EFFECTS OF THAI DANCE ON NEURODYNAMIC RESPONSE IN SUBJECTS WITH CARPAL TUNNEL SYNDROME

USA KARUKUNCHIT

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE
(PHYSICAL THERAPY)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2010

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Thesis
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was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of master of science (Physical Therapy)
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ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to my major advisor, Dr. Keerin Mekhora, for his excellent knowledge, valuable advice and all problems solving throughout this study.

Also, I am equally grateful and deepest appreciation to Assistant Professor Chompunoot Suwanasri and Associate Professor Witchate Pichaisak, my co-advisor, for their excellent guideline and advice.

I would like to thank Mr. Prasert Sakulsriprasert for his assistance and suggestion. I also would like to thank my friends who provided the suggestion of the methods.

In particular, I would like to thank the physical therapists from the Clinic of Faculty of Physical Therapy, Mahidol University for their cooperation and comments. Especially, I also like to thank all research participants for their excellent cooperation in this study.

Finally, I am deeply indebted to my family especially my father for their love, understanding, warmest encouragement, and support throughout my study.

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EFFECTS OF THAI DANCE ON NEURODYNAMIC RESPONSE IN SUBJECTS WITH CARPAL TUNNEL SYNDROME

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ABSTRACT

The purpose of this study was to investigate the effects of Thai dance on neurodynamic response in subjects with carpal tunnel syndrome (CTS). Twelve participants from 30 to 60 years of age and mild or moderate CTS were recruited in this study.

Thai dance comprised three maneuvers. Those were Prom See Na to Yoong Fon Hang, Lor Knaew and Cha Nee Rai Mai. Five minutes of dance practice was provided every day for three weeks. All participants were assessed using severity of symptoms and functional status scale (SSS and FSS), Phalen test, Tinel's test, Semmes- Weinstein Monofilament tests (SWMT), hand grip strength test, tip-to-tip pinch strength test, and upper limb neurodynamic test 1(ULNT 1) before and after performing Thai dance once a week for the first, second and third weeks and at the end of the third week.

At the end of Thai dance on the second, third and the end of the three weeks, the results showed significant differences in all parameters ($p<0.05$). However, there was no significant difference after performing Thai dance for one week in Tinel's test. The findings suggested that Thai dance could minimize the severity of symptoms and improve hand functional status. Therefore, Thai dance would be beneficial for patient treatment in mild and moderate stages of CTS.

KEY WORDS: CARPAL TUNNEL SYNDROME/ NEURODYNAMICS/ MEDIAN NERVE MOBILIZATION/ THAI DANCE

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ผลของการรำไทยต่อการตอบสนองทางประสาทพลศาสตร์ในผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ

EFFECTS OF THAI DANCE ON NEURODYNAMIC RESPONSE IN SUBJECTS WITH CARPAL TUNNEL SYNDROME

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บทคัดย่อ

การวิจัยมีวัตถุประสงค์เพื่อศึกษาผลของการรำไทยต่อการตอบสนองทางประสาทพลศาสตร์ ในผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ ผู้เข้าร่วมวิจัย 12 คน อายุ 30-60ปี และเป็นผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือที่มีระดับความรุนแรงน้อยหรือปานกลาง

รำไทย 3 ท่า ประกอบด้วย พรหมสี่หน้า-ยูงฟ้อนหาง ล่อแก้ว และชะนีร่ายไม้ ในการฝึกแต่ละวันใช้เวลา 5 นาที เป็นเวลา 3 สัปดาห์ ผู้เข้าร่วมวิจัยได้รับการประเมินระดับความรุนแรงของอาการและความสามารถในการทำกิจวัตรประจำวัน การทดสอบของฟาเลน (Phalen test) การทดสอบของไทเนล (Tinel's test) การทดสอบระดับการรับรู้สัมผัสบริเวณมือด้วยเส้นใยสังเคราะห์ SWM (Semmes-Weinstein Monofilament tests, SWMT) การทดสอบความแข็งแรงของกล้ามเนื้อมือ (hand grip strength and tip-to-tip pinch strength test) และการทดสอบประสาทพลศาสตร์ของเส้นประสาทมีเดียน (upper limb neurodynamic test 1,ULNT1) ก่อนและหลังรำไทยสัปดาห์ละ 1 ครั้ง ในสัปดาห์ที่ 1, 2, 3 และสิ้นสุดสัปดาห์ที่ 3

สัปดาห์ที่ 2, 3 และสิ้นสุดสัปดาห์ที่ 3 พบว่ามีความแตกต่างอย่างมีนัยสำคัญทางสถิติในทุกตัวแปร อย่างไรก็ตามไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติภายหลังรำไทย 1 สัปดาห์ ด้วยการ ทดสอบของไทเนล (Tinel's test) การรำไทยลดระดับความรุนแรงของอาการ และ พัฒนาความสามารถในการทำกิจวัตรประจำวัน ดังนั้นการรำไทย มีประโยชน์ต่อการพัฒนาประสิทธิภาพการรักษาแบบไม่ผ่าตัดในผู้ป่วยกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือที่มีระดับความรุนแรงน้อยและปานกลาง

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LIST OF ABBREVIATIONS

CTS	Carpal tunnel syndrome
cm.	centimeter(s)
kg.	kilogram(s)
et al.	et alii, et alia, et aliae, et alibi
Rt.	right side
Lt.	left side
SSS	Symptom Severity Scale
FSS	Functional Status Scale
SWMT	Semmes-Weinstein Monofilament
ULNT	Upper limb neurodynamic test
2PD	two-point discrimination test
NCV	nerve conduction velocity

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CHAPTER I
INTRODUCTION

Carpal Tunnel Syndrome (CTS) is the most common neuropathy of the upper extremity [1, 2]. CTS is approximately 3% in the general population up to 15-20% in occupations that involve repetitive forceful hand tasks [3, 4]. It most often occurs after the age of 30 years, with women affected more than men by a ratio of 3 to 1 [5]. It is considered an entrapment neuropathy because the deep transverse carpal ligament compresses fibers of the median nerve against the palmar surface of the carpal bones at the wrist. Abnormally high carpal tunnel pressures exist in patients with CTS [6]. The increased pressure likely causes obstruction to venous outflow, tissue congestion, edema formation, and ischemia in the nerve. If the median nerve compression increases, then tension will increase [7]. As a consequence, the nerve function is impaired. Sensory fibers often are affected first, followed by motor fibers [8]. Symptoms of CTS include pain, paresthesia, numbness, or tingling involving the fingers innervated by the median nerve [9]. CTS results in considerable discomfort and pain, limitation of activities of daily living, loss of sleep and work disability [4]. Become a growing reason for workers' compensation claims due to absence from work [10]. It is an important cause of workplace morbidity with approximately 3,000 cases of CTS resulting in day lost from work in 1996 [8]. There are an estimated 400,000 to 500,000 carpal tunnel releases for median nerve decompression performed annually in the United States, with an economic cost in excess of two billion dollars per year [11].

Surgery to release the pressure from the median nerve may be helpful but it can have a 15- 20% failure rate [12]. However, in some mild and moderate stage cases, conservative methods of treatment may be successful. The Cochrane Database of Systematic Reviews evaluated the clinical efficacy of the conservative management of CTS. There is significant short-term benefit from oral steroids, ultrasound,

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splinting, yoga and carpal bone mobilization [13]. However, there is conflicting evidence for oral steroids and ultrasound, and those diuretics; vitamin B6, yoga, non-steroidal anti-inflammatory drugs, and laser acupuncture are ineffective in providing short-term symptom relief [2]. Local corticosteroid injections provide short-term relief, but there is no benefit compared to placebo beyond one month [5]. In general, long-term outcomes are poor [14].

Most studies which examined the clinical efficacy of nerve gliding exercises in CTS were not included in the Cochrane review [15-17]. However, the other reviews do suggest the use of nerve and tendon gliding exercises in the conservative treatment of CTS [18, 19]. Also in the post-operative management following carpal tunnel release, nerve and tendon gliding exercises are recommended [20]. In 1991, Totten and Hunter defined and developed nerve gliding exercise for the purpose of increasing the mobility of the median nerve after surgery in patients with CTS and Rozmaryn et al. treated patients experiencing CTS with nerve gliding exercise and reported of patients with good or excellent results in 70.2% [15, 21].

Because the biomechanical forces on the nerve are linked, the sequencing and range of joint movement affect the adaptive response of the nerve [22]. Utilization of neural mobilization requires the careful position and movement of the patient [23]. The clinician should move rhythmically and slowly. From the clinical research, there is evidence supporting neural mobilization as an effective treatment strategy. The rationale in treating patient with the nervous system mobilization is an attempt to improve axonal transport. The mobilization of nerve may reduce the pressure existing within the nerve and could therefore result in an improvement of blood flow to the nerve. Consequently, the regeneration and healing of an injured nerve may also occur [7].

Thai dance has been popular among Thais and foreigners. Thai dance has an own characteristic and being Thai in itself. It is the national art. With music, it will create happiness or it can be performed with songs having only the rhythm. It is served as exercise and the personal development. To perform Thai dance, one has to use a lot

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of energy in training and in the demonstration. Thai dance is performed by using hands as the main performance [24]. Thai dance maneuvers used is similar to some component of the upper limb neurodynamic testing position and it is gentle movement. From the study of Saleesing and Karukuncit (2006), the effect of Thai dance in participants with positive upper limb neurodynamic test was unveiled. They showed that Thai dance decrease upper limb nerve tension [25]. Kosol and Saetang (2007), and Pimsutekunton and Janpram (2007) found the effect of the Thai dance in symptomatic and asymptomatic office workers with positive upper limb neurodynamic test. They reported that Thai dance decrease upper limb nerve tension in office workers [26, 27].

However, due to the lack of literature within this area it seems that there is a need for research to inform patient management. Therefore, the purpose of this study is to describe effects of the Thai dance on neurodynamic response for participants with CTS.

Research Question

Is there an effect of Thai dance on improving severity of symptoms, functional status, physical signs and neurodynamic responses in patients with CTS?

Purposes of the Study

General Objective

To study the effects of the Thai dance on severity of symptoms, functional status, physical signs and neurodynamic responses in patients with CTS.

Specific objectives

1. To compare the severity of symptoms and functional status scale before and after Thai dance

2. To compare the duration of Phalen test response before and after Thai dance

3. To compare the distance of Tinel’s test response before and after Thai dance

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4. To compare the number of Semmes-Weinstein Monofilament (SWM) for the hand light touch sensation value before and after Thai dance

5. To compare the hand grip strength and tip to tip pinch strength value before and after Thai dance

6. To compare elbow extension range of motion during performing ULNT1 before and after Thai dance

Parameters of the Study

1. Severity of symptoms and functional status scale (score)
2. Duration of Phalen test response (seconds)
3. Distance of Tinel's test response (cm.)
4. Number of Semmes-Weinstein Monofilament (filament)
5. Hand grip strength and tip to tip pinch strength value (kg.)
6. Elbow extension range of motion (degree)

Scope of the Study

This study focused on the effects of Thai dance on neurodynamic responses for patients with CTS. All participants had aged range between 30 and 60 years. Participants were recruited from the Clinic of Faculty of Physical Therapy, Mahidol University. The severity of symptoms, functional status scale, Phalen test, Tinel's test, SWMT, hand grip and ULNT1 were measured at the first, second and third weeks.

Hypotheses of the Study

1. There was a significant difference between severity of symptoms and functional status before and after Thai dance.

2. There was a significant difference between duration of Phalen test response before and after Thai dance.

3. There was a significant difference between distance of Tinel's test response before and after Thai dance.

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4. There was a significant difference between the number of Semmes-Weinstein Monofilament (SWM) for the hand light touch sensation value before and after Thai dance.

5. There was a significant difference between hand grip strength and tip to tip pinch strength value before and after Thai dance.

6. There was a significant difference between elbow extension range of motion during performing ULNT1 before and after Thai dance.

Advantages of the Study

1. This study provided the knowledge in consequence of Thai dance on neurodynamic responses in CTS.

2. The Thai dance is culturally known by Thai people, so that it can be easily applied for Thai people as a program of self sliding nerve to improve effectiveness of neural mobilization treatment.

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CHAPTER II
LITERATURE REVIEW

2.1 Definition and Etiology of Carpal Tunnel Syndrome

CTS is defined when the median nerve becomes compressed as it travels from the forearm to the hand through the carpal tunnel [28].

Compression of the median nerve can be triggered by factors that provoke an increase in volume of a structure within the carpal tunnel such as traumatic, repetitive stress injuries, rheumatoid arthritis, gout, hypothyroidism, pregnancy, diabetics [29].

2.2 Pathophysiology of Carpal Tunnel Syndrome

Carpal tunnel area is smaller and the tunnel constituents are more rigid than elsewhere. Repetitive wrist, forceful works with the hands, hand vibration and computer activities are the most common risk factors. The walls of the carpal tunnel repeatedly changes. If the tunnel pressure increases to that greater than in the vein, venous drainage stops. Once venous stasis is present, nerve fiber nutrition will be impaired, and the resultant ischemia may cause pain and other symptoms such as paresthesia. If hypoxia continues, damage to the sensitive capillary endothelium follows and results in leakage of protein rich. Endoneurial fluid pressure rises, intrafascicular pressure rises. From oedematous stage, fibroblastic proliferation, enhanced by the protein rich oedema is likely. The result will be intraneural fibrosis within the nerve. Consequence of scarred nerve is nerve friction [7].

2.3 Clinical Signs and Symptoms of Carpal Tunnel Syndrome

The clinical symptoms characteristic of CTS vary with duration of the disease and the pathophysiologic background [8]. It can be stated as follows.

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2.3.1 Early stage

Increase in carpal tunnel tissue pressure, epineurial edema, venous congestion in median nerve, impaired intraneural microcirculation. Symptoms of the hand indicates hypoxia of the median nerve in the carpal tunnel, occurring during the night only and resulting in a local metabolic disorder of the nerve at wrist level. The patient complains of intermittent paresthesia and numbness in median innervated fingers of the hand, tests positive for Phalen's and Tinel's test .These patients do best with conservative therapeutic management.

2.3.2 Moderate stage

Persistent interference of intraneural microcirculation is present with intrafascicular edema. It is more frequent tingling and paresthesia during the night and also during the daytime. There is decreased vibratory sensation, positive findings on Phalen's and Tinel's test, thenar may be weakness, and abnormal sensory findings.

2.3.3 Severe stage

Fibrosis occurs and local myelin damage. Electromyography (EMG) studies show denervation potentials in the muscles supplied by the median nerve. Persistent sensory changes, abnormal two-point discrimination greater than 4 mm, and thenar atrophy are present.

2.4 Physical examination of Carpal Tunnel Syndrome

The physical examination should contain the following components.

2.4.1 Phalen test

Phalen test is performed by having the patient drop both wrists into flexion, fingers and thumbs extended for 60 seconds. A positive test includes numbness or paresthesias (numbness, tingling) in the median nerve distribution within 60 seconds of sustained flexion [8, 11, 28-29, 32-33].

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2.4.2 Tinel's test

Tinel's test is performed with a light percussion of the median nerve at the wrist. A positive Tinel's test includes tingling and paresthesias over the median nerve distribution [8, 11, 28-29, 32-33]. The useful provocation tests are Phalen test and Tinel's test at wrist which have sensitivity and specificity as presented in table 2.1 [11].

Table 2.1 Sensitivity and specificity of provocation tests for CTS

Properties of tests	Phalen test	Tinel's test
Sensitivity (%)	75 (42-85)	70 (38-100)
Specificity (%)	95 (54-98)	99 (55-100)

2.4.3 Semmes-Weinstein monofilament test (SWMT)

A patient with CTS may demonstrate decreased sensation in the median nerve distribution of the hand. A Semmes-Weinstein monofilament test (SWMT) is an accurate and objectively measurable test for sensory deficits in the hand. The sensitivity (82%) and specificity (86%) of the combined test were calculated. The Semmes-Weinstein can be a predictor of the quality of neural return, or the severity of diminution. A light touch test was performed on the distal pads of the thumb, index, and middle fingers of both hands with the wrist in neutral position. The test was considered positive if the patients were unable to detect the pressure of the 3.61, 4.31, 4.56, or 6.65 filaments for that finger. The recognition of light tough and deep pressure is within normal limits; ability to feel the 2.83 filament. Diminished light tough is that close to normal graphesthesia and stereognosis, good temperature and protective sensation and fair to good two point discrimination; inability to feel 2.83 but can recognize the 3.61 filament. Diminished protective sensation is difficulty manipulating some objects and drops objects, complain of weakness during some manipulative skills, has some appreciation of two point discrimination; inability to feel 3.61 but recognition of 4.31 filaments. Loss of protective sensation is absent temperature appreciation, is able to feel pinprick, has deep pressure sensation, difficulty manipulating outside the line of vision, tends to injure self easily, able to feel pinprick,

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and should have instruction on protective care of the hand; inability to feel 4.31 but recognition of 4.56 filament; inability to feel 4.56 but recognition of 6.65 filament [8, 11].

2.4.4 Hand grip strength testing

Hand grip strength was the most common method of reporting motor outcome of CTS, it requires synergistic function of intrinsic and extrinsic muscles of the hand. Strength testing for grip can be done by the use of a calibrated dynamometer. Grip strength was measured (in kilograms) using a Jamar hand dynamometer. The dynamometer gives accurate and clinically reproducible grip strength readings. In most cases of mild to moderate CTS the effected hand will demonstrate lowered scores than the non- affected hand [40-41].

2.4.5 Tip to tip pinch strength test

Strength testing for the abductor pollicis brevis is the first to weakness with CTS. Hand grip strength does not exclusively use the abductor pollicis brevis muscle affected by CTS. From systematic review, tip to tip pinch is more responsive than power grip or lateral pinch. The abductor pollicis brevis can be tested by using a Jamar hand pinch dynamometer [40-41].

2.4.6 Functional Assessment

The use of a specific functional capacity questionnaire is recommended to establish current functional deficits, assist in establishing goals, and to track progress. Levine et al. (1993) developed a self-administered questionnaire for the assessment of severity of symptoms and functional status in the patients who have carpal tunnel syndrome. The scales were highly reproducible (Pearson correlation coefficient, r=0.91 and 0.93 for severity of symptoms and functional status, respectively) and internal consistent. (Cronbach alpha, 0.89 and 0.91 for severity of symptoms and functional status, respectively) The Symptom Severity Scale (SSS) has eleven questions concerning pain, nocturnal symptoms, numbness, tingling, and weakness. The Functional Status Scale (FSS) has eight questions (difficulty in writing, buttoning

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clothes, opening jars, holding a book, gripping of a telephone handle, household chores, carrying of grocery bags, bathing, and dressing). Each scale generates a final score (sum of individual scores divided by number of items) which ranges from 1 to 5, with a higher score indicating greater disability. The answers were rated from 1 point (no symptoms or no difficulty with activity) to 5 points (most severe symptoms completely preventing the activity or cannot perform activity at all) [42].

2.4.7 Upper limb neurodynamic test 1(ULNT 1)

The examination processes of these physical abilities of the nervous system for mobility and transmission of tension are defined as Neural Tension Tests[7] . The ULNT provides a simple, effective and repeatable method of clinical examination by moving the neural tissues and stimulating them mechanically in order to gain an impression of their mobility and sensitivity to mechanical stresses[42] .The test may elicit a component of neuromechanical tension, increased mechanosensitivity or a disturbance of pain mechanism [43]. The aim of ULNT is to determine the source of a patient's pain and other sensory symptoms in the hand and arm. ULNT definition was applied concerning positivity of the test. It reproduces the patient's symptoms (pain, numbness, tingling). The test responses can be altered by movement of distant body parts such as neck. There are differences in the test from the left side to the right side and from what is known to be normal. In clinical practice the outcome of the ULNT is interpreted with respect to three variables including pain, through-range muscular stiffness and the maximum range of elbow extension during the last component of the test.

2.5 Medical Treatment

Medications such as oral cortico-steroids, anti-inflammatory drugs, diuretics, and pyridoxine (vitamin B6) are known to provide short-term benefit [19]. Other medications treatments are effective in treating CTS such as steroid injections, wrist splint, and surgery treatment.

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2.5.1 Steroid injections

Steroid injections are very effective in resolving symptoms of carpal tunnel syndrome, in the short term, particularly if symptoms are mild and moderate stage [19].

