotation and extend wrist joints (*chang pra san nga*).
  - 6.3 From 6.2 move up above head (*tung wong soong*).
  - 6.4 From 6.3 lateral slide down and hold at shoulder abduction at 90 degrees (*pit sa mai reang morn*).
  - 6.5 From 6.4 hold and lateral flexion of neck on left side and repeat on right side.
  - 6.6 From 6.5 left hand on hip while right hand hold with neck rotate on right side, then change in other side.
  - 6.7 Both arms above head with slight shoulder external rotation, elbows flexion and wrists extension (*prom si na*).
  - 6.8 From 6.7 draw in back, shoulders external rotation with elbows extension and wrists extension (*nok yoong fon hang*).
  - 6.9 Stand with feet shoulder width apart with toes point out, hip slight external rotation and knee slight flexion, both hands on hips (*marn klub lung*).
  - 6.10 From 6.9 neck extension and neck flexion.
  - 6.11 Place right foot in front with knee slightly flex while left leg straight in back, then back rotate in left side with both hands perform “*chip*”, repeat on other side
- (Each stretching exercise hold 10 seconds)

## 7. Cool down

- 7.1 Sit on chair, gentle massage on face, hands, arms and legs.
- 7.2 Eye close and focus on breathing.

## Session 2: Basic movement of upper extremities: *sod soi mala*

### Objectives

1. Upper limbs movement
2. Increase range of motions

### Exercise description

1. Warm up
2. Instructor performs “*sod soi mala*”.
3. PD patients sit on chair and perform “*sod soi mala*” at least 20 times.
4. Stand in circle, perform “*sod soi mala*” and walk with music.
5. Cool down

### Session 3: Basic movement of upper extremities:

#### *“chang pra san nga”*

#### Objectives

1. Upper limbs movement
2. Increase range of motions

#### Exercise description

1. Warm up
2. Instructor slowly performs *“chang pra san nga”*.
3. PD patients sit on chair and perform *“chang pra san nga”* at least 20 times.
4. Stand in circle, perform *“chang pra san nga”* and walk with music.
5. Cool down

## Session 4: Basic movement of upper extremities: “*ram sai*”

### Objectives

1. Upper limbs movement
2. Increase range of motions
3. Arms swing
4. Reduce axial rigidity

### Exercise description

1. Warm up
2. Instructor slowly performs “*ram sai*”.
3. PD patients sit on chair and perform “*ram sai*” at least 20 times.
4. Stand in circle, perform “*ram sai*” and walk with music.
5. Cool down

Session 5: Basic movement of upper extremities: “*prom si na nok yoong fon hang*”

Objectives

1. Upper limbs movement
2. Increase range of motions
3. Stretching exercise
4. Posture alignment exercise

Exercise description

1. Warm up
2. Instructor slowly performs “*prom si na nok yoong fon hang*”.
3. PD patients sit on chair and perform “*prom si na nok yoong fon hang*” at least 20 times.
4. Stand in circle, perform “*prom si na nok yoong fon hang*” and walk with music.
5. Cool down

## Session 6: Basic movement of upper extremities: “*lor kweaw*”

### Objectives

1. Upper limbs movement
2. Increase range of motions
3. Hands exercise

### Exercise description

1. Warm up
2. Instructor slowly performs “*lor kweaw*”.
3. PD patients sit on chair and perform “*lor kweaw*” at least 20 times.
4. Stand in circle, perform “*lor kweaw*” and walk with music.
5. Cool down

## Session 7-9: Basic movement of lower extremities

### Objectives

1. Lower limbs movement
2. Weight shifting
3. Leg lifting
4. Increasing range of motions of lower limbs

### Exercise description

1. Warm up
2. Stand with feet shoulder width apart and both hands on hips;
3. Weight shifting skill is trained in these directions: side to side, forward and backward, each direction performs 8 repetitions.
4. Lower body is slowly performed in semi squat position keeping back straight. Knees should be in line with middle toes and should not move forward past toes, perform 8 repetitions.
5. Stand facing box with feet shoulder width apart and both hands on hips. Then bring left foot up onto the step and step back down on the floor for 8 repetitions and repeat on other side.

(3-5 is performed with “*thed teng klong yao*” rhythm)

Break 5 minutes

6. Stand with feet shoulder width apart and sideways to a chair, right hand hold on the chair.
7. Lift left knee up (flex hip and knee 90 degrees) with toes up and land on the floor, perform 8 repetitions and repeat on right leg.

8. Lift left knee up (hip and knee flex 90 degrees and hip external rotate 45 degrees) with toes up and land on the floor, perform 8 repetitions and repeat on right leg.
9. Stand in front of a chair and hold both hands on it.
10. Bend right knee (knee flex 90 degrees), perform 8 repetitions and next to left knee.
11. Cool down  
(6-10 is performed with “*thed teng klong yao*” rhythm)

## Session 10-12: Basic movement of lower extremities

### Objectives

1. Lower limbs movement
2. Weight shifting
3. Balance training
4. Increasing range of motions of lower limbs

### Exercise description

1. Warm up
2. Stand with right foot in front and both hands on hips.
3. Forward and backward weight shifting were performed 8 repetitions and then lift right knee up (flex hip and knee 90 degrees) with toes up while body weight shift backward on left foot, perform 8 repetitions. Bend left knee back (knee flex 90 degrees) while body weight shift forward on right foot, perform 8 repetitions.
4. Stand with feet shoulder width apart.
5. Side to side weight shifting is performed 8 repetitions and then lift left knee up (hip and knee flex 90 degrees and hip external rotate 45 degrees) with toes up while body weight shift to right side, perform 8 repetitions. Lift right knee up while body weight shift on left side, perform 8 repetitions.