2.5.2 Wrist splints

Splints that hold the wrist in neutral are often helpful in controlling symptoms of mild to moderate severity with a full-time splint for 3 to 4 weeks. It can be particularly useful in cases of early carpal tunnel syndrome, when the patient is repeatedly woken at night by painful paraesthesia. A splint is less effective in cases where there is continuous paraesthesia or numbness [19].

2.5.3 Surgery Treatment

Moderate to severe nerve compression evidenced by muscular atrophy, or sensory deficits necessitate surgery. Surgical division of the transverse carpal ligament has shown good results in patients who do not show objective neurological deficit. The long-term results of an endoscopic release are similar to open release [28, 33].

2.6 Physical treatment

2.6.1 Neural mobilization

Techniques can be applied when there is evidence of an entrapment of the median nerve at the wrist and there is a positive neurodynamic test. These neural mobilization techniques include repetitive motions of the segment that produces the symptoms as well as a combination of movements in the more distal and proximal segments. The treatment position used is identical to the testing position.

The techniques aimed to mobility of the median nerve relative to its surrounding structures by performing joint movements that elongate the nerve bed (the tract formed by the structures that surround the nerve) [48]. The rationale in treating patients with nervous system mobilization is an attempt to improving intraneural circulation, axoplasmic flow, and neural connective tissue viscoelasticity, and by

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patients with nervous system mobilization is an attempt to improving intraneural circulation, axoplasmic flow, and neural connective tissue viscoelasticity, and by reducing sensitivity of abnormal impulse generating sites(AIGS) and by this mechanism to improve nerve conduction.The pumping effect may facilitate venous return, oedema dispersal and decrease of pressure inside the perineurium [21]. Blood flow to the wrist and hand also increased after hand exercises thereby increasing circulation, axonal transport, nutrition, and oxygenation to the median nerve in the carpal tunnel. Therefore, they may reduce the reactivity of the pain neuromatrix. Consequently, regeneration and healing of an injured nerve may also occur [7].

These concepts can be applied actively by the patient or passively by the therapist. Butler (1991) suggested grades of the mobilization techniques of the nervous system that the techniques are large amplitude (Maitland Grade II and III) performed slowly and rhythmically [7]. In the irritable, the numbers of repetitions is a sequence of gentle oscillations for initial treatment lasting twenty seconds and then reassess the effect. The number of these sequences could be increased so the techniques last several minutes and twenty-thirty repetitions per set. The physical therapists may prefer to perform just one or two firm sets of a technique

Rozmaryn et al. (1998) and Akalin et al. (2002) treated patients with CTS and one group was treated with a program of median nerve and tendon gliding exercises. The exercise maintained for seven seconds and repeated five times, three to five times per day. The end of treatment for four week, the patients in exercise group revealed a significant decrease in the pain, increase in grip and pinch strength and a decrease in SWMT [15, 17].

Richard and Kari (2002) who studied neural mobilization for patient with lateral elbow pain reported that the mobilization were performed gently, extending the elbow for about two seconds just into the range where the patient felt tension but no pain and then flexing the elbow to the point where the patient felt no tension. Six to seven mobilizations were done. Only with increasing tension did patient report any pain or discomfort. If pain or discomfort or any sign, such as tingling in the hand, were

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produced, the range of the elbow extension was reduced. The patient was instructed to perform neural mobilization exercise one time per day at home in a similar manner to the technique used in the clinic [39].

Jeffrey Alan Schroder (2003) showed that neural mobilization treatments were performed rhythmically and slowly. A total of twenty oscillations were done at each treatment session [32]. Dimitrios (2004) reviewed the treatment of CTS with emphasis in neural mobilization. He reported that the neural mobilization technique included three sets of ten repetitions in each set, at a moderate pace and a three hold at the final stretched position. [6].

Neural mobilization techniques comprise gliding and tensile loading technique. Gliding techniques, or sliding, are neurodynamic maneuvers that attempt to produce a sliding movement between neural structures and adjacent nonneural tissues. The purpose of neurodynamic tensile loading or tensioning techniques is to restore the physical capabilities of neural tissues to tolerate movements that lengthen the corresponding nerve bed. Tensile loading techniques are not stretches, these neurodynamic maneuvers are performed in an oscillatory fashion so as to gently engage resistance to movement that is usually associated with protective muscle activity. Tensile loading techniques are more aggressive than neurodynamic sliders [7].

Totten and Hunter (1991) developed nerve and tendon gliding exercise for carpal tunnel syndrome. During tendon gliding exercises, the fingers were placed in five discrete positions. Those were straight, hook, fist, table top, and straight fist.
During the median nerve gliding exercise, the median nerve was mobilized by putting the hand and wrist in six different positions. 1, wrist in neutral position, fingers and thumb in flexion; 2, wrist in neutral position, fingers and thumb extended; 3, wrist and fingers extended, thumb in neutral position; 4, wrist, fingers, and thumb extended; 5, forearm in supination; 6, the opposite hand applies a gentle stretch to the thumb.
In position 3, the greatest excursion was achieved as the wrist extended. During these exercises, the neck and the shoulder were in a neutral position, and the elbow was in

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supination and 90 degrees of flexion. Each position was maintained for 5 seconds. The exercises were applied as five sessions daily. Each exercise was repeated 10 times at each session. Exercise treatment was continued for 4 weeks. At the end of treatment, statistically significant improvement was obtained in all parameters [21].

Mark T. Walsh et al. (2005) reported that in the irritable symptom patient, glide may be the most appropriate approach. When utilizing gliding techniques, the therapist needs to be aware of the tissue barriers (reflexive muscle contraction) encountered. Treatment and home exercises are performed in the pain-free and tension-free range of motion below stimulus threshold. A clinical example of these two concepts is presented [50].

2.6.2 Other treatments

Many studies have found conservative treatment to be successful in treating CTS such as myofascial release, carpal bone mobilization and ultrasound. Myofascial releases remove the fibrous adhesion wherever it might be along the nerve pathway. The loss of normal gliding of the nerve could result in localized nerve tension and damage to myofascial structures, resulting in fibrous adhesions [29]. Mobilization of the carpals, especially the capitate for increased carpal tunnel space, help to correct position and movement patterns [16,19]. The evidence on the effectiveness of ultrasound relieved the symptoms of carpal tunnel syndrome. It found the treatment to be beneficial in mild to moderate cases [19,29].

2.7 Thai dance

Thai dance in this study is Ram Wong. Ram Wong has been popular among Thais and foreigners since 1941 [24].

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2.7.1 The essential of Thai dancing

Ram Thai has an own characteristic and being Thai in itself. It is the national art with no repetition or like the other nations. It is considered to be proudly national cultural wealth.

2.7.1.1 Showing the delicate and graceful dancing post and the emotion according to the real Thai characteristic with widely meaning

2.7.1.2 With music, it will create the happy emotion or it can dance with the song having only the rhythm or the song and action will be made along with those songs.

2.7.1.3 The song or the song text must be the composing. The verse will be the eight rhymes.

2.7.1.4 Thai drama dressing differs from the other nations by having an own style.

2.7.2Value derived from Thai dancing

2.7.2.1 In case of communication, the dramatic art has developed from the easy form and it is the part of the word or literature and art creating an own language called dancing post language.

2.7.2.2 It is used in the sacrifices such as dancing to do worshiping or offering the sacrifices to the holy one, dancing to redeem a vow to a god or dancing to do teaching worship.

2.7.2.3 It is to use in the formalities such as the guest of the government formalities, the annually respected idol procession ceremony to gain own prosperity, the important celebrations such as birth day.

2.7.2.4 It is to use in the entertainment and meetings .The dramatic art provides an enjoyment to all participants such as the birthday blessing dance and the other entertainments.

2.7.2.5 It is to do the exercise and the personality development. To learn Ram Thai (Thai dancing), one has to use a lot of energy in training and in the demonstration. It is like doing the exercise all the time. It is to stimulate or cure some part of body leading to be adroit and not to be taut including creating of the personality with the beauty and grand balance.

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2.7.2.6 It is to conserve and propagate the dramatic art to be one of the community dentity. In one community, people always inherited and conserve own dramatic art culture not to be disappeared. There is teaching, demonstration and propagation of Thai dramatic art to the other locality or bring it to do the propagation in the foreign countries.

2.7.3 Ram Thai form (Thai dancing form)

2.7.3.1 Wong bon (Upper circle) refers to lifting the arm to the body side. Extend the elbow bending. Open the palm. Raise fingers end upward. The end of fingers actor's circle will be on the above the head. But the end of fingers' actress will be on the elbow tail level and the circle will be narrower

2.7.3.2Wong Klang (Middle circle) refers to the lifting the bending arm and let the end of arm be high in the shoulder level.

2.7.3.3 Wong Nga (Front circle) refers to lifting the arm to the front. The actor's arm circle will be wider than the actress. The end of fingers will be in the cheeks level. The arm circle's actress fingers end will be in the mouth level.

2.7.3.4 Wong Phises refers to raises arms to the sides between Wong Bon and Wong Klan

2.7.3.5 Wong Boa Ban (Opening lotus circle) is lifting up the arm at the body's side. Let the elbow be high in the shoulder's level. Bend the elbow to let the lower arm fold to the body and be in vertical shape to the upper arm. Open palm up with the finger's end pointing to the body's side. The actress ' arm circle will be narrower than the actor's.

2.7.3.6 Wong Lang (Lower circle) is to set in the lowest circle level by laying the arm down in the waist level. Let the hand be at the belt's head. The elbow's actor will be far from the body.

2.7.3.7 Jeeb Ngai (Open gathering) refers to the palm opening and let the end of fingers pointing up. If it is on the belly level, it is called “jeep chai pok" (the belly gathering).

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2.7.3.8 Jeeb Kwam(Over turn gathering) is to over turn the palm and let the end of fingers pointing down. Bend the wrist back to the arm.

2.7.3.9 Jeeb Lang (Sending back gathering) is to send the arm back. Let the arm be tight. Turn the wrist by pointing up the fingers end. Let the arm be tight, lifting up highly and send it back side.

2.11.3.10 Jeeb Prok Nga (front circle gathering) is as the same as the front circle but the hand is gathering.

2.7.3.11 Jeeb Prok Kang (the side gathering) is upper circle gathering. The form is as the same as the upper circle. But the hand is gathering.

2.7.3.12 Jeeb Lo Kaew is like gathering action post. Let the middle finger press on the first part of thump. Bend the thump like the ring circle. The other fingers stretch tightly. Bend the wrist to the arm.

2.8 Thai dance program

The Thai dance maneuvers used is similar to some component of the upper limb neurodynamic testing 1 position**.**

2.8.1 Prom See Na

Prom Se Na is shoulder abduction 90 degree, arm flexion 90 degree and wrist full flexion.

2.8.2 Yoong Fon Hang

Young Fon Hang is shoulder flexion 90 degree to full extension, arm flexion 90 degree to full extension and wrist full extension.

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2.8.3 Lor Knaew

2.8.3.1 Shoulder was in abduction 110 degrees and external rotation. Contra lateral side of shoulder was in abduction 90 degrees and internal rotation.

2.8.3.2 Elbow was in flexion. Contra lateral side of elbow was slightly flexion to full extension.

2.8.3.3 Wrist was slightly extension. Contra lateral side of wrist was slightly flexion.

2.8.3.4 Fingers were in extension. Contra lateral side of fingers was in extension with thumb and middle finger was in flexion.

2.8.4 Cha Nee Rai Mai

2.8.4.1 Shoulder was in abduction 110 degrees and external rotation. Contra lateral side of shoulder was in abduction 90 degrees and external to internal rotation.

2.8.4.2 Elbow was in flexion. Contra lateral side of elbow was full extension.

2.8.4.3 Wrist was slightly extension. Contra lateral side of wrist was slightly extension.

2.8.4.4 Fingers were in extension. Contra lateral side of fingers was in extension.

Figure 2.1 The 1st maneuver comprises of Prom See Na to Yoong Fon Hang

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Figure 2.2 The 2nd maneuver comprises of Lor Knaew

Figure 2.3 The 3rd maneuver comprises of Cha Nee Rai Mai

2.9 Thai dance maneuvers in mobilization techniques (median nerve)

2.9.1 Maneuvers of Thai dance

From the studies of Saleesing and Karukunchit (2003), Kosol and Saetang (2004), Pimsuteekunton and Janpram (2004) ,they showed that the effect of the Thai dance in participants with positive nerve tension of upper extremities. Thai dance maneuvers used, which has been popular and easy form**,** is similar to some component of the upper limb neurodynamic testing and treatment. They reported that Thai dance people can decrease upper limb nerve tension. In this study, Thai dance maneuvers designed to emphasize the median nerve of the studies of Saleesing and Karukunchit

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(2003).Thai dance program is Prom See Na to Yoong Fon Hang and Lor Knaew and Cha Nee Rai Mai [25-27].

Michel (2008) suggested the techniques of the mobilization of the nervous system that a sliding technique is less aggressive and may be more appropriate for acute injuries and situations which may lead to nerve irritation and entrapment. A tension technique may reduce intraneural swelling and circulatory compromise via fluctuating effects on intraneural pressure [51]. The sequence of Thai dance maneuvers is Prom See Na to Yoong Fon Hang, Lor Knaew and Cha Nee Rai Mai maneuvers.

2.9.2 Mobilization techniques of Thai dance program

2.9.2.1 Grade and numbers of repetitions**,** according to Butler (1991) and Jeffrey Alan Schroder (2003), the grade of mobilization in Thai dance is large amplitude (Grade II), slowly and rhythmically. The numbers of repetitions is a sequence of gentle oscillations and twenty repetitions per maneuvers for six minutes [7, 32]. From Richard and Kari (2002), median nerve mobilization is to extend the elbow for about two seconds just into the range where the participant feel tension but no reproduces the participant's symptoms (grade II-III).The participant’s responses dictate the degree of elbow extension during exercise. If pain or discomfort or any signs, such as tingling in the hand, are produced, the range of elbow extension is reduced [39].

2.9.2.2 Time of program, Richard and Kari (2002) suggested that participant is instructed to perform neural mobilization exercise one time per day at home [39]. Rozmaryn et al. (1998) and Akalin et al. (2002) showed that the end of treatment for three weeks, the patients in exercise group revealed a significant decrease in the pain value, increase in grip and pinch strength values and a decrease in SWMT value [15, 17]. Thai dance program is performed one time per day for three weeks. All participants will be tested data of severity of symptoms, functional status, Phalen test, Tinel’s test, SWMT value , hand grip and neurodynamic responses for patients with CTS both before and after Thai dance program on first day in first week, second week and third week.

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CHAPTER III
MATERIALS AND METHODS

3.1 Study design

This study is the pretest-posttest without control group, but using participants as their own control, since all participants were having no progression of the symptom from treatment.

3.2 Research participants

Twelve participants with clinical diagnosis of CTS and positive ULNT 1 were recruited in this study. All participants have age range between 30 and 60 years. Participants were recruited from the clinic of Faculty of Physical Therapy, Mahidol University. The aim and methods of the study were explained to all participants before their informed consents had given.

3.2.1 Inclusion criteria

3.2.1.1 The participants were included according to positive diagnosis of CTS and/or electromyography testing to confirm the diagnosis by Orthopaedics Surgeon or Physical Therapists, history of paresthesia or pain in the median nerve distribution and both clinical tests (Phalen/ Tinel's) and positive upper limb neurodynamic test 1(ULNT1)

3.2.1.2 Twelve participants with a diagnosis of early or moderate stage CTS were included in the study group. In early stage refers to intermittent pain or numbness in median nerve distribution, positive Phalen test more than 30 seconds and/or Tinel's test, normal or decrease sensation in median nerve distribution and normal strength of Abductor Pollicis Brevis muscle (APB). In moderate stage refers to pain or numbness in median nerve distribution, positive

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Phalen test more than 30 seconds and/or Tinel's test, decrease sensation in median nerve distribution and abductor Pollicis Brevis muscle weakness.

3.2.1.3 Stable of treatment result for three weeks

3.2.2 Exclusion criteria

Participants who had the following clinical sign were excluded from the study

3.2.2.1 Severe or chronic stage refers to constant numbness, loss of sensory (SWMT > 4.76), Positive Phalen test less than 30 seconds, symptoms for more than 1year, thenar muscle atrophy and severe pain (>8/10 on the patient pain analog scale).

3.2.2.2 Limit passive movements of neck and upper limb that might be aggravated during ULNT1 or Thai dance such as shoulder abduction and external rotation, elbow extension, wrist flexion and extension and fingers flexion and extension.

3.2.2.3 Any neuropathic disorder that might be aggravated by ULNT1 or Thai dance such as systemic peripheral neuropathy, cancer etc.

3.2.2.4 Unable to communicate or co-operate such as psycho-social problems

3.2.2.5 Having underlying metabolic disorders such as diabetes mellitus or thyroid disease

3.2.3 Withdrawal criteria

3.2.3.1 Did not participate Thai dance program everyday for three weeks

3.2.3.2 Did not participate reassessments once a week for three weeks

3.2.3.3 Aggravated symptoms of CTS such as paresthesia or pain in the median nerve distribution after Thai dance

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3.3 Variables

3.3.1 Independent variables

3.3.1.1Thai dance maneuvers used is similar to Thai dance maneuvers for median nerve mobilization by Saleesing and Karukunchit (2006) [25].

3.3.1.2 Duration of Thai dance program that decrease median nerve tension

3.3.2 Dependent variables

3.3.2.1 Severity of symptoms assessment by Severity of Symptoms Scale (SSS) and Functional Status Scale (FSS) questionnaire

3.3.2.2 Severity of symptoms in the median nerve distribution of the hand by using Phalen test and Tinel's test.

3.3.2.3 Hand light touch sensation value in the median nerve distribution of the hand by using Semmes-Weinstein Monofilament Tests (SWMT)

3.3.2.4 Hand motor strength value in the median nerve distribution of the hand by using hand grip strength and tip to tip pinch strength test

3.3.2.5 Neuromechanical tension in the median nerve distribution by using ULNT1

3.3.3 Control variables

3.3.3.1 Sequence of assessment

3.3.3.2 Interval of rest time during each testing

3.3.3.3 Participants remain on their previous conservative treatment such as mediation, ultrasound

3.4 Measurements

Several measurement tools were selected for use in this study in order to reflect the multidimensional presentation of CTS that encompasses its characteristic presentation of pain, daily pattern, and limitation of range of movement and function.

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The following assessment methods, including questionnaire for assessment of severity of symptoms and functional status, Phalen test, Tinel'sign , Semmes-Weinstein Monofilament tests (SWMT), grip strength, Tip to tip pinch strength and ULNT1 measurement, are carried out for all patients.

3.4.1 Severity of Symptoms Scale (SSS) and Functional Status Scale (FSS) questionnaire

The Symptom Severity Scale (SSS) has eleven questions concerning pain, numbness, tingling, and weakness. The Functional Status Scale (FSS) has eight questions (difficulty in writing, buttoning clothes, opening jars, holding a book, gripping of a telephone handle, household chores, carrying of grocery bags, bathing, and dressing). Each scale generates a final score (sum of individual scores divided by number of items) which ranges from 1 to 5, with a higher score indicating greater disability. The answers were rated from 1 point (no symptoms or no difficulty with activity) to 5 points (most severe symptoms completely preventing the activity or cannot perform activity at all). It was concluded by Levine et al. [42]. The questionnaire is translated for Thai language by Sukaval [53].

3.4.2 Phalen Test

3.4.2.1 The participants were asked to sit on a chair.

3.4.2.2 The examiner explained to the participant that I am going to examine median nerve compression at the hand. If you feel discomfort such as pain, numbness or tingling at any hand or fingers, please tell me.

3.4.2.3 Participants' wrists are dropped into full flexion.

3.4.2.4 Participants' fingers and thumbs were extended.

3.4.2.5 The dorsal surfaces of the hands was placed together with elbows bent and shoulder abducted.

3.4.2.6 The test was recorded as positive if the participant experiences pain or paresthesia (numbness, tingling) in at least one of three radial digits within 60 seconds of sustain flexion. The examiner recorded time that the participant experiences pain or paresthesia.

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Figure 3.1 Phalen Test

3.4.3 Tinel's test

3.4.3.1 The participants were asked to sit on a chair.

3.4.3.2 The examiner explained to the participant that I am going to examine recovery of median nerve at the hand. If you feel discomfort at any finger, please tell me.

3.4.3.3 The participants were applied tap with a fingertip over the transverse carpal ligament.

3.4.3.4 The test was recorded positive if the participant experiences paresthesia or tingling in at least one of three radial digits. The examiner recorded distance from the point that the participant experiences pain or paresthesia to transverse carpal ligament.

Figure 3.2 Tinel's test

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3.4.4 Semmes- Weinstein Monofilament tests (SWMT)

3.4.4.1 Participants were asked to sit on a chair.

3.4.4.2 The examiner explained to the participant that I am going to examine your light tough sensation at the finger tip. If you feel at any finger tip, please tell me that finger.

3.4.4.3 Participants asked to relax their arms and the tested hand with their eye closed.

3.4.4.4 For the first, the smallest monofilament, 2.83, was applied on the participant's distal pads of the finger tip with the wrist in neutral position at random and held for two seconds.

3.4.4.5 The result was recorded only index finger.

3.4.4.6 If the participant felt a 2.83 filament, the examiner recorded the size of that filament. If the participant did not respond to the 2.83 filament, the next number of filament was used until the participant responded and recorded the size of that filament.

3.4.4.7 The examiner repeated testing three times

3.4.4.8 The test was considered positive if the participant was unable to detect the pressure of the 3.61, 4.31, 4.56, or 6.65 filaments for that finger. Severity of decreased sensation was normal <2.83, diminish light touch: 3.22 - 4.56, diminish protective sensation: 4.74 - 6.10, and loss of protective sensation: 6.10 - 6.65

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Figure 3.3 Semmes- Weinstein Monofilament

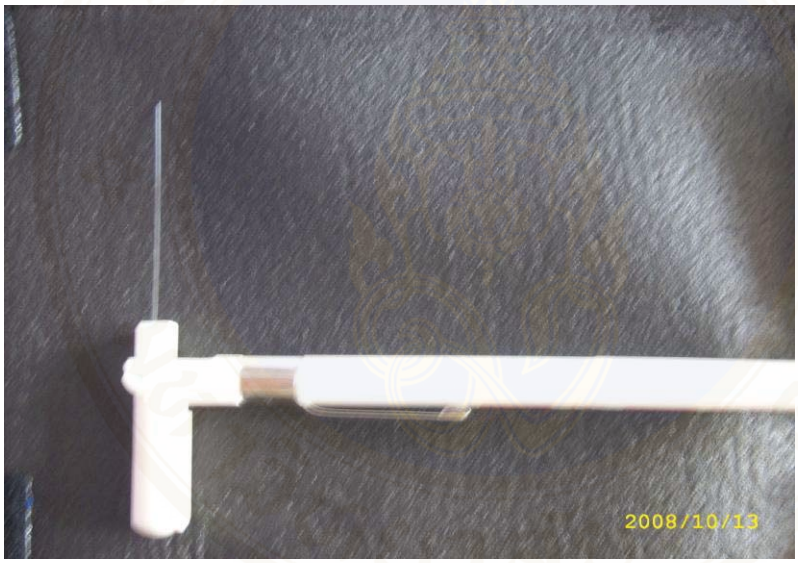

Figure 3.4 Semmes- Weinstein Monofilament

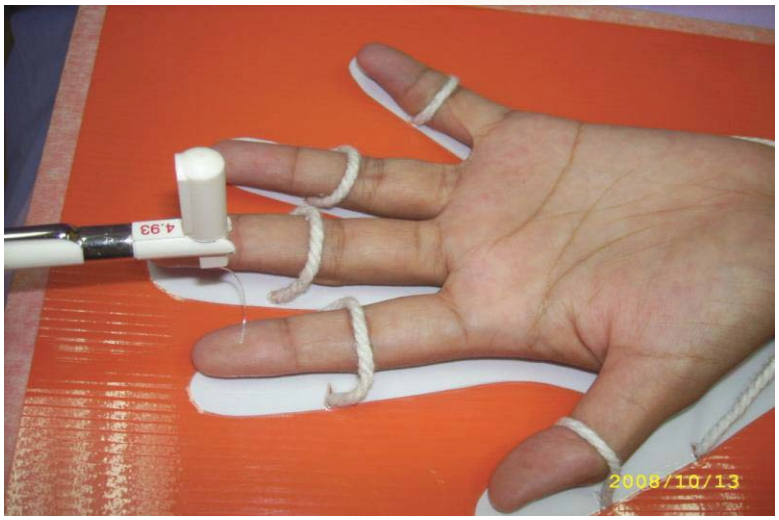

Figure 3.5 Semmes- Weinstein Monofilament tests (SWMT)

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3.4.5 Hand grip strength test

3.4.5.1 The participants were asked to sit on a chair and tested by holding the dynamometer in the tested hand. The elbow flexed to 90 degrees and shoulder adducted by the side of the body. The handle of the dynamometer was adjusted if was required.

3.4.5.2 The base of the dynamometer rested on first metacarpal (heel of palm), while the handle should rest on middle of four fingers.

3.4.5.3 The participants were asked to squeeze the dynamometer with maximum isometric effort, which was maintained for about five seconds. No other body movement was allowed.

3.4.5.4 The examiner repeated testing three times, and the mean of the values was calculated. The mean score of three trials were recorded, with at least 15 seconds recovery between each effort.

3.4.5.5 A baseline grip strength measure was collected on the dominant hand of each subject.

3.4.5.6 The values were listed in kilograms give to compare with standard for adults. They were the average of the best scores of each hand.

3.4.5.7 The dynamometer was adjusted for hand size. This was done to minimize of to enhance the accuracy of the measurement.

3.4.5.8 It was also useful to record whether the participant was left or right hand, as this can help in the interpretation of results. The non-dominant hand usually scores about 10% lower.

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Figure 3.6 JAMAR dynamometer

Figure 3.7 Hand grip strength test

3.4.6 Tip to tip pinch strength test

3.4.6.1 The participants were asked to sit on a chair and held the pinch dynamometer in the tested hand. The pulp of thumb and index fingers flexes with the elbow flexed to 90 degrees and shoulder adducted by the side of the body. The handle of the dynamometer was adjusted if was required.

3.4.6.2 The participants were asked to squeeze the pinch dynamometer with maximum isometric effort, which was maintained for about five seconds. No other body movement was allowed.

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3.4.6.3 The examiner repeated the testing three times, and the mean of the values was calculated. The mean score of three trials were recorded, with at least 15 seconds recovery between each effort.

3.4.6.4 A baseline measure was collected on the dominant hand of each participant.

3.4.6.5 The values were listed in kilograms to compare with standard data for adults.

Figure 3.8 Pinch dynamometer

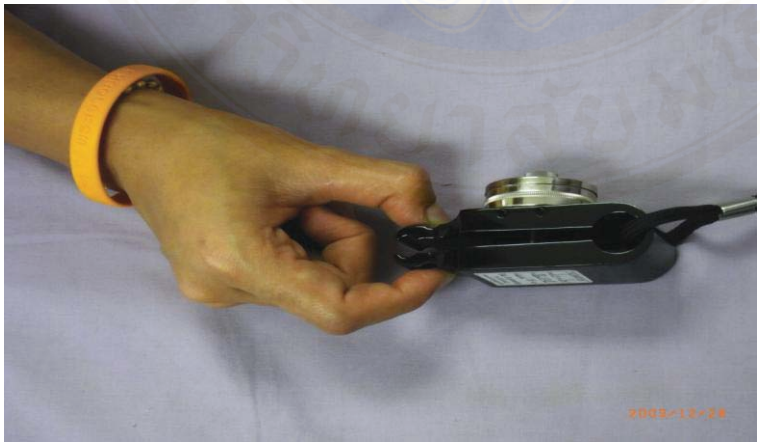

Figure 3.9 Tip to tip pinch strength test

3.4.7 Upper limb neurodynamic test 1(ULNT 1)

In order to standardize the range if shoulder girdle is in depressions, shoulder is in abduction and external rotation, forearm is in supination, fingers are in full extension, wrist is in neutral position, and elbow is in extension, in each

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participant during the test procedure the follow equipment was utilized a shoulder depression sensor spring (Figture 3.10), head block (Figture 3.11), shoulder abduction block (Figture 3.12), and a standard goniometer (Figture 3.13).

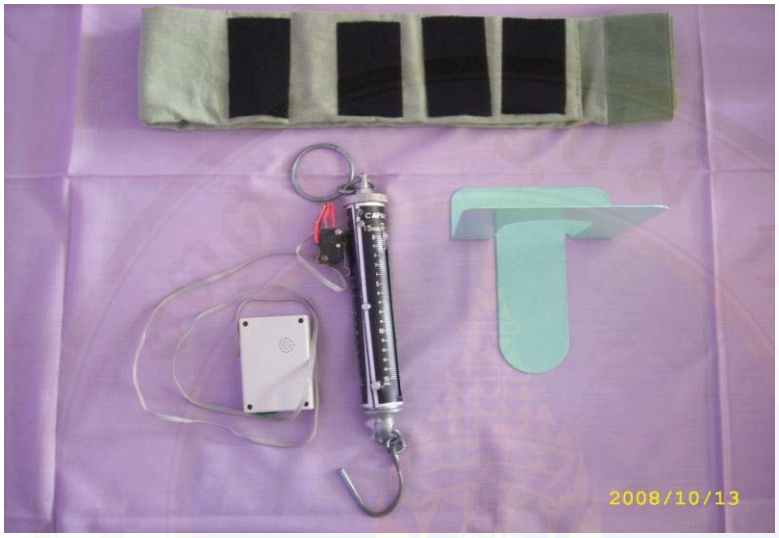

Figure 3.10 Shoulder depression sensor spring

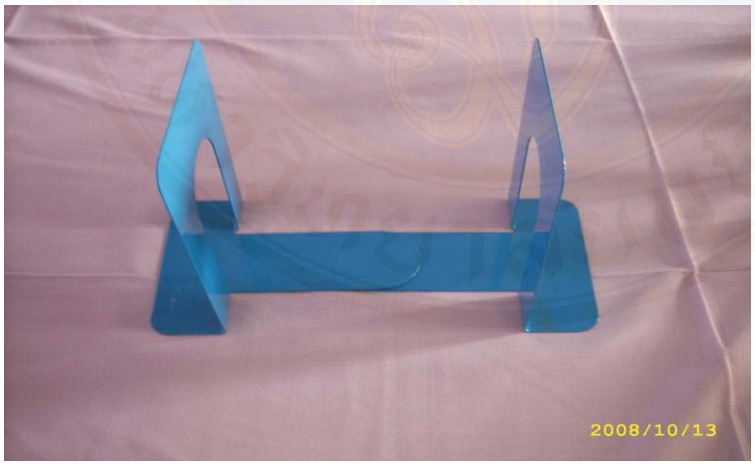

Figure 3.11 Head block

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Figure 3.12 Shoulder abduction block

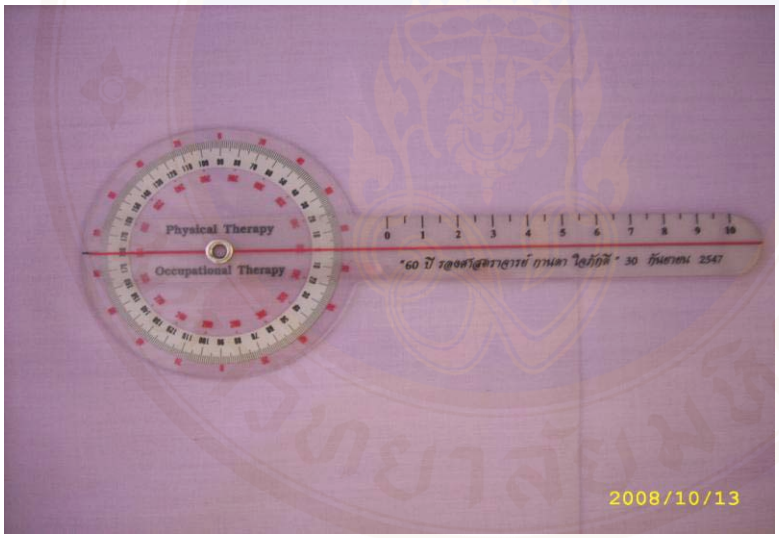

Figure 3.13 Standard goniometer

Participant preparation and preliminary testing, the participants were suitably undressed to allow free movement of the side to be tested. All jewellery and watches were removed from the tested side. Bony landmarks were on the skin over, the lateral epicondyle and the ulnar styloid process, and the medial side of the upper arm (parallel to the humerus). The neck and arm participant's muscles were stretched and held for 30 seconds. The stretching position for Trapezius muscle was full flexion and lateral flexion to opposite and rotation to the same side of neck. The stretching position for Pectoralis muscle was horizontal abduction, extension and external

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rotation with elbow flexion. The stretching position for Teres major, Teres minor and Latissimus dorsi was full range of abduction, external rotation of shoulder with elbow flexion and hand behind back. The method was adopted was a combination of the methods to tested by a single examiner, to examine. Those participants with CTS were aggregated by wrist flexion or extension. Then the participant's wrist was in neutral position followed by forearm supination.

3.4.7.1 The participants were in a supine position without a pillow. Their head was placed on a fixed board, with legs straight. This position was secured with a head block around head and neck to prevent lateral and rotating movement of the head and neck during the test (Figure 3.14).

3.4.7.2 The test arm was placed in its starting position with the shoulder was in neutral, the elbow flexed and the forearm, wrist and fingers were in neutral. The non-tested arm was on the body's side with the hand resting on the abdomen.

3.4.7.3 All movements were taken to the end of available range (R2) or to the point where first symptoms are produced (P1). However, if there were no symptoms or normal sensations, movement are taken to full available range [60].

3.4.7.4 The examiner explained to the participant that I am going to examine your neurodynamic response at the shoulder, arm, hand and fingers. If you feel discomfort such as pain, numbness or tingling, please tell me.

3.4.7.5 The shoulder girdle was depressed in to a neutral position and through the point that the tissues stent to resist. The shoulder girdle was depressed with an initial force of 40 N, prior to adding the other components of the ULNT 1. The shoulder girdle was depressed by spring. A constant pressure of 40 N was maintained with a pressure sensor that was folded in the superior region of the subject's shoulder [7, 61, 62] (Figure 3.15).

3.4.7.6 Shoulder abduction was then performed to a maximum of 110^{o} and examiner applied shoulder abduction block to prevent adduction movement of the shoulder (Figure 3.16).

3.4.7.7 Shoulder was in full external rotation (Figure 3.16).

3.4.7.8 Forearm was in full supination (Figure 3.16).

3.4.7.9 Wrist and fingers was in full extension (Figure 3.17).

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3.4.7.10 Therefore, the last component to be added was elbow extension. The examiner instructed the participant to extend the elbow slowly without sudden accelerations. The range of movement at elbow was measured with a standard goniometer giving a measure of the lack of elbow extension range (Figure 3.17).

Figure 3.14 Supine position with head block

Figure 3.15 Shoulder depression sensor

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Figure 3.16 Shoulder abduction block

Figure 3.17 Elbow extension

3.5 Thai dance program

Thai dance is self neural mobilization exercise to stretch the median nerve for three week of treatment. Thai dance maneuvers is similar to Thai dance maneuvers for median nerve mobilization by Saleesing and Karukunchit (2003)[25].

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During Thai dance, the upper extremities were in three maneuvers. Each maneuver was maintained for two seconds at the final stretched maneuver. The participants were instructed to perform Thai dance program one set per day, everyday. Thai dance program was continued for three weeks. Thai dance program was one time of 10 repetitions in first maneuver, 20 repetitions in second and third maneuvers.

Figure 3.18 The 1st maneuver comprises of Prom See Na to Yoong Fon Hang

Figure 3.19 The 2nd maneuver comprises of Lor Knaew

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Figure 3.20 The 3rd maneuver comprises of Cha Nee Rai Mai

3.6 Procedure

3.6.1 The examiner explained the aim and methods of this study to potential participants.

3.6.2 The examiner was to eligible criteria screening of potential participants.

3.6.3 The participants obtained inform consent prior to the examination.

3.6.4 In first week

3.6.4.1 The participants were examined the outcome measurement before Thai dance on first day.

3.6.4.2 The examiner described and demonstrated Thai dance position with brochure and CD ROM.

3.6.4.3 The participants performed Thai dance one time for five minutes and the examiner observed and corrected the participant's performance.

3.6.4.4 The participants were examined the outcome measurement after Thai dance.

3.6.4.5 The examiner reviewed Thai dance program to ensure that the participant's condition was not aggravated by Thai dance.

3.6.4.6 Participants were given brochure and CD ROM describing Thai dance program and a daily symptom diary to check participant's symptom after Thai dance that the participants did not exercise too aggressive.

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3.6.4.7 Participants performed Thai dance program with CD ROM at home one time, everyday and recorded a daily symptom everyday.

3.6.4.8 The examiner randomly checked the participant's symptom by phone that the participants were progressing well without any complication.

3.6.5 In the second and third weeks

3.6.5.1 The examiner received a daily symptom everyday and checked the participant's symptom.

3.6.5.2 The examiner reviewed Thai dance program to ensure that the participant's condition was not aggravated by Thai dance.

3.6.5.3 The participants were examined the outcome measurement before Thai dance.

3.6.5.4 The participants performed Thai dance one time for five minutes and the examiner corrected each maneuver.

3.6.5.5 The participants were examined the outcome measurement after Thai dance.

3.6.5.6 Participants performed Thai dance program with CD ROM at home one time, everyday and recorded a daily symptom everyday.

3.6.5.7 The examiner randomly checked the participant's symptom by phone that the participants were progressing well without any complication.

3.6.6 At the end of Thai dance program for three weeks, the participants were examined the outcome measurement on last day and the examiner analyzed data.