Break 5 minutes

6. Repeat 2-3 sets, perform with “*thed teng klong yao*” rhythm
7. Cool down

## Session 13-15: Basic movement of lower extremities

### Objectives

1. Lower limbs movement
2. Weight shifting
3. Balance training
4. Step training

### Exercise description

1. Warm up
2. Stand with right foot in front and both hands on hips.
3. Forward and backward weight shifting are performed 8 repetitions and then lift right knee up (flex hip and knee 90 degrees) with toes up while body weight shift backward on left foot, perform 8 repetitions. Bend left knee (knee flex 90 degrees) while body weight shift forward on right foot, perform 8 repetitions.
4. Lift right knee up (flex hip and knee 90 degrees) with toes up while body weight shift backward on left foot and bend left knee back (knee flex 90 degrees) perform 8 repetitions.
5. Stand with feet shoulder width apart.
6. Side to side weight shifting were performed 8 repetitions and then lift left knee up (hip and knee flex 90 degrees and hip external rotate 45 degrees ) with toes up while body weight shift to right side, perform 8 repetitions. Lift right knee up while body weight shift on left side, perform 8 repetitions.
7. Lift left knee up (hip and knee flex 90 degrees and hip external rotate 45 degrees) with toes up while body weight

shift to right side and lift right knee up while body weight shift on left side, perform 8 repetitions.

(2-7 is performed with “*thed teng klong yao*” rhythm)

Break 5 minutes

8. 4 steps forward and backward walking are performed: step forward with right foot and then bring left foot to right foot and bring right foot forward left foot again and then slightly bend left knee before touch the floor with left forefoot.
9. Step backward with left foot and bring right foot backward left foot and bring left foot backward right foot again and then slightly lift right knee up and touch the floor with right forefoot.
10. Repeat until the patients can perform.
11. 4 steps lateral walking are performed: begin walk right side with right foot and then left foot together, right foot again and left foot together. Repeat until the patients can perform.
12. Cool down

## Session 16-18: Basic movement of lower extremities

### Objectives

1. Lower limbs movement
2. Weight shifting
3. Balance training
4. Gait training
5. Increasing range of motion of lower limbs

### Exercise description

1. Warm up
2. Forward and backward weight shifting are performed 8 repetitions and then lift right knee up (flex hip and knee 90 degrees) with toes up while body weight shift backward on left foot, perform 8 repetitions. Forward and backward weight shifting were performed 8 repetitions again and then bend left knee (knee flex 90 degrees) while body weight shift forward on right foot, perform 8 repetitions.
3. Forward and backward weight shifting are performed 8 repetitions and then lift right knee up (flex hip and knee 90 degrees) with toes up while body weight shift backward on left foot and bend left knee back (knee flex 90 degrees) perform 8 repetitions.
4. Begin 4 steps forward walking with right foot, which lift up last repetition, and bend left knee back in fourth step. 4 steps backward walking are performed and then lift right knee up in fourth step. Perform 8 repetitions and repeat on other side.
5. Stand with feet shoulder width apart.
6. Side to side weight shifting are performed 8 repetitions and then lift left knee up (hip and knee flex 90 degrees and

hip external rotate 45 degrees ) with toes up while body weight shift to right side, perform 8 repetitions. Lift right knee up while body weight shift on left side, perform 8 repetitions.

7. Lift left knee up (hip and knee flex 90 degrees and hip external rotate 45 degrees) with toes up while body weight shift to right side and lift right knee up while body weight shift on left side, perform 8 repetitions.
8. Begin 4 steps lateral walking with right foot, which lift up last repetition, 4 steps lateral walking were performed and lift left knee up (hip and knee flex 90 degrees and hip external rotate 45 degrees) instead of left together in fourth step.
9. Repeat on other side

(2-9 is performed with “*thed teng klong yao*” rhythm.)

10. Cool down

## Session 19-21: Balance training

### Objectives

1. Upper and lower limbs movement
2. Weight shifting
3. Balance training
4. Gait training

### Exercise description

1. Warm up
2. “*prom si na nok yoong fon hang*”, “*pit sa mai reang morn*” and “*prom ni mit*” are trained.
3. Leg lifting are trained: stand with right foot in front
  - shift weight to left foot and then lift right knee up (flex hip and knee 90 degrees) while slightly bend left knee down, hold 3 seconds.
  - shift weight to right foot and bend left knee back (flex knee 90 degrees) while slightly bend right knee down, hold 3 seconds.
4. Stand with feet shoulder width apart.
  - shift weight to left side and lift right knee up (hip and knee flex 90 degrees and hip external rotate 45 degrees) while slightly bend left knee down, hold 3 seconds.
  - shift weight to right side and lift left knee up (hip and knee flex 90 degrees and hip external rotate 45 degrees) while slightly bend right knee down, hold 3 seconds.
5. Stand with feet shoulder width apart.
  - shift weight on left foot and bend right knee back while slightly bend left knee down, hold 3 seconds.
  - shift weight on right foot and bend left knee back while slightly bend right knee down, hold 3 seconds.

6. Perform 3-5 with “*kang kwow kin kluay*” 8 repetitions.

Break 5 minutes

7. Perform “*prom si na nok yoong fon hang*”, “*pit sa mai reang morn*” and “*prom ni mit*” with leg lifting.

-“*prom si na nok yoong fon hang*” is performed with leg lifting skill (see no. 3).