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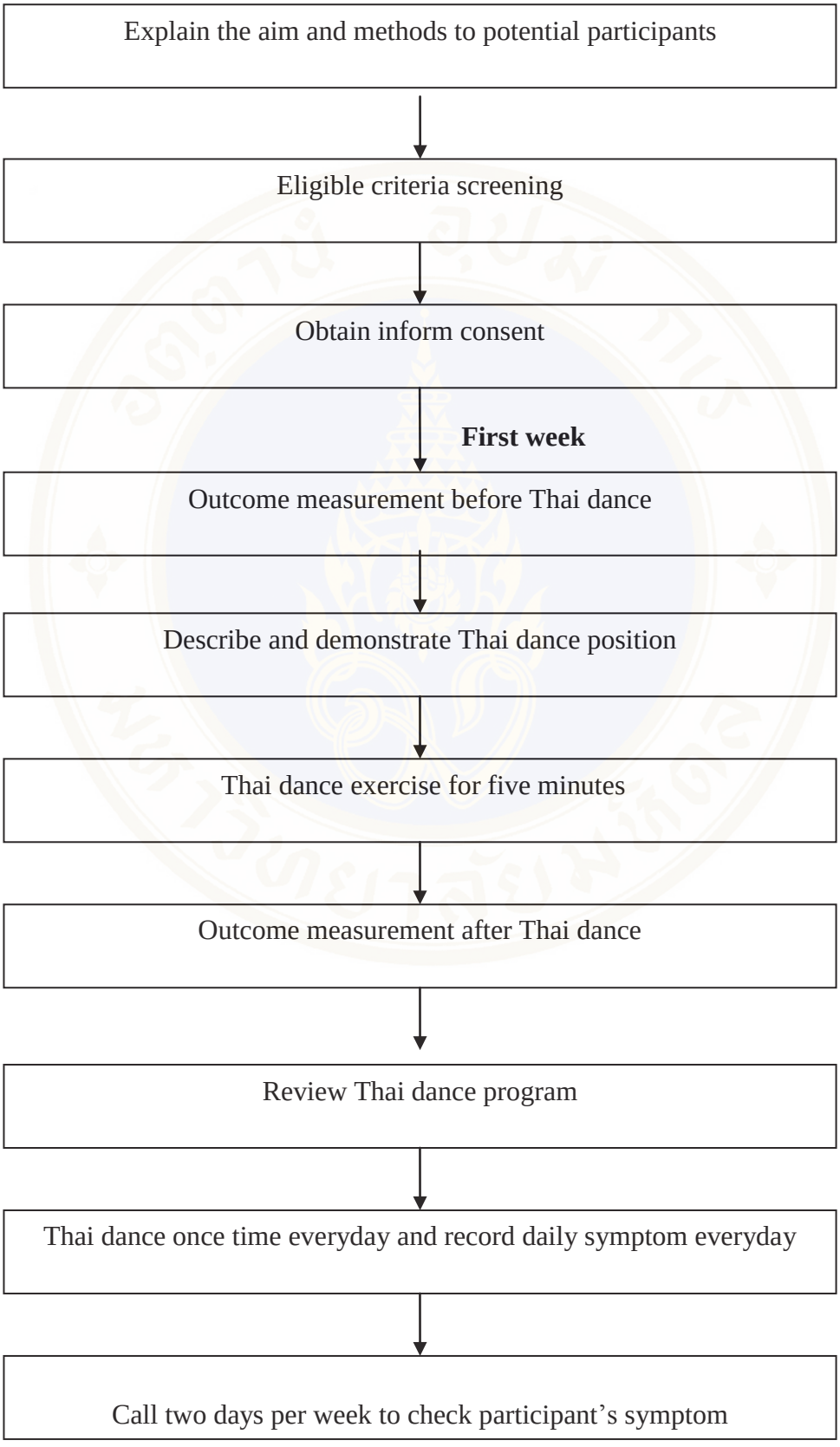
3.7 Study Scheme



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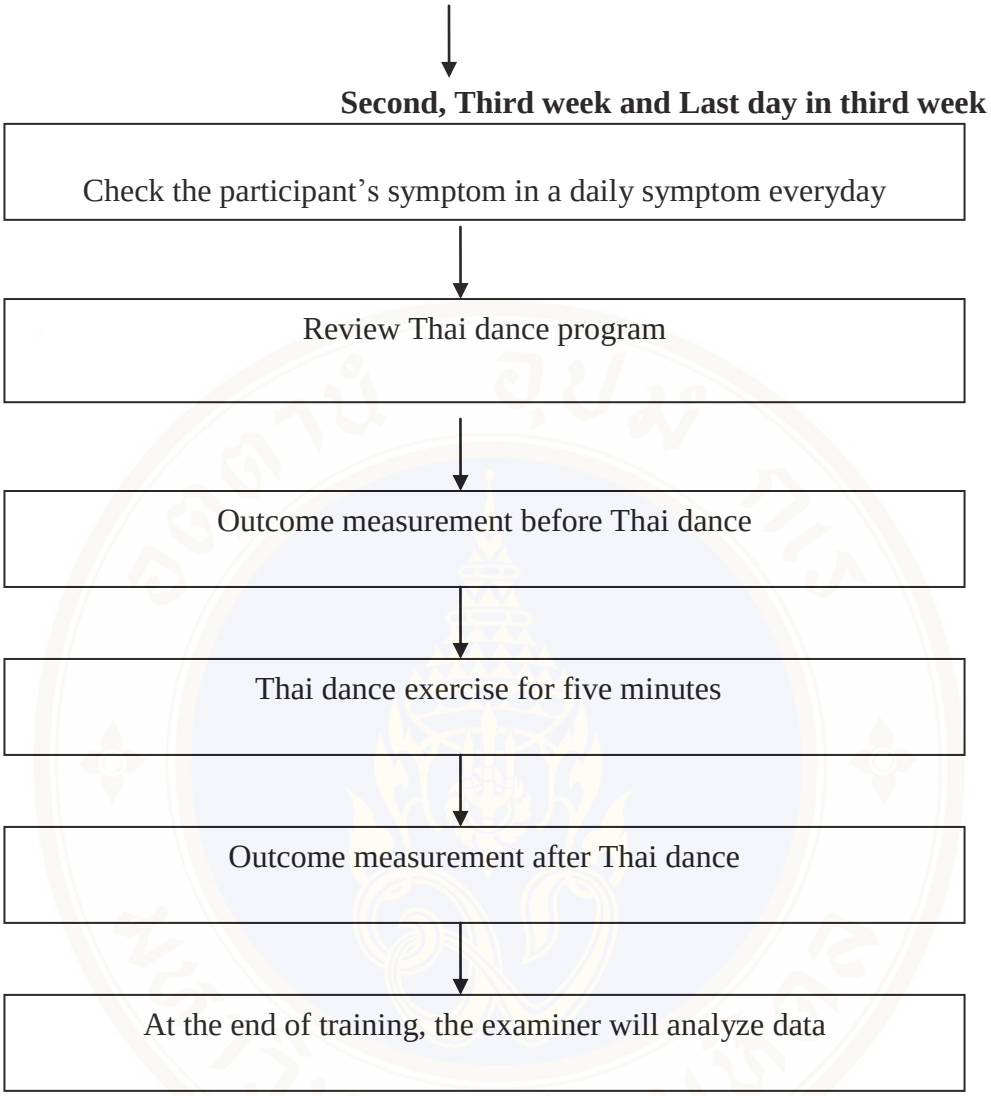

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3.8 Data collection

All data were collected in a private room in the Clinical Lab. The following assessment methods, including questionnaire for assessment of severity of symptoms and functional status measurement, Tinel's sign and Phalen tests, sensation test (SWMT), grip and pinch strength, and ULNT 1 were carried out for all participants both before and after Thai dance program for three weeks (four visits). Participants participated in one testing session, ranging from three to five minutes. All participants were tested to collect data both before and after Thai dance program on first day in first week, second week, third week and last day in third week. The examiner analyzed data

3.9 Data analysis

The SPSS for Microsoft windows release 17.0 program was used for statistical analysis in this study. The statistical significance was set at probality (p-value) level of less than 0.05 ($p < 0.05$).

3.9.1 Kolmogorov-Smirnov Goodness of fit-test was used for testing normal distribution of the data.

3.9.2 One- way repeated measure analysis of variance or Friedman test was used to determine the effects of Thai dance on the measured variables at different time.

3.9.3 Bonferroni test or multiple comparisons after Friedman test was used for determining the pairs of means that were significantly different.

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CHAPTER IV
RESULTS

4.1 Characteristics of Participants

4.1.1 The characteristics of participants including gender, age, occupation and hand domination

Twelve participants with carpal tunnel syndrome (11 females, 1 male) aged from 31 to 60 years. The majority of them (50%) were 51 to 60 years old. Their occupations were sedentary (66%), house worker (17%) and merchant (17). The most affected hand was right side (75%). The characteristics of participants including gender, age, occupation and hand domination are shown in table 4.1

Table 4.1 The characteristics of participants including gender, age, occupation and hand domination

Characteristics	Number	Percentage
1 Gender		
Female	11	92
Male	1	8
2 Age (years)		
31-40	1	8
41-50	5	42
51-60	6	50
3 Occupation		
House worker	2	17
Merchant	2	17
Sedentary	8	66

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Table 4.1 The characteristics of participants including gender, age, occupation and hand domination (continued)

Characteristics	Number	Percentage
4 Affected hand		
Right side	9	75
Left side	1	8
Bilateral side	2	17
5 Hand domination		
Right side	10	83
Left side	2	17

4.1.2 The characteristics of participants' illness, symptoms and treatment

In this study, all participants remained on their previous conservative treatment as it was assigned according to clinical reasoning, and the decisions were made by the medical doctors and/or physical therapists. Most of them (66%) had suffered from CTS for 6 to 12 months before they went to see the doctors or physical therapists while the most of them had symptom less than 6 months (34%). No one had treatment for more than 12 months. In the part of symptoms 66% of them had numbness, 25% had weakness, and the last 7% had combination of pain and numbness. No one had only pain or weakness or combination of pain, numbness and weakness. The treatments for all participants were combination of superficial heat, ultrasound, massage and wrist self-stretching. 41% of them had median nerve mobilization, 33% had oral medication, 25% had carpal bone mobilization and the last 17% had wrist splint. No one had history of steroid injection. From the recorded data, duration of CTS illness, symptoms and the frequencies of the use of conservative treatment are shown in table 4.2.

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Table 4.2 The characteristics of participants by duration of CTS illness, symptoms and treatment

Characteristics	Number	Percentage
1 Duration of CTS illness		
Less than 6 months	4	34
6 to 12 months	8	66
2 Symptoms		
Numbness	8	66
Weakness	3	25
Pain and numbness	1	7
3 Treatment		
Oral medication	4	33
Wrist splint	2	17
Superficial heat	12	100
Ultrasound	12	100
Massage	12	100
Stretching exercise	12	100
Carpal bone mobilization	3	25
Nerve mobilization	5	41

4.2 Comparison of the clinical test score for CTS

4.2.1 Comparison of Severity of Symptoms Scale (SSS) and Functional Status Scale (FSS)

From this study, the SSS and FSS from 1st, 2nd, 3rd week and last day of 3rd week showed similar pattern of decrease. That is decreased gradually overtime. Mean of SSS before Thai dance at 1st week was 23.17 that refer to mild symptoms (Table 4.3). After Thai dance at last day of 3rd week, the mean of SSS was 14.25 that refer to mild symptom (Table 4.3). When compared with baseline data, the change of SSS from 1st week measurement to 2nd week, 3rd week and last day of 3rd week measurement still occurred. Multiple comparisons of SSS after Friedman test revealed

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statistical significant difference ($p<0.05$) at 1st week, 2nd week, 3rd week and last day of 3rd week (Table 4.4).

Mean of FSS before Thai dance at 1st week was 19.5 that refer to moderate difficulty (Table 4.5). After Thai dance at last day of 3rd week, the mean of FSS was 12.83 that refer to mild difficulty (Table 4.5). When compared with baseline data, the change of FSS from 1st week measurement to 2nd week, 3rd week and last day of 3rd week measurement still occurred. Multiple comparisons of FSS after Friedman test revealed with statistical significant difference ($p<0.05$) at 1st week, 2nd week, 3rd week and last day of 3rd week. The means and standard deviation of SSS and FSS are shown in table 4.3 and 4.5 respectively. The comparison of SSS and FSS are shown in figure 4.1 and 4.2 respectively. Multiple comparisons among various times of SSS and FSS are shown in table 4.4 and 4.6 respectively.

Table 4.3 Means and standard deviation of SSS

Week	**Mean (score)**	**Standard deviation**
Week_1	23.17	3.86
Week_2	20	3.02
Week_3	17.33	2.50
Last day of week_3	14.25	2.01

Week_1 = before Thai dance at 1st week
Week_2 = before Thai dance at 2nd week
Week_3 = before Thai dance at 3rd week
Last day of week_3 = before Thai dance at last day of 3rd week

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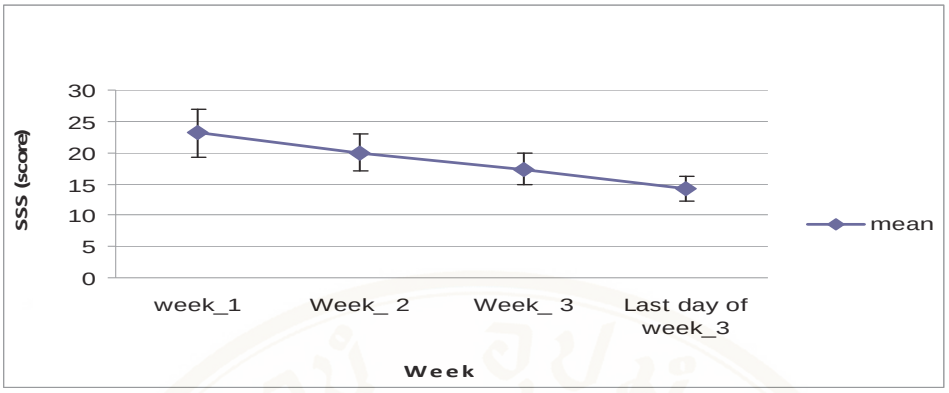

Figure 4.1 Comparison of Severity of symptoms scale (SSS)

Week_1 = before Thai dance at 1st week

Week_2 = before Thai dance at 2nd week

Week_3 = before Thai dance at 3rd week

Last day of week_3 = before Thai dance at last day of 3rd week

Table 4.4 Multiple comparisons of SSS among various times of assessment

Week	Week_1	Week_2	Week_3	Last day of week_3
Week_1	_	0.001*	0.001*	0.001*
Week_2	_	_	0.001*	0.001*
Week_3	_	_	_	0.003*
Last day of week_3	_	_	_	_

* Statistical significant difference from Friedman test at $p < 0.05$

Week_1 = before Thai dance at 1st week

Week_2 = before Thai dance at 2nd week

Week_3 = before Thai dance at 3rd week

Last day of week_3 = before Thai dance at last day of 3rd week

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Table 4.5 Means and standard deviation of FSS

Week	Mean (score)	Standard deviation
Week_1	19.50	3.83
Week_2	16.50	3.66
Week_3	14.75	2.28
Last day of week_3	12.83	2.79

Week_1 = before Thai dance at 1st week

Week_2 = before Thai dance at 2nd week

Week_3 = before Thai dance at 3rd week

Last day of week_3 = before Thai dance at last day of 3rd week

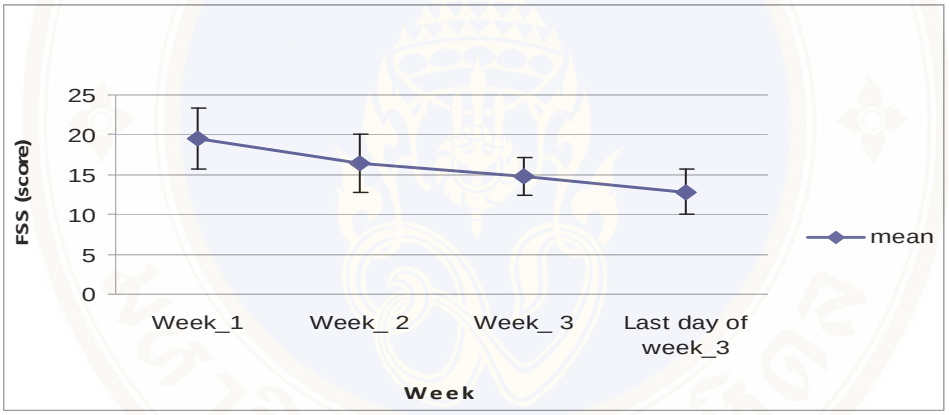

Figure 4.2 Comparison of Functional status scale (FSS)

Week_1 = before Thai dance at 1st week

Week_2 = before Thai dance at 2nd week

Week_3 = before Thai dance at 3rd week

Last day of week_3 = before Thai dance at last day of 3rd week

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Table 4.6 Multiple comparisons of FSS among various times of assessment

Week	Week_1	Week_2	Week_3	Last day of week_3
Week_1	_	0.002*	0.001*	0.001*
Week_2	_	_	0.007*	0.002*
Week_3	_	_	_	0.003*
Last day of week_3	_	_	_	_

* Statistical significant difference from Friedman test at $p< 0.05$

Week_1 = before Thai dance at 1st week

Week_2 = before Thai dance at 2nd week

Week_3 = before Thai dance at 3rd week

Last day of week_3 = before Thai dance at last day of 3rd week

4.2.2 Comparison of time response to positive Phalen test

The time that the participant started to have symptoms during performing Phalen test was recalculated. From the study, mean of time response to positive Phalen test before Thai dance at the first day was 29 seconds. Mean of time response to positive Phalen test after Thai dance immediately at the first day was 38.36 seconds. It showed immediate effect after Thai dance. The end of Thai dance program at last day of 3rd week, mean of time response to positive Phalen test was 54.29 seconds. When compared with the base line data, the participants were likely to show better results at all periods.

The results of one-way repeated measures analysis of variance revealed statistical significant difference ($p<0.05$). Thus, Bonferroni test was used to determine which pairs of means that were statistical significant difference. The statistical significant was not found for one week after Thai dance. However, the comparison o the time response to positive Phalen test after Thai dance for two weeks were increase significantly. Means and standard deviation of time by the participant's response positive Phalen test are shown in table 4.7, and the comparisons of time are shown in

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figure 4.3. Multiple comparisons among various times of measurement Phalen test are reported in table 4.8.

Table 4.7 Means and standard deviation of time response to positive Phalen test

Week	Mean (second)	Standard deviation
Pre_1	29	10.55
Post_1	38.36	11.26
Pre_2	39.21	11.97
Post_2	44.01	8.63
Pre_3	46.79	15.14
Post_3	51.57	10.11
Last-pre_3	50.71	13.28
Last-post_3	54.29	7.56

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

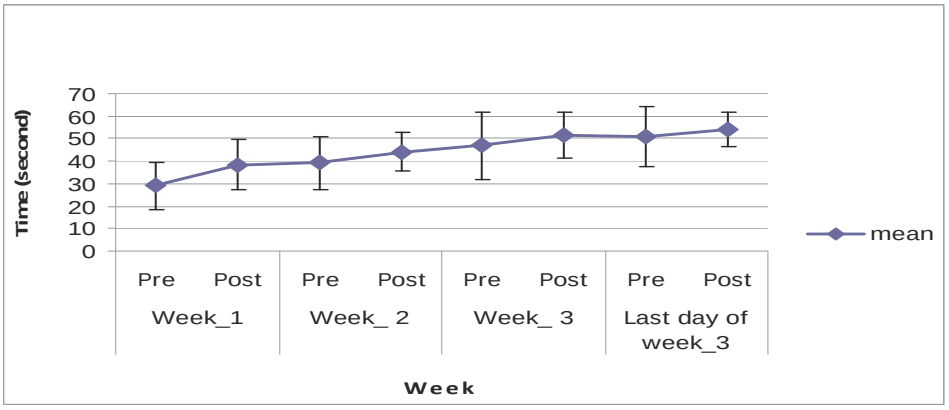

Figure 4.3 Comparison of time response to positive Phalen test

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Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

Table 4.8 Multiple comparisons of time response to positive Phalen test among various times of assessment

Week	Pre_1	Post_1	Pre_2	Post_2	Pre_3	Post_3	Last-pre_3	Last-post_3
Pre_1	_	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Post_1	_	_	1.000	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Pre_2	_	_	_	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Post_2	_	_	_	_	1.000	<0.001*	<0.001*	<0.001*
Pre_3	_	_	_	_	_	0.013*	0.005*	0.002*
Post_3	_	_	_	_	_	_	1.000	0.083
Last-pre_3	_	_	_	_	_	_	_	0.146
Last-post_3	_	_	_	_	_	_	_	_

* Statistical significant difference from Bonferroni test at p< 0.05

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

4.2.3 Comparison of distance response to positive Tinel's test

In this study, six participants (6 hands) had positive Tinel's test before start Thai dance at 1st week. Mean distance response to positive Tinel test before and

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after Thai dance immediately had no difference at all periods. However, means of distance response to positive Tinel test at 1st week, 2nd week, 3rd week and last day of 3rd week were 0.83, 0.81, 0.73 and 0.67 respectively. It revealed that the participants had continued Thai dance, the distance from wrist to tapping area became shorter. The results of multiple comparisons after Friedman test showed with no statistical significant difference for the immediate effect and one week after Thai dance. Means and standard deviation of distance by the participant's response positive Tinel's test is shown in table 4.9, and the comparison of distance is shown in a figure 4.4. Multiple comparisons among various times of measurement Tinel's test are reported in table 4.10.

Table 4.9 Means and standard deviation of distance by the participant's response positive Tinel's test

Week	**Mean (cm.)**	**Standard deviation**
Pre_1	0.83	1
Post_1	0.83	1
Pre_2	0.81	0.98
Post_2	0.81	0.98
Pre_3	0.73	0.88
Post_3	0.73	0.88
Last-pre_3	0.67	0.81
Last-post_3	0.67	0.81

Pre_1	= before Thai dance at 1st week
Post_1	= after Thai dance at 1st week
Pre_2	= before Thai dance at 2nd week
Post_2	= after Thai dance at 2nd week
Pre_3	= before Thai dance at 3rd week
Post_3	= after Thai dance at 3rd week
Last-pre_3	= before Thai dance at last day of 3rd week
Last-post_3	= after Thai dance at last day of 3rd week

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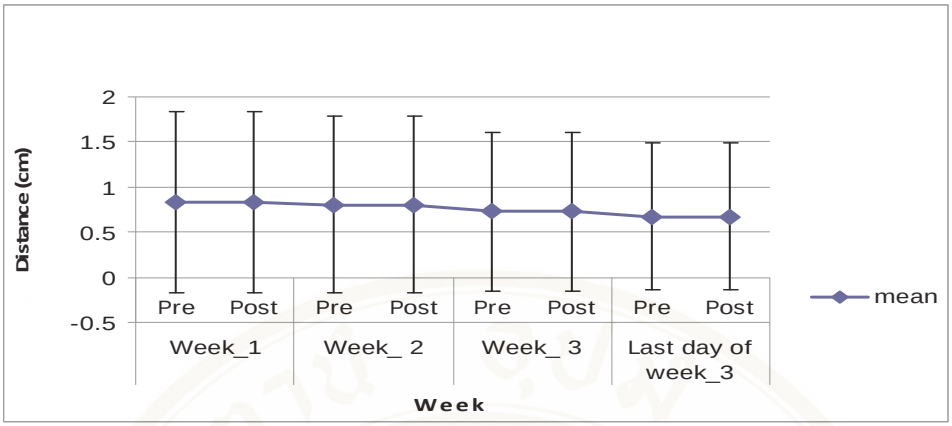

Figure 4.4 Comparison of distance by the participant's response positive Tinel's test

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

Table 4.10 Multiple comparisons of distance by the participant's response positive Tinel's test among various times of assessment

Week	Pre_1	Post_1	Pre_2	Post_2	Pre_3	Post_3	Last-pre_3	Last-post_3
Pre_1	_	1.000	0.317	0.317	0.039*	0.039*	0.034*	0.034*
Post_1	_	_	0.317	0.317	0.039*	0.039*	0.034*	0.034*
Pre_2	_	_	_	1.000	0.034*	0.034*	0.038*	0.038*
Post_2	_	_	_	_	0.034*	0.034*	0.038*	0.038*
Pre_3	_	_	_	_	_	1.000	0.102	0.102
Post_3	_	_	_	_	_	_	0.102	0.102
Last-pre_3	_	_	_	_	_	_	_	1.000
Last-post_3	_	_	_	_	_	_	_	_

* Statistical significant difference from Bonferroni test at $p < 0.05$

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

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Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

4.2.4 Comparison of hand light touch sensation

Hand light touch sensation value was evaluated by using Semmes-Weinstein Monofilament Test (SWMT). It was recorded by the size of the smallest filament that participant was able to detect the pressure on the affected side. The mean of monofilament size before and after Thai dance at the first day were 3.75 and 3.60 respectively that refers to moderate stage of CTS. The size of monofilament that participant was able to detect decreased after Thai dance immediately. Whereas, the mean of monofilament size after Thai dance at last day of 3rd week was 3.16 that refer to mild stage of CTS. When compared with baseline data, the participant was likely to show improvement at all periods. The results of multiple comparisons after Friedman test revealed the statistical significant difference after Thai dance for one week. The percentile at 25th , 50th and 75th of hand light touch sensation value of SWMT are shown in table 4.11, and the comparison of hand light touch sensation are shown in figure 4.5, and multiple comparisons among various times of measurement are reported in table 4.12.

Table 4.11 Percentile 25th , 50th and 75th of hand light touch sensation value for SWMT

Week	Percentile 25th	Percentile 50th	Percentile 75th
Pre_1	3.61	3.61	3.90
Post_1	3.61	3.61	3.61
Pre_2	3.61	3.61	3.67
Post_2	3.22	3.22	3.61
Pre_3	3.22	3.61	3.61
Post_3	3.22	3.22	3.61
Last-pre_3	3.22	3.22	3.61
Last-post_3	3.12	3.22	3.22

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Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

2.83 = Normal

3.61 = Diminished light touch

4.31 = Diminished protection sensation

4.56 = Loss of protective sensation

6.65 = Untested able

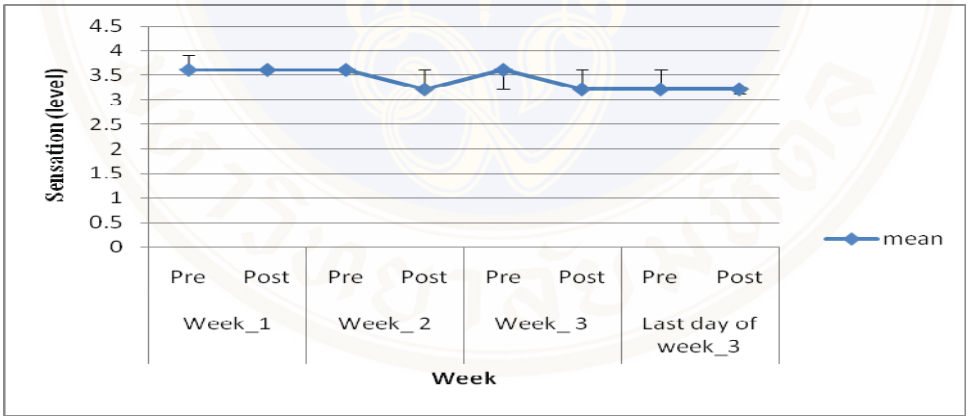

Figure 4.5 Comparison of hand light touch sensation value for SWMT

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

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Table 4.12 Multiple comparisons of hand light touch sensation value for SWMT among various times of assessment

Week	Pre_1	Post_1	Pre_2	Post_2	Pre_3	Post_3	Last-pre_3	Last-post_3
Pre_1	_	0.023*	0.083	0.001*	0.004*	0.001*	0.001*	0.001*
Post_1	_	_	0.317	0.011*	0.025*	0.001*	0.002*	0.001*
Pre_2	_	_	_	0.002*	0.008*	,0.001*	0.001*	0.001*
Post_2	_	_	_	_	0.083	0.046*	0.083	0.007*
Pre_3	_	_	_	_	_	0.008*	0.014*	0.001*
Post_3	_	_	_	_	_	_	0.317	0.025*
Last-pre_3	_	_	_	_	_	_	_	0.014*
Last-post_3	_	_	_	_	_	_	_	_

* Statistical significant difference from Freidman test at $p< 0.05$

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

4.2.5 Comparison of hand strength value for hand grip and tip to tip pinch strength test

Hand grip and tip to tip pinch strength were found in the similar pattern of increase. There were increased gradually overtime. Mean of hand grip strength value before and after Thai dance immediately at the first day were 21.68 and 23.57 kg. respectively. It showed immediate effect after Thai dance. Mean of hand grip strength after Thai dance at last day of 3rd week was 26.79 kg that was similar to hand grip strength of female Thai adult (26.25 kg.). When compared with baseline data, the increase of hand grip strength from 1st week measurement to 2nd week, 3rd week and last day of 3rd week measurement still occurred. Results of one-way repeated measurement analysis of variance revealed with statistical significant difference ($p<0.05$). Thus, Bonferroni test was used to determine the pairs of means that were

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significantly different. There was no significant change after Thai dance one week. While, significant difference was seen after Thai dance two weeks.

Mean of tip to tip pinch strength value before and after having Thai dance immediately at the first day were 4.43 and 5.64 kg. respectively. The immediate improvement was found. After Thai dance for three weeks,mean of tip to tip pinch strength was 7.14 kg that was similar to tip to tip pinch strength of Thai adult (6.31 kg.). When compared with baseline data, the participants were likely to show better results at all weeks. The results of multiple comparisons after Freidman test was showed with statistical significant difference at all periods except after Thai dance at 2^{nd} week and before Thai dance at 3^{rd} week, after Thai dance at 3^{rd} week and after Thai dance at last day of 3^{rd} week. Means and standard deviation of hand strength value for hand grip and tip to tip pinch strength test are shown in table 4.13 and 4.15 respectively, and the comparison of hand grip and tip to tip pinch strength value are shown in figure 4.6 and 4.7 respectively. Multiple comparisons among various times of hand grip and tip to tip pinch strength value are reported in table 4.14 and 4.16.

Table 4.13 Means and standard deviation of hand strength value for grip strength test

Week	**Mean (kg.)**	**Standard deviation**
Pre_1	21.68	8
Post_1	23.57	8.27
Pre_2	23.71	8.26
Post_2	25	8.80
Pre_3	24.71	8.75
Post_3	26.07	8.98
Last-pre_3	25.86	9.12
Last-post_3	26.79	9.46

Pre_1	= before Thai dance at 1^{st} week
Post_1	= after Thai dance at 1^{st} week
Pre_2	= before Thai dance at 2^{nd} week
Post_2	= after Thai dance at 2^{nd} week
Pre_3	= before Thai dance at 3^{rd} week
Post_3	= after Thai dance at 3^{rd} week

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Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

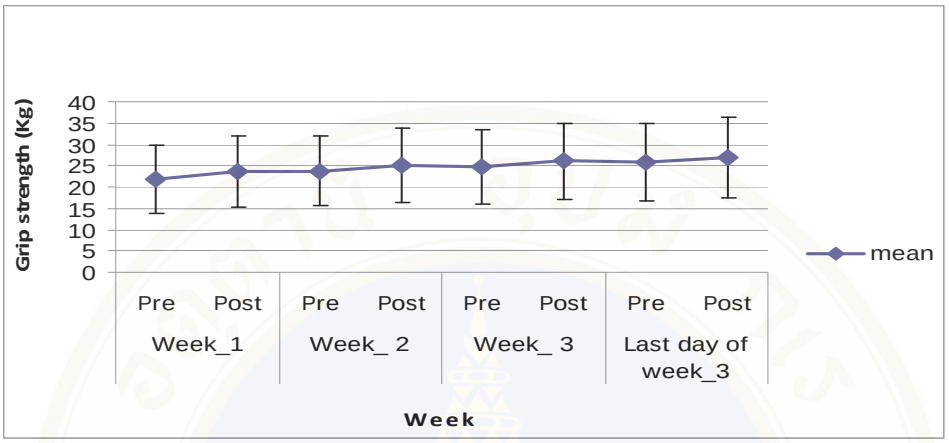

Figure 4.6 Comparison of hand strength value for grip strength test

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

Table 4.14 Multiple comparisons of hand strength value for grip strength test among various times of assessment

Week	Pre_1	Post_1	Pre_2	Post_2	Pre_3	Post_3	Last-pre_3	Last-post_3
Pre_1	_	<0.001*	0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Post_1	_	_	1.000	0.006*	0.020*	<0.001*	<0.001*	<0.001*
Pre_2	_	_	_	0.002*	0.002*	<0.001*	<0.001*	<0.001*
Post_2	_	_	_	_	1.000	0.001*	0.025*	<0.001*
Pre_3	_	_	_	_	_	0.072	0.041*	0.019*
Post_3	_	_	_	_	_	_	1.000	0.321
Last-pre_3	_	_	_	_	_	_	_	0.457
Last-post_3	_	_	_	_	_	_	_	_

* Statistical significant difference from Bonferroni test at p< 0.05

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Pre_1 = before Thai dance at 1st week
Post_1 = after Thai dance at 1st week
Pre_2 = before Thai dance at 2nd week
Post_2 = after Thai dance at 2nd week
Pre_3 = before Thai dance at 3rd week
Post_3 = after Thai dance at 3rd week
Last-pre_3 = before Thai dance at last day of 3rd week
Last-post_3 = after Thai dance at last day of 3rd week

Table 4.15 Means and standard deviation of hand strength value for tip to tip pinch strength test

Week	Mean (kg.)	Standard deviation
Pre_1	4.43	1.22
Post_1	5.64	1.69
Pre_2	5.21	1.48
Post_2	6.14	1.66
Pre_3	6.21	1.72
Post_3	7	1.62
Last-pre_3	6.71	1.82
Last-post_3	7.14	1.61

Pre_1 = before Thai dance at 1st week
Post_1 = after Thai dance at 1st week
Pre_2 = before Thai dance at 2nd week
Post_2 = after Thai dance at 2nd week
Pre_3 = before Thai dance at 3rd week
Post_3 = after Thai dance at 3rd week
Last-pre_3 = before Thai dance at last day of 3rd week
Last-post_3 = after Thai dance at last day of 3rd week

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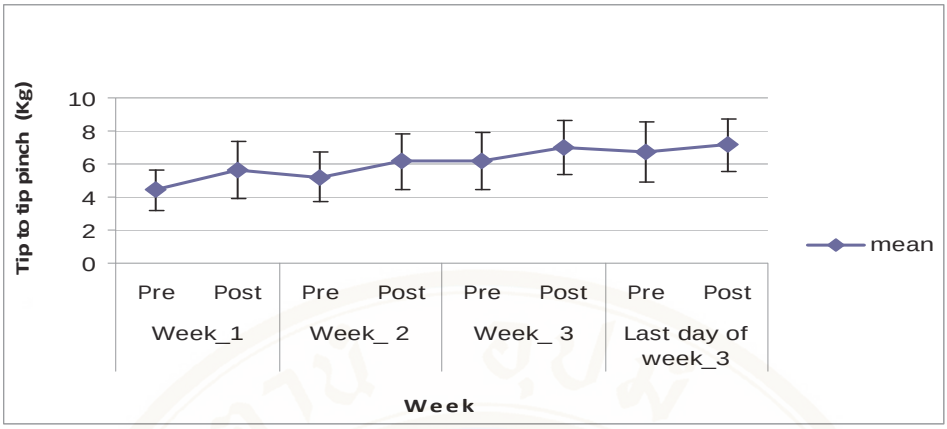

Figure 4.7 Comparison of tip to tip pinch strength test

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

Table 4.16 Multiple comparisons of tip to tip pinch strength test among various times of assessment

Week	Pre_1	Post_1	Pre_2	Post_2	Pre_3	Post_3	Last-pre_3	Last-post_3
Pre_1	_	0.004*	0.009*	0.001*	0.002*	0.001*	0.001*	0.001*
Post_1	_	_	0.0063*	0.038*	0.033*	0.002*	0.004*	0.002*
Pre_2	_	_	_	0.006*	0.007*	0.001*	0.002*	0.001*
Post_2	_	_	_	_	0.739	0.006*	0.011*	0.004*
Pre_3	_	_	_	_	_	0.009*	0.038*	0.004*
Post_3	_	_	_	_	_	_	0.046*	0.157
Last-pre_3	_	_	_	_	_	_	_	0.014*
Last-post_3	_	_	_	_	_	_	_	_

* Statistical significant difference from Freidman test at $p < 0.05$

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

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Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

4.2.6 Comparison of elbow extension degree for ULNT1

The mean of elbow extension degree of ULNT1 before and after Thai dance at the first day were 144.43 and 159.29 respectively. The elbow extension degree increased rapidly after Thai dance immediately. Whereas, mean of elbow extension degree of ULNT1 after Thai dance at last day of 3rd week was 178.57 that was similar to elbow extension degree of healthy participant. When compared with the baseline data, the participants were likely to show better results at all periods.

The results of multiple comparisons after Friedman test revealed statistical significant difference after Thai dance for two weeks except between after Thai dance at 1st week and before Thai dance at 2nd week, after Thai dance at 2nd week and before Thai dance at 3rd week, after Thai dance at 3rd week and before Thai dance at last day of 3rd week. Means and standard deviation of elbow extension degree for ULNT1 are shown in table 4.17, and the comparisons of elbow extension degree are shown in figure 4.8. Multiple comparisons among various times of measurement are reported in table 4.18.

Table 4.17 Means and standard deviation of elbow extension degree for ULNT1

Week	Mean (degree)	Standard deviation
Pre_1	144.43	10.89
Post_1	159.29	10.72
Pre_2	156.07	9.24
Post_2	167.14	8.93
Pre_3	167.86	11.88
Post_3	175.71	6.46
Last-pre_3	175.71	7.56
Last-post_3	178.57	3.63

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Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

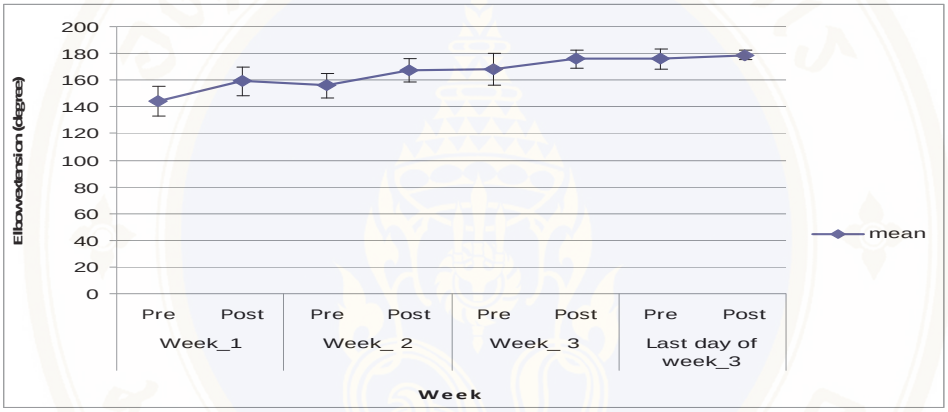

Figure 4.8 Comparison of elbow extension degree for ULNT1

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

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Table 4.18 Multiple comparisons of elbow extension degree for ULNT1 among various times of assessment

Week	Pre_1	Post_1	Pre_2	Post_2	Pre_3	Post_3	Last-pre_3	Last-post_3
Pre_1	_	0.001*	0.001*	0.001*	0.001*	0.001*	0.001*	0.001*
Post_1	_	_	0.086	0.004*	0.010*	0.001*	0.001*	0.001*
Pre_2	_	_	_	<0.001*	0.002*	0.001*	0.001*	0.001*
Post_2	_	_	_	_	0.608	0.002*	0.002*	0.002*
Pre_3	_	_	_	_	_	0.005*	0.002*	0.004*
Post_3	_	_	_	_	_	_	1.000	0.046*
Last-pre_3	_	_	_	_	_	_	_	0.046*
Last-post_3	_	_	_	_	_	_	_	_

* Statistical significant difference from Freidman test at $p < 0.05$

Pre_1 = before Thai dance at 1st week

Post_1 = after Thai dance at 1st week

Pre_2 = before Thai dance at 2nd week

Post_2 = after Thai dance at 2nd week

Pre_3 = before Thai dance at 3rd week

Post_3 = after Thai dance at 3rd week

Last-pre_3 = before Thai dance at last day of 3rd week

Last-post_3 = after Thai dance at last day of 3rd week

4.3 The opinion of participants on Thai dance program

The majority of participants' opinion in each item was good and no one answered for poor opinion. All participants are continued to do Thai dance program and advice their others friends to do this program. The number and percentage of participants' opinion are shown in table 4.19.

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Table 4.19 Number and percentage of the participants' opinion on Thai dance program

Characteristics	Excellent	Good	Fair	Poor	Less
1 The simply of Thai dance positions	_	9 (75%)	3 (25%)	_	_
2 The Thai dance ability of participants at the time that set	_	8 (67%)	4 (33%)	_	_
3 The benefit which gain from Thai dance	_	8 (67%)	4 (33%)	_	_
4 The satisfaction from Thai dance	_	7 (58%)	5 (42%)	_	_

Characteristics	Yes	Not certain	No
5 Will you have done the Thai dance afterward?	12 (100%)	_	_
6 Will you recommend other people to do the Thai dance?	12 (100%)	_	_

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CHAPTER V
DISCUSSION

5.1 The methodology and participants

In order to study effects of Thai dance on neurodynamic responses in participants with carpal tunnel syndrome, the study used the pretest-posttest design. Because of the difficulties in finding homogeneous patients with CTS, this study designed to have no control group. From diagnosis and treatment guideline of CTS, positive treatment results include measureable functional gain, improved hand sensation and motor function. The number of participants was 12 as it was calculated from sample size calculation in the pilot study.

From the results, it was found that the majority of patients (93%) were female. In women, house work and typing was claimed to contribute higher incidence of CTS [8,29,53]. Similarly, participants in this study were housewives and computer users. Women are at particular risk because they do the household tasks, which involve repetitive hand movements. As repetitive overuse may cause transverse carpal ligament being inflamed resulting in decreased amount of carpal tunnel space, or the irritation may bring swelling into the area causing an increase of content within the tunnel [6,55]. Moreover, patients were usually worked with hand dominants, so they used right hand for work. In this current study, most of them were right hand dominants up to 83%. Similar to many studies, it was found that the prevalence of CTS is more common in women and right hand dominants [3,4,8,55].

Considering the age of the participants like the most studies, this current study recruited patients with similar age in the range of 30-60 years. From the reviewed literature, CTS occurs most commonly in adults older than 30 years. Because of their active life, these participants were easily to suffer from CTS [8,29]. From a survey study in Thailand, the most of the daily activities performed by Thai people

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produced symptoms of CTS such as carrying a bag, gripping handle work, cleaning the house and typing [53,55].