-“*pit sa mai reang morn*” are performed with leg lifting skill (see no.4).

-“*prom ni mit*” are performed with leg lifting skill (see no.5).

8. Perform with “*kang kow kin kluay*” rhythm.

## Session 22-24: basic movement of *ram klong yao*

### Objectives

1. Upper and lower limbs movement
2. Gait training
3. Turning
4. Axial rotation
5. Multitask activities

### Exercise description

1. Warm up
2. Basic movements of “*ram klong yao*” are trained.
  - 2.1- Stand with feet shoulder width apart, left hand on left hip.
    - right hand set position as follow: shoulder abduction 90 degrees, elbow flexion 90 degrees, hand perform “*chip*” in pronation and slowly supinate with extend wrist and fingers and then draw to touch right mandible while rotate neck to left side (*nang eye*).
    - perform 8 repetitions and repeat on other side.
  - 2.2- both hands perform “*tang wong soong*” and move up and down.
  - 2.3- elbow flexion 90 degrees, both hands perform “*chip*” with reciprocal elbow pronation and supination.
3. Tramp and walk forward-backward-side to side and turn are trained.

Break 5 minutes

4. Stand in 2 row, tramp and walk forward-backward-side to side and turn are performed with “*rum sai*”, “*tang wong soong*”.
5. Stop walking and perform 2.1, 8 repetitions in each side.
6. Tramp and walk forward-backward-side to side and turn are performed with “*rum sai*”, “*tang wong soong*” again.
7. Stop and set 2 rows to circle and perform 2.3.
8. 4-7 is performed with “*thed teng klong yao*” rhythm.
9. Cool down

## Session 25-30: Thai dance exercise 1

### Objectives

1. Upper and lower limbs movement
2. Gait training
3. Axial rotation
4. Coordination
5. Multitask activities

### Exercise description

1. Warm up
2. 4 steps are performed with “*sod soi ma la*” in “*reung pleng klong yao*” music.
3. 4 steps are performed with “*chang pra san nga*” in “*rum wong kwam mai ni duang ta*” music.
4. Step is performed with “*lor kweaw*” in “*rum wong dao pra suk*” music.

Break 5 minutes

5. 4 steps are performed with “*prom si na nok yoong fon hang*” in “*rum wong chom sa wan*” music.
6. Lateral walk are perform with “*pit sa mai reang morn*” in “*rum wong ban klai jai ruk*”.
7. Cool down

## Session 31-36: Thai dance exercise 2

### Objectives

1. Upper and lower limbs movement
2. Gait training
3. Axial rotation
4. Coordination
5. Multitask activities

### Exercise description

1. Warm up
2. “*rum klong yao*” in session 22-24 are performed.
3. Balance training in session 19-21 are performed.

Break 5 minutes

4. Thai dance exercise 1 in session 25-30 are performed.
5. Cool down

## Basic movements of upper extremities



*Sod soi ma la*



*Chang pra san nga*



*Ram sai*



*Prom si na*



*Nok yoong fon hang*



*Lor kweaw*

### Basic movements of lower extremities



Weight shifting (forward-backward)



Weight shifting (lateral side)



Starting position

Right leg lifting

Left leg lifting



Right leg bending

Left leg bending



Right leg bending with open hip 45 degrees

Left leg bending with open hip 45 degrees



4/4

3/4

2/4

1/4

Four point step



Shift weight and lift leg

Balance training



*Prom si na with leg lefting*



*Nok yoong fon hang  
with leg bending*



*Pit sa mai reang morn* with right leg bending and open hip 45 degrees



*Prom ni mit* with leg bending

Basic movement of *Ram glong yao*



*Ram sai*      *Tung wong soong*      Reciprocal movement



*Nang eye*

Breathing exercise



1

2

3

4

5

### Warm-up



1

2

3

4



5

6

7

8



1

2

3

4



5

6

7

8

Thai dance stretching exercise



1

2

3

4



5

6



7



8



9



10



11

## **Appendix B: Test of Item Objective Conguence Index (IOC)**

The purpose of this study was to develop Thai dance for the exercise program for Parkinson's disease patients and to assess the impact of the Thai dance exercise program on functional performance and the quality of life of Parkinson's patients. 36 sessions were specifically choreographed and designed to meet the impairment of PD patients. The duration of intervention was 12 weeks, with a total of 36 sessions, 1 hour per one session with 3 sessions per week. Each session included 5 parts: 1) relaxation & breathing exercise (5 minutes), 2) warm-up (5 minutes), 3) Thai classical stretching (5 minutes), 4) Thai classical dance (40 minutes) and 5) cool-down (5 minutes).