In studying symptoms of participants from CTS, 66% of CTS patients in this study had suffered from numbness. This phenomenon reflects the fact that CTS pathology affects the median nerve, which involves sensory and motor control for the hands. When median nerve is compressed, chemical inflammatory mediators such as bradykinins, serotonin, prostaglandins and histamine are released. It created an acidic environment which is known to enhance mechanosensitivity of the neural tissue and produced pain response. Moreover, the intraneural pressure increases to interfere with the endoneurial capillary flow. It caused hypoxia and interrupted impulse conduction. Then, neural numbness is occurred. The median nerve is compressed for longer periods, it can not supply motor function of nerve fiber. Then the affected muscle of patients with CTS becomes weakness [8-9].

Almost all of the participants (66%) had suffered from CTS before they went to see the doctors or physical therapists for six to twelve months. After approximately six months of nerve compression, it was documented that a combination of ischemic block to axonal transmission and structural changes of nerve fiber that related to perception of touch and motor function demyelination resulted in increased threshold of the sensory nerve and weakness of the motor nerve. It reflected that participants were in neurapraxia phase as described by Seddon, similar to first degree phase as described by Sunderland that complete recovery occurred in 2-12 weeks [8,56].

Considerably the age of patients and the duration of symptoms could be listed as factors influencing CTS by Kaplan et al. They tried to define more accurately those patients likely to respond to conservative treatments by identifying five risk factors. These factors are an age over 50 years, duration of symptoms over 10 months, constant paraesthesia, the presence of associated trigger fingers, and/or positive results of Phalen test in less than 30 seconds [57]. All participants were recruited in this study was there for limited at the age of 60 years with the duration of symptoms being

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limited at 12 months. Although, the age of participants was over 50 years and the duration of symptoms was over 10 months, none of them had trigger fingers.

Generally, conservative treatment was effective in mild and moderate stage cases [8, 33]. Thai dance maneuver used in this study is similar to some component of the median nerve mobilization. Then, all participants with a diagnosis of mild and moderate stage were included in this study. Additionally, the recovery of patients in standard conservative treatment combination with nerve gliding exercise was found to be significantly greater than that of patients in nerve gliding exercise alone [58]. Although, conservative treatment did not relieve symptoms and improved hand function, participants remained on their previous conservative treatment. All participants received superficial heat, ultrasound, massage and wrist stretching exercise. From the best available evidence to data shows statistically significant benefits from ultrasound and wrist stretching [19].

Moreover, treatment did not improve hand function within three to four weeks. It should be modified from diagnosis and treatment guideline of CTS. Therefore, treatment used in this study was given by the same physiotherapists for three weeks. Those therapists have been working as musculoskeletal physical therapist with three to four years of experience. All physical therapists were presumably not different in the duration of experience, so that the experience might not have a big influence on the result.

Of the many studies of conservative treatment of CTS, nerve gliding exercise was developed for the purpose of increasing the mobility of the median nerve after surgery in patients with CTS. During the median nerve gliding exercise, it was mobilized by putting the hand and wrist in six different positions. The neck and shoulder were in a neutral position, and the elbow was in supination and 90 degrees of flexion. Each position was maintained for five seconds. The exercise was applied as five sessions daily. Each exercise was repeated ten times at each session. These exercises, which help the median nerve to glide first in the distal segments and later in

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the carpal tunnel and forearm, are begun with the nerve in its most relaxed position [15-16, 21,27,34,36].

Thai dance is culturally known by Thai people. Therefore, it can be easily applied for Thai people as a program of self nerve mobilization exercise. Thai dance maneuver used is similar to some component of the upper limb neurodynamic test position and it is gentle movement. In this study, Thai dance maneuver was designed to emphasize the median nerve of the study Saleesing and Karukunchit. During performing Thai dance, the neck was placed in neural position. However, the upper limb was performed in three maneuvers. Those were Prom See Na to Yoong Fon Hang, Lor Knaew and Cha Nee Rai Mai. Then, Thai dance enhanced mobility of the median nerve at all segments by joint motion. Prom See Na to Yoong Fon Hang is identical to the median nerve mobilization position or ULNT2a. This maneuver is not performed external rotation of shoulder. However, it is identical to perform both side the upper extremities. Lor Knaew is similar to some component of ULNT1. This maneuver designed to emphasize extension of elbow. However, it is not performed external rotation of shoulder. Cha Nee Rai Mai is similar to some component of ULNT1. This maneuver designed to emphasize external rotation of shoulder and full extension of elbow. Then, the sequence of Thai dance maneuvers is Prom See Na to Yoong Fon Hang, Lor Knaew and Cha Nee Rai Mai. Each maneuver was maintained for two seconds and repeated 20 times [39]. Thai dance was performed for five minutes one a day. Similarly, wrist extension was performed during Thai dance as nerve gliding exercise. However, nerve mobilization required the careful position and movement of the patients. The clinician is advised to move slowly and rhythmically [22-23, 39, 49]. Likely, Thai dance movements are a dance that has slowly and rhythmically movement pattern. Three Thai dance maneuvers are performed to nerve gliding in affected side, while reducing the length of the nerve in non-affected side. Therefore, Thai dance resulted in less strain and excursion of the median nerve at the wrist when compared to mobilizing of ULNT1 position. Thai dance maneuvers is not aggressive to perform self median nerve mobilization exercise. So that, Thai dance would be easy for Thai people to perform and gain benefit from nerve mobilization. In additional, the evaluation was applied within three weeks period. From literature

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review, the duration of evaluation was long period enough to find the change of Thai dance on neurodynamic response in CTS [19,34]. Therefore, it was used for self nerve mobilization in several studies. The studies of Saleesing and Karukunchit (2003), Kosol and Saetang (2004), Pimsuteekunton and Janpram (2004), Thai dance was proved to be able to decrease upper limb nerve tension in symptomatic and asymptomatic office workers with positive upper limb neurodynamic test was studied [25-27]. Moreover, Weawsorn et al. reported the effect of Thai dance on participant with positive upper limb neurodymanic test 1. At the end of training, statistically significant improvement was obtained in elbow extension range of motion using ULNT1 and hand light touch sensation using SWMT. Therefore, this protocol is used in this study [59].

The study was conducted in clinical setting. The objectives of the study were to investigate effects of Thai dance on the neurodynamic response of the median nerve in CTS. In this current study, before and after performing Thai dance, each subject was examined individually by the researcher. The physical examinations consisted of Severity of Symptom Scale (SSS) and Functional Status Scale (FSS), Phalen test, Tinel's test, Semmes-Weinstein Monofilament test (SWMT), grip and tip to tip pinch strength test and Upper Limb Neurodynamic Test 1 (ULNT1) were evaluated before and after performing Thai dance. Additional, in previous studies the effectiveness of conservative treatment of CTS, patient's satisfaction and symptomatic relief achieved by treatment were considered as important outcome parameters. Severity of symptom and functional status assessment should also have been considered [42]. However, the previous studied failed to demonstrate the success of conservative treatment by severity of symptom and functional status assessment. In this study, all of these outcome parameters were used. Moreover, the clinical tests were used for screening the probable CTS patients. The two best provocative tests used in a CTS diagnosis are Phalen test and Tinel's test. Phalen test is the most sensitivity of provocative test and Tinel's test is the most specificity of screening test for CTS [8,60]. Then, Phalen test and Tinel's test were used for advancing progression of CTS.

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When considering, hand sensation, pain, numbness, and tingling sensations are clinical problems and are caused by compression of the narrow sensory nerve fiber. Measurement of cutaneous pressure threshold is the most evaluation of compression neuropathy because perception of touch is the first to change involved with compression neuropathy. The most commonly used sensibility test for measurement of compression neuropathy is two-point discrimination test (2PD) and Semmes-Weinstein monofilament test (SWMT). 2PD assesses the hand's ability to function as a sensory organ. 2PD requires a high innervations density. The test determines the minimum distance at which one or two points in contact with the skin. However, there is not statistical significant correlation between the results of 2PD and the recovery of neural function [64,65]. SWMT is used to measure adapting to threshold of perception. SWMT is commonly used to measure pressure thresholds. The American Society of Hand Therapists recommended that there is high inter-rater reliability for diagnosing peripheral neuropathy. There is statistical significant correlation between the results of SWMT and median sensory NCV. Moreover, the SWMT is more sensitive in identifying compressive neuropathy than 2PD. When abnormal 2PD is present, the disease is more severe [8,61]. Therefore, SWMT is suitable test for detecting severity of CTS and progression of nerve recovery. Moreover, strength is one of the characteristics of hand function in determining the effectiveness of treatment. The most frequently used method to evaluate the outcome of motor function for CTS is the hand grip strength and tip to tip pinch strength testing. In this study, two tests were evaluated motor hand function for CTS [40,66-67]. Additionally, nerve restriction is possibly caused by the adhesions of transverse carpal ligament. It produces ischemia and reducing axonal transport in carpal tunnel. Releasing tension in the median nerve could improve intraneural blood flow. Upper limb neurodynamic test (ULNT) is examination of physical abilities of the nervous system of upper limb for mobility and transmission tension. These are the high sensitivity and the predictive value [6,49,50]. Therefore, ULNT1 was used for detecting median nerve mobility.

In this study, Thai dance is self sliding to improve effectiveness of neural mobilization treatment used in combination of Thai dance and conservative treatment in patients with CTS. Then, a combination of Thai dance and conservative treatment is

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a preferable. Anyhow, the measurements were assessed to study the effectiveness of Thai dance without conservative treatment. This study designed to measure between after performing Thai dance at this week and before performing Thai dance at the next week.

From the results, the data were found in the similar pattern of improvement between the physical therapy treatment with median nerve mobilization and the physical therapy treatment groups. There were changed gradually overtime. After the first Thai dance, the participants in both groups showed immediate effect except Tinel's test. In the comparison before performing Thai dance, the participants of both groups were likely to show better results all weeks. Additionally, the comparison between two groups at any time of measurement had no difference. The physical therapy treatment without median nerve mobilization group had greater improves for one sensation level, however there from after Thai dance at 2nd week to before Thai dance at last day of 3rd week was no significance compared with the physical therapy treatment with median nerve mobilization group. Therefore, it is possible to indicate that both groups might respond to Thai dance indifferently. Moreover, the participants remained on their previous treatment that the result of treatments was stable for three weeks before performing Thai dance at the first day. Then, it might reflect that all participants in both groups had similar pattern of respond to Thai dance. The comparisons of measurements between two groups are showed in Appendix R.

5.2 Effects of Thai dance program on neurodynamic response

5.2.1 Effect of Thai dance program on severity of symptoms scale (SSS) and functional status scale (FSS)

Carpal tunnel syndrome (CTS) results in considerable discomfort, limitation of activities of daily living and work disability. Patients have been more concerned with symptoms and function. Relief of symptoms and functional status is essential outcome of treatment. A self-administered questionnaire for the assessment of severity of symptoms and functional status in CTS are reproducible, internally

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consistent and responsive to clinical change [42]. Therefore, it was used to evaluate the effect of Thai dance in this study

There were two parts of this questionnaire. The first was the parts of severity of symptoms and the second was the parts of hand functional status for patient's ability to do activity by using hand for daily living. The part of severity of symptoms was designed to provide a subjective assessment of the severity of symptoms of the patients with CTS. The test consists of 11 questions, each with five possible responses. The possible minimum score for this was 11 referring to no symptoms, 12-26 referring to mild symptoms, 27-40 refers to moderate symptoms, 41-54 referring to severe symptoms, and the possible maximum score is 55 referring to the most severe symptoms. The part of hand functional status was designed to provide a subjective assessment for the activity using by hand in daily living of the patients with CTS. The eight activities comprised the functional status scale of activity daily living. The test consists of eight questions, each with five possible responses. The five responses have a five-point range with one representing no difficulty for active and five representing that can do nothing. The possible minimum score for this is 8 referring to no difficulty, 9-16 referring to mild difficulty, 17-24 referring to moderate difficulty, 25-32 referring to the severe difficulty, 33-39 referring the most severe difficulty and the possible maximum score is 40 referring to not be able to do at all due to the symptoms [43]. In addition, questionnaire was translated into Thai language by Sukaval in 2003. The reliability of the questionnaire for the assessment of the severity of symptoms and functional status in CTS, the Cronbach alpha coefficient was 0.72 and 0.82 [53].

From the results, it was reported that the mean of SSS at 1st week, 2nd week, 3rd week and last day of 3rd week were 23.17, 20, 17.33 and 14.25 respectively. It refers to mild severity of symptoms for three weeks. However, the decrease of SSS could be detected at all periods. Multiple comparisons between mean severity of symptoms and functional status scale in the first, second and third weeks and the end of Thai dance program were increased statistically significantly different ($p < 0.05$).

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The decreases of SSS might also represent the effectiveness of given Thai dance programs.

From the study, SSS and FSS decrease gradually overtime. Mean of FSS at 1st week, 2nd week, 3rd week and last day of 3rd week were 19.5, 16.5, 14.75 and 12.83 respectively. Before performing Thai dance at 1st week, the participants usually had moderate difficulty functional status. However, at the end of Thai dance program, the participants usually had mild difficulty of functional status. The multiple comparisons of FSS were increased statistical significant difference at all periods. From the result, the improvement of SSS and FSS at the end of Thai dance program indicated that participants had symptoms reduced hand activity function.

The studies by Akalin et al. and Baysal et al. revealed similar result of improvement in SSS and FSS. Akalin et al. compares the group of wrist splint to the group with wrist splint in combination with nerve gliding exercise for four weeks. They reported significant improvement of SSS and FSS in both groups [17]. Another study of Baysal et al. studied whether nerve gliding exercise technique was similar in SSS and FSS improvement. They found that the effect of nerve gliding exercise on SSS and FSS improvement in patients with CTS. The researchers explained that nerve gliding exercise was used to decrease adhesions developed in the CTS and regulate venous return in the median nerve [34].

5.2.2 Effect of Thai dance program on Phalen test

Phalen test is compression exerted by the mechanical interface at wrist flexion pressing on the median nerve. Wrist flexion closes the carpal tunnel structures around the median nerve and compresses the nerve. This mechanism produces increased pressure on median nerve by reducing the carpal tunnel space that impaired nerve fiber nutrition. Neural ischemia is a source of symptoms [8,49,60].

From this study, mean of time response to positive Phalen test before and after performing Thai dance at the first day were 29 and 38.36 seconds respectively. Whereas, mean of time positive Phalen test at last day of 3rd week was 54.29 seconds,

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that showed immediate and long term effect after Thai dance. The results of Bonferroni test showed that statistical significance was not found for one week. However, after performing Thai dance at two weeks, the Phalen test indicated an increase significantly.

The immediate increases duration of time response to positive Phalen test after performing Thai dance were found in the first, second and third weeks and the end of Thai dance program with statistical significance. It might represent the immediate effects of Thai dance. However, the result in short term for one week after performing Thai dance was not found. It could be also detected in long term for two weeks after Thai dance. From the result, the increases duration of time response to positive Phalen test at the end of Thai dance program might indicate the decreased of carpal tunnel pressure.

Similarly, Akallin et al., Baysal et al. and Pinar et al. investigated the effectiveness of nerve gliding exercise used in combination with conservative treatment in patients with CTS. The patients were instructed to wear splints for the remaining four weeks. The patients in the experimental group were instructed to perform nerve gliding exercise. Compared with the baseline data, the subjects of both groups were likely to show the reducing positive response to Phalen test. The improvement in the experimental group was slightly greater, but the difference between the groups was not significant [17,34,36]. Whereas, Bardak et al. compared the effectiveness of nerve gliding exercise with standard conservative treatment, which consists of splinting and local steroid injection, in the treatment of CTS. At the end of treatment, significant reducing positive response to Phalen test was detected in all groups. However, the recovery of patients in control group was found to be significantly greater than that of patients in experimental group [55].

5.2.3 Effect of Thai dance program on Tinel's test

Tinel's indicated to involve abnormal mechanosensitivity of nerve. This result is based on hyperirritability of anoxic at the level of the regenerating nerves, thus producing a tingling sensation into innervated skin areas. The sign may be caused

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by an abnormally excitable membrane by gentle tapping over a regenerating nerve. Distal progression of the point of maximal response indicated of nerve regeneration. It is taken as a sign of demyelination or injury to the nerve related to chronic compression [8,60,63].

The mean of distance response to positive Tinel test before and after performing Thai dance immediately had no difference at all periods. However, means of distance response to positive Tinel test at 1st week, 2nd week, 3rd week and last day of 3rd week were 0.83, 0.81, 0.73 and 0.67 cm. respectively. It revealed that decrease the distance response to positive Tinel test at all weeks. Multiple comparisons showed with statistical significant difference after Thai dance for two weeks. The decreased distance response to positive of Tinel's test was not found at immediate, the first and second weeks after Thai dance. The long term decrease of Tinel's test was found in second weeks after Thai dance. From the result, the decrease distance responded to positive Tinel's test at the end of Thai dance program indicated that the neural regeneration might occur after performing Thai dance for two weeks.

From the literature review, Akalin et al., Baysal et al. and Pinar et al. reported that the statistical significant reducing positive response to Tinel's test was obtained in both groups. However, the statistical difference was not found between the control and the experimental group [17,34,36]. In contrast, Bardak et al. compared nerve gliding exercise with conservative treatment. According of the evaluation at the end of the treatment, a significant reducing positive response to Tinel's test was seen in all groups. Whereas, the conservative treatment was more compared reducing response to Tinel's test with nerve gliding exercise [55].

5.2.4 Effect of Thai dance program on Semmes-Weinstein monofilament test (SWMT)

The recovery of sensory function after nerve injury is essential for hand function. For the sensory evaluation of hands, the SMWT is thought to be important in terms of clinical finding during the early stages of CTS. The study of Supphalak and Gulapar reported that there is statistical moderately significant correlation between the

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results of SWMT and median sensory nerve conduction study. Moreover, mean of monofilament size number is 2.83, 3.22, 3.61 and 3.84 refer to normal, mild, moderate stage of CTS respectively [61].

From the result, mean of monofilament size before Thai dance at the first day was 3.75 that refer to moderate stage of CTS. Whereas the mean of monofilament size after Thai dance at the last day of the 3rd week was 3.16 that refer to mild stage of CTS. The results of multiple comparisons showed the statistical significant difference after Thai dance for two weeks. The decrease mean of monofilament size at the end of Thai dance program might reflect that sensory hand function restore after Thai dance for two weeks. Of the many studies of conservative treatment of CTS, only one study investigated the effectiveness of nerve gliding exercise used in combination with conservative before and after with assessment of Phalen test, Tinel test, grip and pinch strength and SWMT. The static volar wrist splints were applied in the control group. In the experimental group, nerve gliding exercise was applied for the remaining four weeks. The significant progression detected in both groups were compared, the experimental group in which received nerve gliding exercise demonstrated more rapid grip strength improvement [36].

5.2.5 Effect of Thai dance program on grip strength and tip to tip strength test

In moderate to serve stage of CTS, a strength deficit of the intrinsic hand muscles occurs, resulting in loss of hand function. Decreased hand strength may be attributed to denervation of motor units in the median nerve innervated intrinsic hand muscles, which would cause a decrease in the amplitude of compound muscle action potential or the loss of sensory feedback or pain. Grip and pinch strength have been shown as the most important factors related to hand function [8,40]. According to the results of this study, the mean of hand grip strength before Thai dance at the first day was 21.68 kg. After Thai dance at the last day of the 3rd week was 26.79 kg. It was equal to hand grip strength of female Thai adult (26.25kg.) [66]. Multiple comparison of hand grip strength found statistical significant difference after Thai dance for two weeks.

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However, hand grip and tip to tip pinch strength revealed similar result of improvement. The mean of tip to tip pinch strength before Thai dance at the first day and after Thai dance at the last day of the3rd week were 4.43 and 7.14 kg. respectively. At the end of Thai dance program, tip to tip pinch strength was equal to pinch value of Thai adult (6.31 kg.) [66]. The result of multiple comparisons showed with statistical significant difference after Thai dance for two weeks.

In this study, hand grip and tip to tip pinch strength revealed similar result of improvement. The immediate improvement of hand strength testing after Thai dance were found in the first, second and third weeks and the end of Thai dance program with statistical significance. The immediate effect on grip strength at the end of program after Thai dance was not found. It is feasible that there was no significant difference score of grip strength between the affected side and non-affected side. The multiple comparison between mean scores of hand grip and tip to tip pinch strength at the first, second and third weeks and the end of Thai dance program were statistical significance. These results revealed that the effect of Thai dance exercise had an influence on the increase of hand grip and tip pinch strength. It might lead to improve motor hand function.