Therefore, the authors would like to ask the experts validate the Thai dance exercise program for Parkinson's disease patients in detail as follow:

- 1 agree: detail in each domain can not use in the study
- 0 uncertain: detail in each domain can use in the study
- +1 agree: detail in each domain can use in the study

item	contents	results			remarks
		-1	0	+1	
1	<b>Contents of exercise</b> <u>warm-up period</u> performing of relaxation -duration of relaxation -music -patient performance -benefits				
	-performing of breathing -duration of breathing -music -Patient performance -benefits				
	-performing of warm-up -duration of warm-up -music -patient performance -benefits				
	-performing of stretching -duration of stretching -music -Patient performance -benefits				
	<u>Thai dance exercise period</u> 1-6 sessions (basic movements of upper extremities) -sod soi mala -chang prasan nga -ram sai -prom si na nok yoong fon hang -lor kweaw				

	<ul style="list-style-type: none"> <li>-patient performance</li> <li>-benefits</li> </ul>				
	<p>7-18 sessions (basic movements of lower extremities &amp; gait pattern)</p> <ul style="list-style-type: none"> <li>-performing of choreography</li> <li>-continual of each session</li> <li>-duration</li> <li>-music</li> <li>-rhythm of music</li> <li>-patient performance</li> <li>-benefits</li> </ul>				
	<p>19-21 sessions (balance skill)</p> <ul style="list-style-type: none"> <li>-performing of choreography</li> <li>-continual of each session</li> <li>-duration</li> <li>-music</li> <li>-rhythm of music</li> <li>-patient performance</li> <li>-benefits</li> </ul>				
	<p>22-24 sessions (<i>ram glong yao</i> skill)</p> <ul style="list-style-type: none"> <li>-performing of choreography</li> <li>-continual of each session</li> <li>-duration</li> <li>-music</li> <li>-rhythm of music</li> <li>-patient performance</li> <li>-benefits</li> </ul>				

	25-30 sessions (Thai dance exercise 1) -Thai dance pattern -duration -music -rhythm of music -patient performance -benefits				
	30-36 sessions (Thai dance exercise 2) -Thai dance pattern -duration -music -rhythm of music -patient performance -benefits				
	<u>Cool down period</u> -performing of cool-down -duration of cool-down -music -patient performance -benefits				
2	<b>Exercise instructor</b> -performing in each choreography -leader performance				
3	<b>Place and environment</b> -appropriate to PD patients				

Recommendations

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Signature\_\_\_\_\_

item	contents	results
1	<b>Contents of exercise</b> <u>warm-up period</u> <ul style="list-style-type: none"> <li>• performing of relaxation</li> <li>• duration of relaxation</li> <li>• music</li> <li>• patient performance</li> <li>• benefits</li> </ul>	 1 1 1 1 1
	<ul style="list-style-type: none"> <li>• performing of breathing</li> <li>• duration of breathing</li> <li>• music</li> <li>• Patient performance</li> <li>• benefits</li> </ul>	 1 1 1 1 1
	<ul style="list-style-type: none"> <li>• performing of warm-up</li> <li>• duration of warm-up</li> <li>• music</li> <li>• patient performance</li> <li>• benefits</li> </ul>	 1 1 1 1 1
	<ul style="list-style-type: none"> <li>• performing of stretching</li> <li>• duration of stretching</li> <li>• music</li> <li>• Patient performance</li> <li>• benefits</li> </ul>	 1 1 1 1 1
	<u>Thai dance exercise period</u> 1-6 sessions (basic movements of upper extremiites) <ul style="list-style-type: none"> <li>• <i>sod soi mala</i></li> <li>• <i>chang prasan nga</i></li> <li>• <i>ram sai</i></li> <li>• <i>prom si na nok yoong fon hang</i></li> <li>• <i>lor kweaw</i></li> <li>• patient performance</li> <li>• benefits</li> </ul>	 1 0.8 1 0.6 0.8 0.8 0.8

	<p>7-18 sessions (basic movements of lower extremities &amp; gait pattern)</p> <ul style="list-style-type: none"> <li>• performing of choreography</li> <li>• continual of each session</li> <li>• duration</li> <li>• music</li> <li>• rhythm of music</li> <li>• patient performance</li> <li>• benefits</li> </ul>	<p>0.8 0.8 1 0.8 0.8 0.8 1</p>
	<p>19-21 sessions (balance skill)</p> <ul style="list-style-type: none"> <li>• performing of choreography</li> <li>• continual of each session</li> <li>• duration</li> <li>• music</li> <li>• rhythm of music</li> <li>patient performance</li> <li>• benefits</li> </ul>	<p>0.8 1 1 1 1 1 1</p>
	<p>22-24 sessions (ram glong yao skill)</p> <ul style="list-style-type: none"> <li>• performing of choreography</li> <li>• continual of each session</li> <li>• duration</li> <li>• music</li> <li>• rhythm of music</li> <li>• patient performance</li> <li>• benefits</li> </ul>	<p>1 1 1 0.8 0.8 1 1</p>
	<p>25-30 sessions (Thai dance exercise 1)</p> <ul style="list-style-type: none"> <li>• Thai dance pattern</li> <li>• duration</li> <li>• music</li> <li>• rhythm of music</li> <li>• patient performance</li> <li>• benefits</li> </ul>	<p>1 1 1 0.8 1 1</p>

	30-36 sessions (Thai dance exercise 2) <ul style="list-style-type: none"> <li>• Thai dance pattern</li> <li>• duration</li> <li>• music</li> <li>• rhythm of music</li> <li>• patient performance</li> <li>• benefits</li> </ul>	1 1 0.8 0.8 0.8 1
	<u>Cool down period</u> <ul style="list-style-type: none"> <li>• performing of cool-down</li> <li>• duration of cool-down</li> <li>• music</li> <li>• patient performance</li> <li>• benefits</li> </ul>	1 1 1 1 1
2	<b>Exercise instructor</b> <ul style="list-style-type: none"> <li>• performing in each choreography</li> <li>• leader performance</li> </ul>	0.8 0.8
3	<b>Place and environment</b> <ul style="list-style-type: none"> <li>• appropriate to PD patients</li> </ul>	1

**Appendix C: Name of Experts**

1. Associate Professor Sopa Pichaiyongwongdee  
Faculty of Physical Therapy Mahidol University
2. Assistant Professor Rattana Rattanatharn  
Faculty of Medicine Chulalongkorn Hospital University
3. Dr. Akravudh Viriyavejakul  
Prasat Neurological Institute
4. Dr. Charungthai Dejthevaporn  
Faculty of Medicine Ramathibodi Hospital University
5. MRS.Sathaporn Sonthong  
Faculty of Fine and Applied Art Chulalongkorn University

**Appendix D: Data collection Form**

1. Patient No.....  
 Date:...../...../.....  
 Patient's name.....sex  Male  Female  
 Address.....Tel:.....  
 .

**Baseline data**

- 2. Age.....years
- 3. Height.....cm.
- 4. Weight.....kg.
- 3. Years since diagnosis.....
- 4. Disability stage (Hoehn & Yahr).....
- 5. Medications

Medicine	Dose				

## Outcome data

<b>Study 1</b>	<b>Baseline</b>	<b>Post-test</b>
UPDRS subscale II		
UPDRS subscale III		
Berg Balance Score (BBS)		
The 8-item Parkinson's disease questionnaire (PDQ8)		
The Times up and Go test (TUG)	1.	
	2.	
	3.	
average		
360 turning test	1.	
	2.	
	3.	
average		

Gait	Baseline		Post-test	
	Left side	Right side	Left side	Right side
cadence	1			
	2			
	3			
Average				
velocity	1			
	2			
	3			
Average				
Step length	1			
	2			
	3			
Average				
Stride length	1			
	2			
	3			
Average				

Study 2	Baseline		Post-test		2 months follow-up	
	On	Off	On	Off	On	Off
UPDRS subscale II						
UPDRS subscale III						
Berg Balance Score (BBS)						
The 8-item Parkinson's disease questionnaire (PDQ8)						
The Times up and Go test (TUG)	1					
	2					
	3					
Average						
360 turning test	1					
	2					
	3					
Average						



## **Appendix E: The Unified Parkinson's Disease Rating Scale (UPDRS)**

### **II. Activities of Daily Living**

#### **Speech**

- 0-normal
- 1-mildly affected, no difficulty being understood
- 2-moderately affected, may be asked to repeat
- 3-severely affected, frequently asked to repeat
- 4-unintelligible most of time

#### **Salivation**

- 0-normal
- 1-slight but noticeable increase, may have nighttime drooling
- 2-moderately excessive saliva, has minimal drooling
- 3-marked drooling

#### **Swallowing**

- 0-normal
- 1-rare choking
- 2-occasional choking
- 3-requires soft food
- 4-requires NG tube or G-tube

#### **Handwriting**

- 0-normal
- 1-slightly small or slow
- 2-all words small but legible
- 3-severely affected, not all words legible
- 4-majority illegible

#### **Cutting Food/Handing Utensils**

- 0-normal
- 1-somewhat slow and clumsy but no help needed
- 2-can cut most foods, some help needed
- 3-food must be cut, but can feed self
- 4-needs to be fed

**Dressing**

- 0-normal
- 1-somewhat slow, no help needed
- 2-occasional help with buttons or arms in sleeves
- 3-considerable help required but can do something alone
- 4-helpless

**Hygiene**

- 0-normal
- 1-somewhat slow but no help needed
- 2-needs help with shower or bath or very slow in hygienic care
- 3-requires assistance for washing, brushing teeth, going to bathroom
- 4-helpless

**Turning in Bed/ Adjusting Bed Clothes**

- 0-normal
- 1-somewhat slow no help needed
- 2-can turn alone or adjust sheets but with great difficulty
- 3-can initiate but not turn or adjust alone
- 4-helpless

**Falling-Unrelated to Freezing**

- 0-none
- 1-rare falls
- 2-occasional, less than one per day
- 3-average of once per day
- 4->1 per day

**Freezing When Walking**

- 0-normal
- 1-rare, may have start hesitation
- 2-occasional falls from freezing
- 3-frequent freezing, occasional falls
- 4-frequent falls from freezing

**Walking**

- 0-normal
- 1-mild difficulty, day drag legs or decrease arm swing

- 2-moderate difficulty requires no assist
- 3-severe disturbance requires assistance
- 4-cannot walk at all even with assist

### **Tremor**

- 0-absent
- 1-slight and infrequent, not bothersome to patient
- 2-moderate, bothersome to patient
- 3-severe, interfere with many activities
- 4-marked, interferes with many activities

### **Sensory Complaints Related to Parkinsonism**

- 0-none
- 1-occasionally has numbness, tingling, and mild aching
- 2-frequent, but not distressing
- 3-frequent painful sensation
- 4-excruciating pain

## **III. Motor Exam**

### **Speech**

- 0-normal
- 1-slight loss of expression, diction, volume
- 2-monotone, slurred but understandable, mod. impaired
- 3-marked impairment, difficult to understand
- 4-unintelligible

### **Facial Expression**

- 0-Normal
- 1-slight hypomymia, could be poker face
- 2-slight but definite abnormal diminution in expression
- 3-mod. hypomimia, lips parted some of time
- 4-masked or fixed face, lips parted 1/4 of inch or more with complete loss of expression

### **\*Tremor at Rest**

#### **Face**

- 0-absent
- 1-slight and infrequent
- 2-mild and present most of time

- 3-moderate and present most of time
- 4-marked and present most of time

**Right Upper Extremity (RUE)**

- 0-absent
- 1-slight and infrequent
- 2-mild and present most of time
- 3-moderate and present most of time
- 4-marked and present most of time