Pinar et al. investigated the effectiveness of nerve gliding exercises used in combination with conservative treatment in CTS. The significance was found increase in grip strength and the insignificant findings of reduced pain and improvement in Phalen test, Tinel‘s test and electrophysiologic test [36]. In contrast, Akalin et al. reported significant improvement only in pinch strength in the group with wrist splint in combination with exercises compared with the wrist splint group [17]. Of the many studies of nerve mobilization effect, only Baysal et al. has studied immediate effect in patients with CTS. According to the evaluation at the end of the treatments, no improvement was found in grip strength, pinch strength and electrophysiological evaluation [34].

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5.2.6 Effect of Thai dance program on ULNT1

Nerve excursion during flexion and extension of the wrist or flexion of the finger results in strain on the nerve fibers and is restricted in patients with CTS. Upper limb neurodynamic test (ULNT) is examination of physical abilities of the nervous system of upper limb for mobility and transmission tension. These are the high sensitivity and the predictive value [6,8,49].

From the result, the elbow extension degree increased rapidly after Thai dance. After Thai dance, mean of elbow extension degree of ULNT1 at the last day of the 3rd week was 178.57 degree that was equal to elbow extension degree of healthy subject [58]. The results of multiple comparisons revealed that with statistical significant difference after Thai dance for two weeks.

In this study, the immediate increases of elbow extension degree after performing Thai dance were found with statistical significance. The increase of elbow extension degree might represent immediate effects of Thai dance. However, the increases of elbow extension degree after Thai dance for one week was not found with statistical significance. After performing Thai dance two weeks, the increased of elbow extension degree could be also detected. These findings indicated Thai dance can improve nerve mobility. Similar to this study, Tal-Akabi and Rushton utilized neural tissue mobilization techniques in their randomized clinical trail on patients with CTS, but they did not used specific techniques. Neural tissue mobilization was more effective than no treatment for reducing pain and the need for CTS surgery [16]. In Thailand, Thai dance was proved to be able to upper limb nerve mobility in symptomatic and asymptomatic office workers with positive ULNT [25-27, 59].

5.3 Pathophysiology of CTS

In mild and moderate stage of CTS, conservative treatment of CTS case may be successful. Thai dance program was developed for the purpose of increasing the mobility of upper limb nerve. Many studies of nerve mobilization exercise for upper limb nerve tension, only four studies have used Thai dance. Previous studies

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have shown that the participants with upper limb nerve tension could be successfully treated by performing Thai dance [25-27,59].

The compression in the carpal tunnel diminishes the blood flow to the epineurium due to an intracarpal tunnel pressure. As the increasing pressure, the endoneurium releases specific protein into the tissue, which makes the edema effect. This effect continues increase pressure the ischemic environment within the nerve and the protein release. The proteinaceous exudates promote fibroblast proliferation, these becomes fibrous scar tissue. The end result is the decreased nerve conduction of axons though the carpal tunnel and decreased glide of the median nerve while flexion and extension of wrist joint [7-8,51].

Two major factors in the recovery of neural function consisted of vascular and mechanical factors. Through, the vascular factors, Thai dance may enhance healing conditions by pumping effect. This effect leaded to the increase of blood flow through the nerve circulation. Consequently, Thai dance improved axonal transport and facilitated venous return resulted in improving nerve conduction and mobility. Considering mechanical factor, Thai dance might improve epineurium blood flow to the median nerve in the carpal tunnel, resulted in reductions of local median nerve conduction block and minimize shear stress. Therefore, axonal regeneration and remyelination might be occurred. As a consequence, the nerve might accommodate itself with no irritation to the tissue causing inhabitation of nociceptive stimulation which resulted in and restoring nerve function, reducing intraneural pressure and nerve sensitivity (Figure 5.1) [7,49]. The major factors in the recovery of neural function are shown in figure 5.1.

The initial compression is caused by changes in intraneural microcirculation that is associated with some edema, which disappears during the day. Progressive compression leads to more sever and constant symptoms. The microcirculation may be altered throughout the day by edema and there may be morphological changes such as segmental demyelination. Recovery might take many weeks and months because of the morphological changes and persistent edema

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[8,65,56]. Similar to this study, the immediate recovery effect may result in a pumping action during performing Thai dance. Consequently intraneural microcirculation or metabolic block might be improved. However, a structural change might not be occurred after performing Thai dance immediately. After performing Thai dance for two weeks, the result might be a permanent structural change in the median nerve and the nerve might return to its normal function. It can provide a relief of nerve tension and more useful in the reduction in pain and other symptoms. Consequently, there were statistically significant improve in all parameters for three weeks after performing Thai dance.

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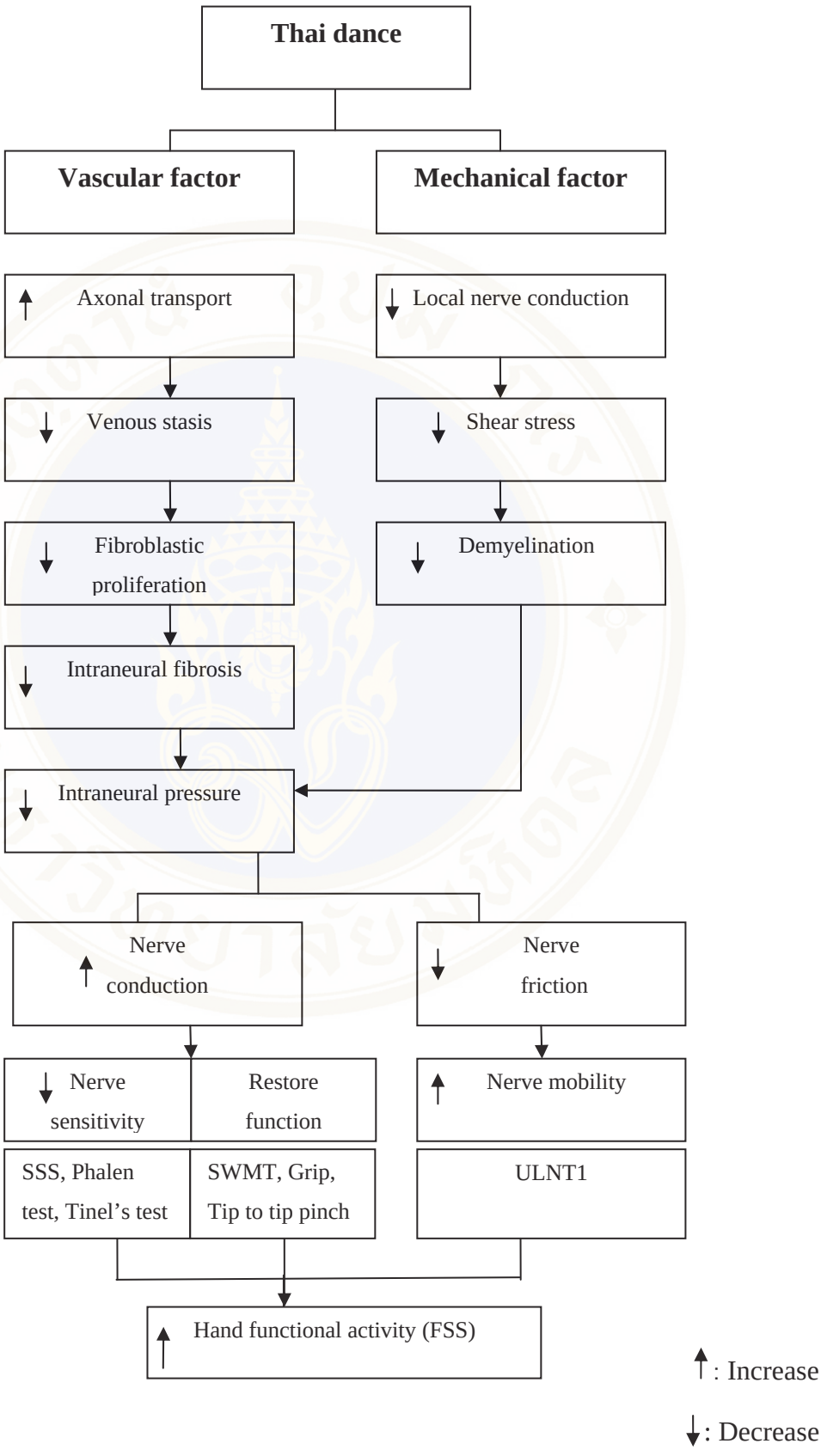

Figure 5.1 The major factors in the recovery of neural function

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5.4 The opinion of participants on Thai dance program

This study showed that the participants' opinion was ranged from fair to good. The findings revealed that the participants' opinion of satisfaction levels after performing Thai dance was at the fair to good level. The participants' satisfaction with Thai dance program may be because this program provided knowledge about how to exercise their hands and how to solve their suffering symptoms. Thai dance program included correct position and gentle movement to help and promote the participants capability to develop their self cares. Also, the participants can improve their knowledge of the hand rehabilitation education program and could apply it for their own daily living. The Thai dance maneuvers were easy to do, so it was helpful to them. Moreover, VCD could stimulate motivation to do Thai dance.

5.5 Clinical Implication

The result of this study emphasizes the efficacy of Thai dance in CTS. This study was conducted in clinical settings. Therefore, the procedure consisted of conservative treatments and Thai dance were given. Each patient was given proper treatments decided by the experienced therapist. All participants remained on their previous conservative treatment for three weeks. Participants with mild or moderate stage of CTS performed Thai dance program for five minutes once a day. From the results, it was found that the participants gained benefit from Thai dance as it was reported in decreasing severity of symptoms, increasing functional status, minimizing response to positive Phalen test and Tinel's test. Moreover, there were an improvement sensory and strength of hand function. Mainly, there was no statistical significant difference after Thai dance for one week in any parameters but statistical significant improvement was indicated after Thai dance for two weeks. In this study, the results could reflect the effects of Thai dance on neurodynamic response in CTS. Therefore, this study indicated that Thai dance can be a choice for improvement hand function activity in patients with mild or moderate stage of CTS. Anyhow, a combination of Thai dance and conservative treatment is a preferable. Patients with CTS performed Thai dance in three maneuvers. Those were Prom See Na to Yoong Fon Hang, Lor Knaew and Cha Nee Rai Mai. Each maneuver was maintained for two

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seconds and repeated 20 times. Thai dance was performed for five minutes once a day. Thai dance requires the careful position and movement. Then, therapist advised patients that Thai dance was done slowly and rhythmically.

5.6 Further study and limitation

For further study, there is no study investigating the effects of Thai dance on neurodynamic response in participant with CTS. Accordingly, the result of this study is encouraging to Thai dance exercise for CTS. However, this study was not conducted in laboratory settings. It is interesting to investigate the effects of Thai dance on electrophysiological finding in participant with CTS. The limitation of this study is the design, with no control group. It is better to have control group and to make clinical and electrophysiological studies in the long term follow up. However, there are methodological strengths of this study. These include the standard measures and the evaluation of the functional status of patients.

Additionally, Thai dance in combination with physical therapy treatment should be compared with other combinations such as nerve gliding exercise. Thus, it may be beneficial treatment combination with the physical therapy programs. Moreover, other Thai dance program should be additionally tested to investigate the effect of Thai dance on neurodynamic response in participants with ulnar or radial nerve tension such as Guyon cannel syndrome, Thoracic outlet syndrome, Cubital tunnel syndrome, Pronator tunnel syndrome.

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CHAPTER VI
CONCLUSION

The purpose of this study was to investigate the effects of Thai dance on neurodynamic response in participants with CTS. All participants with mild to moderate stage of CTS were asked to performed Thai dance for five minutes everyday for three weeks. Thai dance comprised three maneuvers. Those were Prom See Na to Yoong Fon Hang, Lor Knaew and Cha Nee Rai Mai. All participants were assessed for severity of symptoms and functional status scale (SSS and FSS), Phalen's test, Tinel's test, Semmes- Weinstein Monofilament tests (SWMT), Hand grip strength test, Tip to tip pinch strength test and Upper limb neurodynamic test 1(ULNT 1) before and after performing Thai dance one a week at1st, 2nd,3rd and the end of 3rd weeks.

Thai dance was significantly effective immediately and three weeks. The immediate recovery results from restored intraneural circulation or reversal of metabolic block and disappearance of intraneural edema. Whereas long term recovery, the result is a permanent mobility change in the nerve and the nerve will return to normal function. Participants gained benefit from Thai dance as reported in minimizing response to positive Phalen test and Tinel's test. Improvement of sensory and strength of hand function were also found. Considering the participant's opinion, the finds revealed the participant's satisfaction levels after performing Thai dance was at the fair to good level. The participants' satisfaction with Thai dance program may be because this program provided knowledge about how to exercise their hands and how to solve their suffering symptoms. Therefore, Thai dance might be another choice for improving the symptoms and hand function activity in patients with mild to moderate stage of CTS.

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APPENDICES

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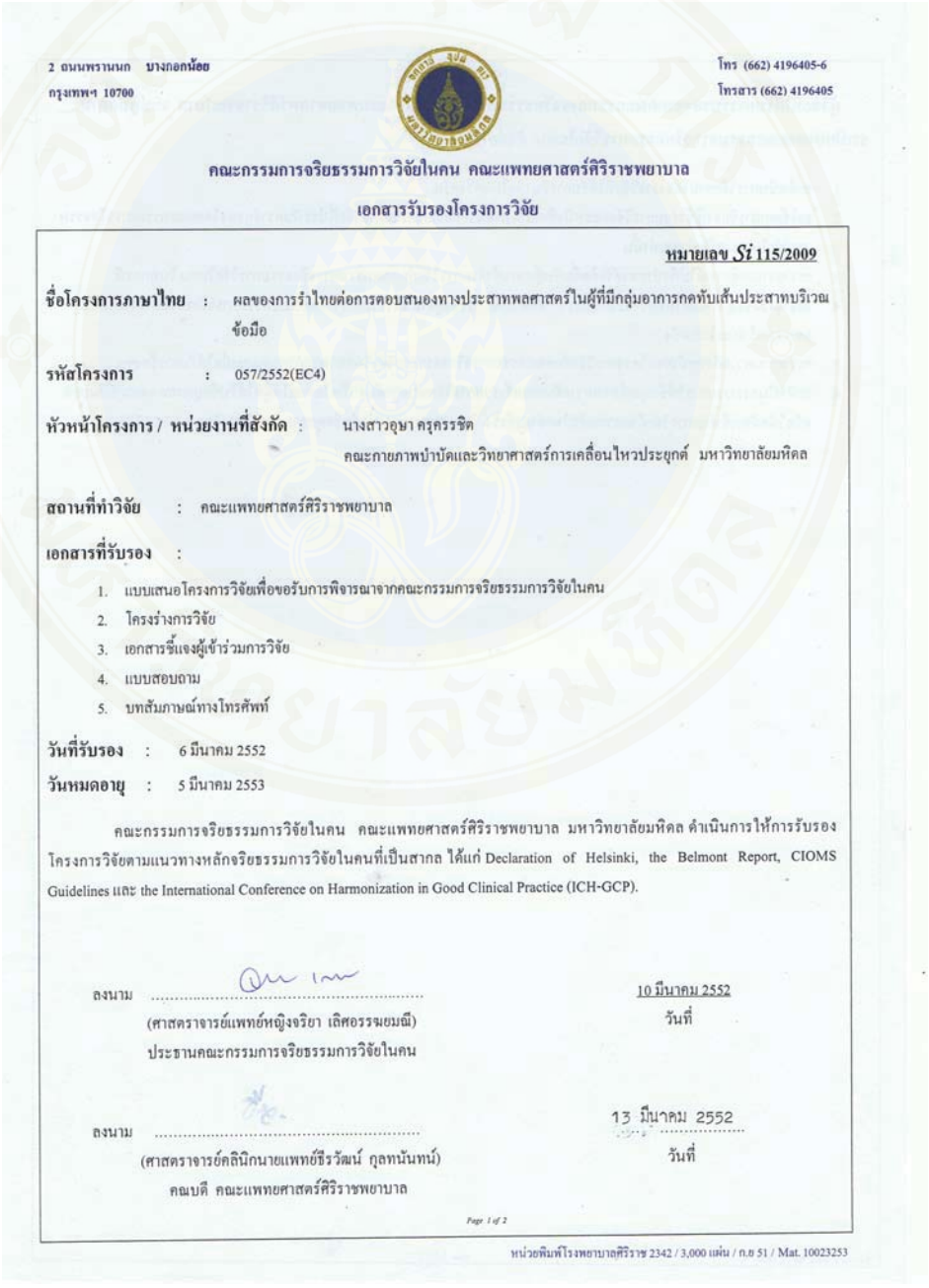
APPENDIX A

THE ETHICAL COMMITTEE ON RESEARCH INVOLVING HUMAN SUBJECT



2 ถนนพรานนก บางกอกน้อย
กรุงเทพฯ 10700

โทร (662) 4196405-6
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คณะกรรมการจริยธรรมการวิจัยในคน คณะแพทยศาสตร์ศิริราชพยาบาล

เอกสารรับรองโครงการวิจัย

หมายเลข Si 115/2009

ชื่อโครงการภาษาไทย : ผลของการรำไทยต่อการตอบสนองทางประสาทพลศาสตร์ในผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ

รหัสโครงการ : 057/2552(EC4)

หัวหน้าโครงการ / หน่วยงานที่สังกัด : นางสาวอุษา ครุฑรรชิต
คณะกายภาพบำบัดและวิทยาศาสตร์การเคลื่อนไหวประยุกต์ มหาวิทยาลัยมหิดล

สถานที่ทำวิจัย : คณะแพทยศาสตร์ศิริราชพยาบาล

เอกสารที่รับรอง :

1. แบบเสนอโครงการวิจัยเพื่อขอรับการพิจารณาจากคณะกรรมการจริยธรรมการวิจัยในคน
2. โครงร่างการวิจัย
3. เอกสารชี้แจงผู้เข้าร่วมการวิจัย
4. แบบสอบถาม
5. บทสัมภาษณ์ทางโทรศัพท์

วันที่รับรอง : 6 มีนาคม 2552

วันหมดอายุ : 5 มีนาคม 2553

คณะกรรมการจริยธรรมการวิจัยในคน คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล ดำเนินการให้การรับรองโครงการวิจัยตามแนวทางหลักจริยธรรมการวิจัยในคนที่เป็นสากล ได้แก่ Declaration of Helsinki, the Belmont Report, CIOMS Guidelines และ the International Conference on Harmonization in Good Clinical Practice (ICH-GCP).

ลงนาม .....
(ศาสตราจารย์แพทย์หญิงจริยา เลิศอรรมยมณี)
ประธานคณะกรรมการจริยธรรมการวิจัยในคน
10 มีนาคม 2552
วันที่

ลงนาม .....
(ศาสตราจารย์คลินิกนายแพทย์ชีรวัฒน์ กุลทนันทน์)
คณบดี คณะแพทยศาสตร์ศิริราชพยาบาล
13 มีนาคม 2552
วันที่

Page 1 of 2

หน่วยพิมพ์โรงพยาบาลศิริราช 2342 / 3,000 แผ่น / ก.ย 51 / Mat. 10023253

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MAHIDOL UNIVERSITY
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Siriraj Institutional Review Board

Certificate of Approval

COA no.Si 115/2009

Protocol Title : Effects of Thai dance on neurodynamic response in subjects with Carpal Tunnels Syndrome.

Protocol number : 057/2552(EC4)

Principal Investigator/Affiliation : Miss Usa Karukunchit
Faculty of Physical Therapy And Applied Movement Science , Mahidol University

Research site : Faculty of Medicine Siriraj Hospital

Approval includes :

1. SIRB Submission Form
2. Proposal
3. Participant Information Sheet
4. Questionnaire
5. Telephone Script

Approval date : March 6, 2009

Expired date : March 5, 2010

This is to certify that Siriraj Institutional Review Board is in full Compliance with International Guidelines For Human Research Protection such as the Declaration of Helsinki, the Belmont Report, CIOMS Guidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP).