**LUE**

- 0-absent
- 1-slight and infrequent
- 2-mild and present most of time
- 3-moderate and present most of time
- 4-marked and present most of time

**RLE**

- 0-absent
- 1-slight and infrequent
- 2-mild and present most of time
- 3-moderate and present most of time
- 4-marked and present most of time

**LLE**

- 0-absent
- 1-slight and infrequent
- 2-mild and present most of time
- 3-moderate and present most of time
- 4-marked and present most of time

**\*Action or Postural Tremor**

**RUE**

- 0-absent
- 1-slight, present with action
- 2-moderate, present with action
- 3-moderate present with action and posture holding
- 4-marked, interferes with feeding

**LUE**

- 0-absent
- 1-slight, present with action
- 2-moderate, present with action
- 3-moderate present with action and posture holding
- 4-marked, interferes with feeding

**\*Rigidity**

**Neck**

- 0-absent
- 1-slight or only with activation
- 2-mild/moderate
- 3-marked, full range of motion
- 4-severe

**RUE**

- 0-absent
- 1-slight or only with activation
- 2-mild/moderate
- 3-marked, full range of motion
- 4-severe

**LUE**

- 0-absent
- 1-slight or only with activation
- 2-mild/moderate
- 3-marked, full range of motion
- 4-severe

**RLE**

- 0-absent
- 1-slight or only with activation
- 2-mild/moderate
- 3-marked, full range of motion
- 4-severe

**LLE**

- 0-absent
- 1-slight or only with activation
- 2-mild/moderate

3-marked, full range of motion

4-severe

**\*Finger taps**

**Right**

0-normal

1-mild slowing, and/or reduction in amp.

2-moderate impaired. Definite and early fatiguing, may have occasional arrests

3-severely impaired. Frequent hesitations and arrests.

4-can barely perform

**Left**

0-normal

1-mild slowing, and/or reduction in amp.

2-moderate impaired. Definite and early fatiguing, may have occasional arrests

3-severely impaired. Frequent hesitations and arrests.

4-can barely perform

**\*Hand Movements (open and close hands in rapid succession)**

**Right**

0-normal

1-mild slowing, and/or reduction in amp.

2-moderate impaired. Definite and early fatiguing, may have occasional arrests

3-severely impaired. Frequent hesitations and arrests.

4-can barely perform

**Left**

0-normal

1-mild slowing, and/or reduction in amp.

2-moderate impaired. Definite and early fatiguing, may have occasional arrests

3-severely impaired. Frequent hesitations and arrests.

4-can barely perform

**\*Rapid Alternating Movements (pronate and supinate hands)**

**Right**

0-normal

1-mild slowing, and/or reduction in amp.

2-moderate impaired. Definite and early fatiguing, may have occasional arrests

3-severely impaired. Frequent hesitations and arrests.

4-can barely perform

**Left**

0-normal

1-mild slowing, and/or reduction in amp.

2-moderate impaired. Definite and early fatiguing, may have occasional arrests

3-severely impaired. Frequent hesitations and arrests.

4-can barely perform

**\*Leg Agility (tap heel on ground, amp should be 3 inches)**

**Right**

0-normal

1-mild slowing, and/or reduction in amp.

2-moderate impaired. Definite and early fatiguing, may have occasional arrests

3-severely impaired. Frequent hesitations and arrests.

4-can barely perform

**Left**

0-normal

1-mild slowing, and/or reduction in amp.

2-moderate impaired. Definite and early fatiguing may have occasional arrests

3-severely impaired. Frequent hesitations and arrests.

4-can barely perform

**\*Arising From Chair (pt. arises with arms folded across chest)**

0-normal

1-slow, may need more than one attempt

2-pushes self up from arms or seat  
 3-tends to fall back, may need multiple tries but can arise  
 without  
 assistance

4-unable to arise without help

**\*Posture**

0-normal erect

1-slightly stooped, could be normal for older person

2-definitely abnormal, mod. stooped, may lean to one side

3-severely stooped with kyphosis

4-marked flexion with extreme abnormality of posture

**\*Gait**

0-normal

1-walks slowly, may shuffle with short steps, no festination  
 or propulsion

2-walks with difficulty, little or no assistance, some  
 festination,  
 short steps or propulsion

3-severe disturbance, frequent assistance

4-cannot walk

**\*Postural Stability (retropulsion test)**

0-normal

1-recovers unaided

2-would fall if not caught

3-falls spontaneously

4-unable to stand

**\*Body Bradykinesia/ Hypokinesia**

0-none

1-minimal slowness, could be normal, deliberate character

2-mild slowness and poverty of movement, definitely  
 abnormal, or dec. amp. of movement

3-moderate slowness, poverty, or small amplitude

4-marked slowness, poverty, or amplitude

## Appendix F: The 8-item Parkinson's Disease Questionnaire (PDQ- 8 )

All questionnaire to be answered by the subject with one of the option below:

0 = Never

1 = Occasionally

2 = Sometimes

3 = Often

4 = Always ( or cannot do at all , if applicable )

Due to having Parkinson 's disease , how often have you experienced the following , during the last month?

Item description	baseline	Post-test	2 months follow-up
1. Had difficulty getting around in public?			
2. Had difficulty dressing yourself?			
3. Felt depressed?			
4. Had problems with your close personal relationships?			
5. Had problems with your concentration, e.g. when reading or watching TV?			
6. Felt unable to communicate with people properly?			
7. Had painful muscle cramps or spasms?			
8. Felt embarrassed in public due to having Parkinson's Disease?			

## **Appendix G: Berg Balance Scale Questionnaire (BBS)**

### **Equipment needed:**

Ruler

2 standard chairs (one with arm rests, one without)

Footstool or step

Stopwatch or wristwatch

15 ft walkway

### **Completion:**

**Time:** 15-20 minutes

**Scoring:** A five-point ordinal scale, ranging from 0-4. “0” indicates the lowest level of function and “4” the highest level of function.

Total Score = 56

**Interpretation:** 41-56 = low fall risk 21-40 = medium fall risk  
0 –20 = high fall risk (score of 45 required for independent safe ambulation)

### **1.SITTING TO STANDING**

*Instructions:* Please stand up. Try not to use your hand for support.

- ( ) 4 able to stand without using hands and stabilize independently
- ( ) 3 able to stand independently using hands
- ( ) 2 able to stand using hands after several tries
- ( ) 1 needs minimal aid to stand or stabilize
- ( ) 0 needs moderate or maximal assist to stand

**2.STANDING UNSUPPORTED**

*Instructions:* Please stand for two minutes without holding on.

- ( ) 4 able to stand safely for 2 minutes
- ( ) 3 able to stand 2 minutes with supervision
- ( ) 2 able to stand 30 seconds unsupported
- ( ) 1 needs several tries to stand 30 seconds unsupported
- ( ) 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

**3.SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL**

*Instructions:* Please sit with arms folded for 2 minutes.

- ( ) 4 able to sit safely and securely for 2 minutes
- ( ) 3 able to sit 2 minutes under supervision
- ( ) 2 able to able to sit 30 seconds
- ( ) 1 able to sit 10 seconds
- ( ) 0 unable to sit without support 10 seconds

**4.STANDING TO SITTING**

*Instructions::* Please sit down.

- ( ) 4 sits safely with minimal use of hands
- ( ) 3 controls descent by using hands
- ( ) 2 uses back of legs against chair to control descent

- ( ) 1 sits independently but has uncontrolled descent
- ( ) 0 needs assist to sit

### **5.TRANSFERS**

*Instructions:* Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

- ( ) 4 able to transfer safely with minor use of hands
- ( ) 3 able to transfer safely definite need of hands
- ( ) 2 able to transfer with verbal cuing and/or supervision
- ( ) 1 needs one person to assist
- ( ) 0 needs two people to assist or supervise to be safe

### **6.STANDING UNSUPPORTED WITH EYES CLOSED**

*Instructions:* Please close your eyes and stand still for 10 seconds.

- ( ) 4 able to stand 10 seconds safely
- ( ) 3 able to stand 10 seconds with supervision
- ( ) 2 able to stand 3 seconds
- ( ) 1 unable to keep eyes closed 3 seconds but stays safely
- ( ) 0 needs help to keep from falling

## **7.STANDING UNSUPPORTED WITH FEET TOGETHER**

*Instructions:* Place your feet together and stand without holding on.

- ( ) 4 able to place feet together independently and stand 1 minute safely
- ( ) 3 able to place feet together independently and stand 1 minute with supervision
- ( ) 2 able to place feet together independently but unable to hold for 30 seconds
- ( ) 1 needs help to attain position but able to stand 15 seconds feet together
- ( ) 0 needs help to attain position and unable to hold for 15 seconds

## **8.REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING**

*Instructions:* Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

- ( ) 4 can reach forward confidently 25 cm (10 inches)
- ( ) 3 can reach forward 12 cm (5 inches)
- ( ) 2 can reach forward 5 cm (2 inches)

- ( ) 1 reaches forward but needs supervision
- ( ) 0 loses balance while trying/requires external support

### **9.PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION**

*Instructions:* Pick up the shoe/slipper, which is place in front of your feet.

- ( ) 4 able to pick up slipper safely and easily
- ( ) 3 able to pick up slipper but needs supervision
- ( ) 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently
- ( ) 1 unable to pick up and needs supervision while trying
- ( ) 0 unable to try/needs assist to keep from losing balance or falling

### **10.TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING**

*Instructions:* Turn to look directly behind you over toward the left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.

- ( ) 4 looks behind from both sides and weight shifts well
- ( ) 3 looks behind one side only other side shows less weight shift
- ( ) 2 turns sideways only but maintains balance
- ( ) 1 needs supervision when turning

( ) 0 needs assist to keep from losing balance or falling

### **11.TURN 360 DEGREES**

*Instructions:* Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

( ) 4 able to turn 360 degrees safely in 4 seconds or less

( ) 3 able to turn 360 degrees safely one side only 4 seconds or less

( ) 2 able to turn 360 degrees safely but slowly

( ) 1 needs close supervision or verbal cuing

( ) 0 needs assistance while turning

### **12.PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED**

*Instructions:* Place each foot alternately on the step/stool. Continue until each foot has touch the step/stool four times.

( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds

( ) 3 able to stand independently and complete 8 steps in > 20 seconds

( ) 2 able to complete 4 steps without aid with supervision

( ) 1 able to complete > 2 steps needs minimal assist

( ) 0 needs assistance to keep from falling/unable to try

### **13.STANDING UNSUPPORTED ONE FOOT IN FRONT**

*Instructions:* (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)

- ( ) 4 able to place foot stride length ahead independently and hold 30 seconds
- ( ) 3 able to place foot ahead independently and hold 30 seconds
- ( ) 2 able to take small step independently and hold 30 seconds
- ( ) 1 needs help to step but can hold 15 seconds
- ( ) 0 loses balance while stepping or standing

### **14.STANDING ON ONE LEG**

*Instructions:* Stand on one leg as long as you can without holding on.

- ( ) 4 able to lift leg independently and hold > 10 seconds
- ( ) 3 able to lift leg independently and hold 5-10 seconds
- ( ) 2 able to lift leg independently and hold  $\geq$  3 seconds
- ( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently.
- ( ) 0 unable to try of needs assist to prevent fall

( ) TOTAL SCORE (Maximum = 56)

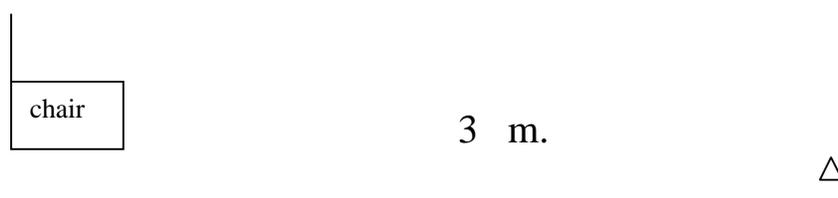
## Appendix H: The Timed UP and Go test

### Setting Up the test area

- Determine a path free from obstruction
- Place a chair with arms at one end of the path.
- Mark off a 3 m (10 ft.) distance using tape or a cone or other clear marking.

### Start the test

- Speak clearly and slowly.
- Inform participant of sequence and outcome
- “When I say go, you will stand up from the chair, walk to the mark (cone) on the floor, turn around, walk back to the chair and sit down.” “I will be timing you using the stopwatch.” Ask participants to repeat the instructions to make sure they understand.
- Participant starts with their back against the chair, their arms resting on the arm rests, and their walking aid at hand
- Using a cue like “Ready, set, go” might be useful.
- Either a wrist-watch with a second hand or a stop-watch can be used to time the performance.



## **Appendix I: Note of patients in Thai dance group**

### *Retired doctor age 80*

I felt grateful and had a total faith in the research team for creating Thai dance exercise for patients with Parkinson's disease. The obvious benefit is the walking which I can raise my legs higher with fewer feet dragging. My walk is more energetic, and my steps have more stability. I experience fewer freezing gaits, better stability, and lesser sway. For writing, my hand and fingers work better than before, where I can write longer and better. I feel very happy when I am with the group. The group makes me feel joyful, less depressed, less mood swing, and less lonely.

### *Business person age 63*

At first when I joined the group, I had not expected anything. However after the Thai dance exercise followed the music, I feel fun and joy. The group is warm and sacrifices to their members. After a while, we are better physically and emotionally. We are happier and more relaxed. My shaking is so few that I almost forget that I have Parkinson's disease. I began to realize that exercise and emotional controls are very essential in lives. Since lives are so short, there is no reason why we should get depressed and feel suffering all the time. Happiness or suffering is up to your mind. Keep smiling. If we get up and fight with Parkinson disease, Parkinson disease cannot do anything to us. No people in this world are happy all the time. Fate is fair for everybody. Happiness and beauty is everywhere, it is up to us to choose which way to see.

### *Former salesman age 60*

Music can make me happy and when I am happy my symptoms are good as well as improve my first step.

*Former police officer age 58*

I used to feel depressed and rather isolated. My movement was slow and my personality had changed. After three months of exercise, I experience many changes as follows.

1. Mental: I used to feel depressed, isolated, and despair. After exercise and meeting and talking with friends who share same experience, I feel better and am encouraged to keep fighting.
2. Physical: Thai dance helps me to have better walking and balance. I feel more confident in my walking (because before exercise, my movement was rather slow.)
3. Emotional: Thai dance is joyful, fun, and makes me cool. I enjoy and laugh with the songs that are very lively.

*Freelance age 48*

I have participated with this group of Thai dance for patients with Parkinson disease for 36 sessions. I have the following good experiences:

1. Rigidity is reduced in upper and lower limbs and body.
2. I used to walk with back bending. Now I feel that I walk with better posture.
3. I have better attitude toward Thai dance.
4. I have better relationship with others and opened up my vision in life and social.

*Housewife age 60*

Thai dance can be used to exercise in daily day which help me to move, walk and balance. I have gained happiness in my mind and I can go back to society again.

*Retired teacher age 60*

My activities daily of living have improve after participating in Thai dance class such as take shower, clean my back, move down for cutting my feet nail, take less time for dressing and moving to car, more self confident and good expression, good writing, good mental and good concentration.

*Housewife age 51*

I am thankful for all good suggestions and recommendations. Some people in our group say that the more you practice the more you know and value of Thai dance. Some are grateful for Parkinson's disease that brings us together. I want to say to the world that Thai traditional wisdom and Thai people are capable to create great things that are up to date. We have a lovely researcher who cares for patients and applied Thai traditional wisdom to solve a global problem. We have a great dean with a great vision who supports the program. We have an internationally famous expert in Parkinson's disease who sees the value of Thai traditional wisdom. For every person who I have named, if they did not have great visions and see the value of Thai traditional wisdom, I would not have been here to do the Thai dance exercise. I would like to take this opportunity to thank everybody to do good things for the patients.

*Former police and musician age 77*

My mentality come back to normal, symptom of fatigue and pain improve. Depression has gone after participating this exercise. I can come back to sing a song and play saxophone again.

## Biography

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Bachelor degree: Faculty of Physical Therapy,  
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