Prof. Jariya Lertakyamanee, M.D.
Chairperson

March 10, 2009
date

(Clin. Prof. Teerawat Kulthanan, M.D.)
Dean of Faculty of Medicine Siriraj Hospital

March 13,2009
date

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หน่วยพิมพ์โรงพยาบาลศิริราช 2341 / 3,000 แผ่น / ก.ย 51 / Mat. 10023252

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APPENDIX B
CONSENT FORM

หนังสือแสดงเจตนายินยอมเข้าร่วมโครงการวิจัย

วันที่…….....เดือน.....พ.ศ……..

ข้าพเจ้า…….....อายุ……..ปี อาศัยอยู่บ้านเลขที่ …….

ถนน….....ตำบล……อำเภอ……..…..……..…....….....

จังหวัด……รหัสไปรษณีย์……..…….....โทรศัพท์…….....

ขอแสดงเจตนายินยอมเข้าร่วมโครงการวิจัยเรื่อง ผลของการรำไทยต่อการตอบสนองทางประสาทพลศาสตร์ในผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ

โดยข้าพเจ้าได้รับรายละเอียดเกี่ยวกับที่มาและจุดมุ่งหมายในการทำวิจัยรายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ประโยชน์ที่คาดว่าจะได้รับของการวิจัยและความเสี่ยงที่อาจจะเกิดขึ้นจากการเข้าร่วมการวิจัย รวมทั้งแนวทางป้องกันและแก้ไขหากเกิดอันตรายขึ้น ค่าตอบแทนที่ได้รับ ค่าใช้จ่ายที่ข้าพเจ้าจะต้องรับผิดชอบเอง โดยได้อ่านข้อความที่มีรายละเอียดอยู่ในเอกสารชี้แจ้งผู้เข้าร่วมการวิจัยโดยตลอด อีกทั้งยังได้รับคำอธิบายและตอบข้อสงสัยจากหัวหน้าโครงการวิจัยเป็นที่เรียบร้อยแล้ว

ข้าพเจ้าจึงสมัครใจเข้าร่วมโครงการวิจัยนี้

หากข้าพเจ้ามีข้อข้องใจเกี่ยวกับขั้นตอนของการวิจัย หรือหากเกิดผลข้างเคียงที่ไม่พึงประสงค์จากการวิจับนี้กับข้าพเจ้า ข้าพเจ้าสามรถติดต่อกับ น.ส.อุยา ครุครรชิต คณะการภาพบำบัดและวิทยาศาสตร์การเคลื่อนไหวประยุกต์ มหาวิทยาลัยมหิดล วิทยาเขตศาลายา 999 ถ.พุทธมณฑลสาย4 ต.ศาลายา อ.พุทธมณฑล จ.นครปฐม โทรศัพท์ 083-981-3982 ได้ตลอด 24 ชั่วโมง

หากข้าพเจ้าได้รับการปฏิบัติไม่ตรงตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าจะสามารถติดต่อกับประธานคณะกรรมการจริยธรรมการวิจัยในคน หรือผู้แทน ได้ที่

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สำนักงานคณะกรรมการจริยธรรมการวิจัยในคน ตึกอดุลยเดชวิกรม ชั้น 6 ร.พ.ศิริราช เบอร์โทรศัพท์ 0-2419-7000 ต่อ 6405

ข้าพเจ้าได้รับทราบถึงสิทธิ์ที่ข้าพเจ้าจะได้รับข้อมูลเพิ่มเติมทั้งทางด้านประโยชน์และโทษจากการเข้าร่วมการวิจัย และสามารถถอนตัวหรืองดเข้าร่วมการวิจัยได้ทุกเมื่อ โดยจะไม่มีผลกระทบต่อการบริการและการรักษาพยาบาลที่ข้าพเจ้าได้รับต่อไปในอนาคต และยินยอมให้ผู้วิจัยใช้ข้อมูลส่วนตัวของข้าพเจ้าที่ได้รับจากการวิจัย แต่จะไม่เผยแพร่ต่อสาธารณะเป็นรายบุคคล โดยจะนำเสนอเป็นข้อมูลโดยรวมจากการวิจัยเท่านั้น

ข้าพเจ้าเข้าใจข้อความในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และหนังสือแสดงเจตนายินยอมนี้โดยตลอดแล้ว จึงลงลายมือชื่อไว้

ลงชื่อ..... ผู้ให้ความยินยอม/ผู้แทน

(.....)โดยชอบธรรม(ระบุความเกี่ยวข้อง)

วันที่.....

ลงชื่อ.....ผู้ให้ข้อมูลและขอความยินยอม/หัวหน้าโครงการวิจัย

(.....)

วันที่.....

ในกรณีที่ผู้เข้าร่วมการวิจัยอ่านหนังสือไม่ออกผู้ที่อ่านข้อความทั้งหมดแทนผู้เข้าร่วมการวิจัย

คือ .....

จึงได้ลงลายมือชื่อไว้เป็นพยาน

ลงชื่อ.....พยาน/วันที่.....

(.....)

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APPENDIX C
PARTICIPANT INFORMATION SHEET

เอกสารชี้แจงผู้เข้าร่วมการวิจัย
(Participant Information Sheet)

ในเอกสารนี้อาจมีข้อความที่ข้าพเจ้าอ่านแล้วไม่เข้าใจ โปรดสอบถามหัวหน้าโครงการวิจัย หรือผู้แทนให้ช่วยอธิบายจนกว่า จะเข้าใจดี ข้าพเจ้าอาจจะขอเอกสารนี้กลับไปอ่านที่บ้านเพื่อปรึกษาหารือกับญาติพี่น้อง เพื่อนสนิท แพทย์ประจำตัวของข้าพเจ้า หรือแพทย์ท่านอื่น เพื่อช่วยในการตัดสินใจเข้าร่วมการวิจัย

โครงการวิจัยเรื่อง ผลของการรำไทยต่อการตอบสนองทางประสาทพลศาสตร์ในผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ

ชื่อผู้วิจัย นางสาวอุษา ครุครรชิต

สถานที่ทำวิจัย 1) หน่วยตรวจโรคออร์โธปิดิกส์ ภาควิชาศัลยศาสตร์ออร์โธปิดิกส์และกายภาพบำบัด
คณะแพทยศาสตร์ศิริราชพยาบาล ตึกผู้ป่วยนอก ห้อง 118
โรงพยาบาลศิริราช เขตบางกอกน้อย กรุงเทพฯ
2) คณะกายภาพบำบัดและวิทยาศาสตร์การเคลื่อนไหวประยุกต์ มหาวิทยาลัยมหิดล
198/2 อาคารสำนักงานมหาวิทยาลัยมหิดล (เชิงสะพานสมเด็จพระปิ่นเกล้า)
ถ.สมเด็จพระปิ่นเกล้า แขวงบางยี่ขัน เขตบางพลัด กรุงเทพฯ 10700

หมายเลขโทรศัพท์ 083-981-3982

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โครงการวิจัยนี้ทำขึ้นเพื่อศึกษาผลของการรำไทยในผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ เนื่องจาก กลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ เป็นกลุ่มอาการเส้นประสาทถูกกดทับบริเวณมือ สาเหตุของโรคนี้เกิดจากพังผืดบริเวณข้อมือ กดทับเส้นประสาทมีเดียน ทำให้เส้นประสาทเกิดความตึงตัวเพิ่มขึ้น และ การทำงานผิดปกติ ทำให้เกิดอาการปวดร่วมกับอาการชา หากได้รับการถูกกดทับเป็นระยะเวลานาน ทำให้สูญเสียกำลังกล้ามเนื้อมือ ส่งผลให้เกิดความลำบากในการทำกิจวัตรประจำวัน รบกวนการนอน และมีความสามารถในการประกอบอาชีพด้อยลง

จากการศึกษาของชื่นพักตร์และอุษา(2548) ทิวาและลัดดาวัลย์(2549) และการศึกษาของณัฏฐ์ปัณชญาและพรทิพา (2549) พบว่าการรำไทยสามารถลดความตึงตัวของเส้นประสาทแขนในผู้ที่มีเส้นประสาทแขนตึงตัว ดังนั้นการศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลของการรำไทยต่อการตอบสนองทางกลศาสตร์ของระบบประสาทในผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ เพื่อนำข้อมูลมาเป็นประโยชน์ต่อผู้ป่วยในการดูแลรักษาตนเอง รวมทั้งส่งผลต่อคุณภาพชีวิตของผู้ป่วยให้ดีขึ้น

ข้าพเจ้าได้รับเชิญให้เข้าร่วมการวิจัยนี้ เพราะเป็นผู้ที่ได้รับการวินิจฉัยจากแพทย์ทางศัลยศาสตร์ออร์โธปิดิกส์และกายภาพบำบัด หรือนักกายภาพบำบัดว่าเป็นผู้ป่วยที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือระดับความรุนแรงไม่มาก และมีคุณสมบัติเหมาะสมที่จะทำการศึกษาวิจัย ซึ่งการศึกษานี้จะมีผู้เข้าร่วมวิจัยทั้งสิ้น 12 คน และใช้เวลาเข้าร่วมการศึกษารวม 4 วันต่อหนึ่งคน (สัปดาห์ละ 1 ครั้ง) เมื่อท่านยินยอมเข้าร่วมโครงการวิจัยและลงนามในเอกสารแสดงเจตนายินยอมเข้าร่วมการวิจัยโดยได้รับการบอกกล่าวและเต็มใจแล้ว ผู้วิจัยจะดำเนินการตามขั้นตอนการวิจัยดังนี้

1. ขั้นเตรียมการ

ผู้วิจัยทำการอธิบายวัตถุประสงค์, ขั้นตอนการวิจัยและประโยชน์ของการวิจัยให้ข้าพเจ้าทราบ ผู้วิจัยจะสอบถามถึงความสนใจในการเข้าร่วมการวิจัย และอธิบายโครงการวิจัยว่าไม่ใช่ส่วนหนึ่งของการรักษาและสามารถปฏิเสธการเข้าร่วมโครงการวิจัยได้ ซึ่งผู้เข้าร่วมการวิจัยจะไม่ถูกเอาเปรียบ และในการเก็บข้อมูลจะไม่ระบุชื่อของผู้เข้าร่วมวิจัย โดยจะใส่หมายเลขแทน ร่วมถึงข้อมูลจะไม่เปิดเผยต่อสาธารณะเป็นรายบุคคล แต่ข้อมูลรายบุคคลอาจจะมีคณะบุคคลบางกลุ่มเข้ามาตรวจสอบได้ หากผู้ป่วยสนใจ ผู้วิจัยจะอธิบายวัตถุประสงค์และวิธีดำเนินการศึกษาวิจัยให้ทราบอย่างละเอียด พร้อมแสดงเอกสารประกอบภาพท่ารำไทยและการตรวจร่างกาย ผู้วิจัยจะให้ผู้ป่วยมีเวลาในการอ่านและปรึกษาญาติ รวมทั้งแพทย์ หรือนักกายภาพบำบัด ประกอบการตัดสินใจ

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หากมีข้อสงสัย ผู้ป่วยสามารถซักถามได้ จากนั้นข้าพเจ้าลงนามในหนังสือแสดงเจตนายินยอมเข้าร่วมโครงการวิจัย

2. ขั้นตอนการเก็บข้อมูล

1) ผู้วิจัยจะทำการศึกษาประวัติจากเวชระเบียน, ซักประวัติ, แบบสอบถาม และตรวจร่างกายของข้าพเจ้า

2) ผู้วิจัยมีขั้นตอนการศึกษาวิจัยในสัปดาห์ที่ 1 ดังนี้

2.1) ข้าพเจ้าจะได้รับการอธิบายวิธีการเก็บข้อมูล และหากมีข้อสงสัย ข้าพเจ้าสามารถซักถามได้ ซึ่งผู้วิจัยจะใช้เวลาในการเก็บข้อมูลก่อนและหลังการรำไทยประมาณ 60 นาที

2.2) เมื่อข้าพเจ้าเข้าใจวิธีการเก็บข้อมูลแล้ว ข้าพเจ้าจะได้รับการ ซักประวัติ และตรวจร่างกายก่อนการรำไทย ดังนี้

-แบบประเมินระดับความรุนแรงของอาการและความสามารถในการทำกิจกรรม ซึ่งประกอบด้วยแบบสอบถามที่ให้ข้าพเจ้าเป็นผู้ตอบคำถามจำนวน 2 ชุด ชุดที่ 1 เป็นแบบสอบถามเพื่อประเมินระดับความรุนแรงของอาการได้แก่ อาการปวด, ชา, ปวดแปล๊บซ่า และอ่อนแรง และชุดที่ 2 เป็นแบบสอบถามเพื่อประเมินความสามารถในการทำกิจกรรม ได้แก่ การเขียน, ติดกระดุมเสื้อ, ถือหนังสือขณะอ่าน, จับหูโทรศัพท์, เปิดเหยือก, งานบ้าน, หิ้วถุงใส่ของชำ, อาบน้ำและแต่งตัว ซึ่งข้าพเจ้าเป็นผู้ตอบแบบสอบถามด้วยตนเอง

- การทดสอบด้วยวิธีของฟาเลน เป็นการทดสอบการถูกกดทับของเส้นประสาทบริเวณมือ

รูปที่ C1 การทดสอบด้วยวิธีของฟาเลน (Phalen's test)

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- การทดสอบเพื่อหาอาการแสดงของไทเนล ซึ่งเป็นการทดสอบหาอาการแสดงบริเวณมือ

รูปที่ C2 การทดสอบเพื่อหาอาการแสดงของ ไทเนล (Tinel's test)

- การทดสอบความสามารถในการรับความรู้สึกสัมผัส ซึ่งเป็นการทดสอบการรับความรู้สึกสัมผัสบริเวณนิ้ว

รูปที่ C3 ขนาดของลวดสังเคราะห์ที่ใช้ในการทดสอบการรับความรู้สึก

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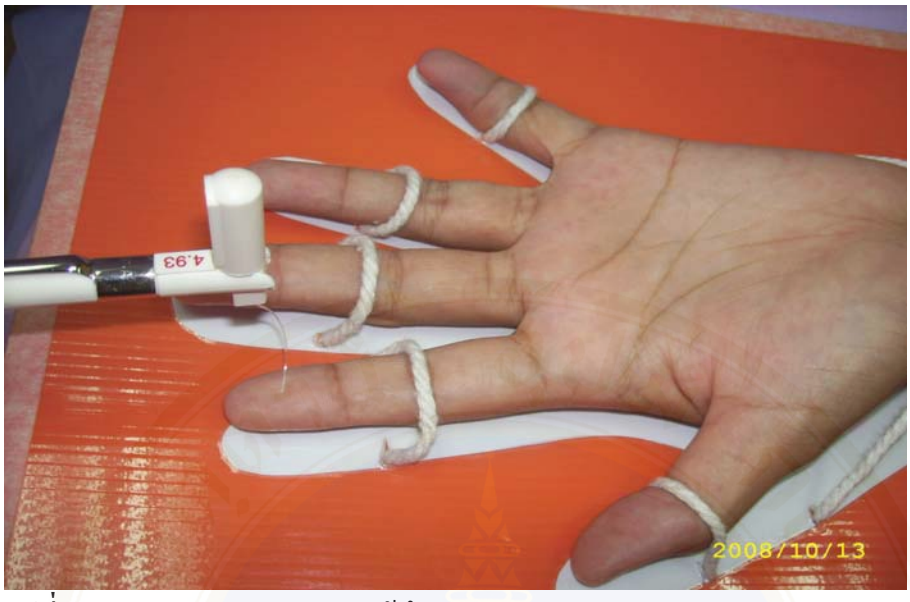

รูปที่ C4 การทดสอบการรับความรู้สึกสัมผัส

- การทดสอบกำลังกล้ามเนื้อมือ ซึ่งเป็นการทดสอบกำลังกล้ามเนื้อบริเวณมือ

รูปที่ C5 การทดสอบกำลังกล้ามเนื้อบริเวณมือ

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รูปที่ C6 การทดสอบกำลังกล้ามเนื้อบริเวณนิ้วมือ

- การทดสอบความตึงตัวของเส้นประสาทมีเดียน

รูปที่ C7 ท่านอนหงายและสวมที่ป้องกันการเคลื่อนไหวศีรษะขณะทดสอบความตึงตัวของเส้นประสาทมีเดียน

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รูปที่ C8 ท่านอนหงายและสวมที่กดไหล่
ขณะทดสอบความตึงตัวของเส้นประสาทมีเดียน

รูปที่ C9 ท่านอนหงายและสวมที่ป้องกันการหุบแขน
ขณะทดสอบความตึงตัวของเส้นประสาทมีเดียน

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รูปที่ C10 การวัดองศาการเหยียดศอก
ขณะทดสอบความตึงตัวของเส้นประสาทมีเดียน

2.3) ข้าพเจ้าจะได้รับการอธิบายขั้นตอนและท่ารำไทยที่ถูกต้องอย่างละเอียด โดยมีแผ่นพับและวีซีดีแสดงท่ารำไทย หากมีข้อสงสัย ข้าพเจ้าสามารถ ซักถามได้

2.4) เมื่อข้าพเจ้าวิจัยเข้าใจขั้นตอนและท่ารำไทยที่ถูกต้องอย่างละเอียด ผู้วิจัยจะให้ข้าพเจ้าทำการรำไทยทั้ง 3 ท่า และผู้วิจัยจะตรวจสอบความถูกต้องของท่ารำ

2.6) เมื่อข้าพเจ้าเข้าใจและสามารถรำไทยได้ถูกต้อง ผู้วิจัยจะให้ข้าพเจ้าทำการรำไทยทั้ง 3 ท่าพร้อมวีซีดี และผู้วิจัยจะตรวจสอบความถูกต้องของท่ารำ ขณะรำ เวลาในการรำไทยประมาณ 5 นาที

2.7) ข้าพเจ้าจะได้รับการ ซักประวัติ และตรวจร่างกาย หลังการรำไทยซึ่งเป็นการตรวจร่างกายที่เคยได้รับก่อนการรำไทย ซึ่งเวลาในการเก็บข้อมูลก่อนและหลังรำไทย

2.8) ข้าพเจ้าจะได้รับแผ่นพับและวีซีดี เพื่อสามารถรำไทยได้ด้วยตนเองทุกวัน วันละ 1 ครั้งเป็นเวลาประมาณ 5นาที ติดต่อกันเป็นเวลา 3 สัปดาห์ และ ได้รับ แบบบันทึกอาการหลังรำไทย

2.9) ผู้วิจัยทำการ โทรศัพท์เพื่อสอบถามอาการหลังรำไทย และป้องกันการเกิดอาการที่ไม่พึงประสงค์หลังรำไทย โดยทำการสุ่มเลือกวันที่จะทำการติดต่อ สัปดาห์ละ 2 ครั้งต่อคน หากข้าพเจ้าไม่ต้องการให้ผู้วิจัยทำการโทรศัพท์เพื่อสอบถามอาการ ผู้วิจัยจะไม่ทำการโทรศัพท์ และหากเกิดอาการที่ไม่พึงประสงค์ ข้าพเจ้าสามารถแจ้งให้ผู้วิจัยทราบตามที่อยู่ที่ได้รับ เพื่อผู้วิจัยจะได้ทำการหาแก้ไขปัญหาได้ทันที และป้องกันการเกิดปัญหานี้ในการรำไทยครั้งต่อไป พร้อมแจ้งให้แพทย์หรือนักกายภาพบำบัดผู้รับผิดชอบทราบ เพื่อแก้ไขปัญหา

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3) ในสัปดาห์ที่ 2และ 3 ของการศึกษาวิจัย มีขั้นตอนการดำเนินการดังนี้

3.1) ผู้วิจัยรับแบบบันทึกอาการหลังรำไทย เพื่อทราบอาการหลังรำไทย และ หากเกิดอาการที่ไม่พึงประสงค์ ผู้วิจัยจะได้ทำการหาแก้ไขปัญหาได้ทันที และป้องกันการเกิดปัญหานี้ในการรำไทยครั้งต่อไป พร้อมแจ้งให้แพทย์หรือนักกายภาพบำบัดผู้รับผิดชอบทราบ เพื่อแก้ไขปัญหา

3.2) ข้าพเจ้าจะได้รับการ ซักประวัติ และตรวจร่างกาย ก่อนการรำไทยซึ่งเป็นการตรวจร่างกายที่เคยได้รับในสัปดาห์ที่ 1

3.3) ผู้วิจัยจะให้ข้าพเจ้าทำการรำไทยทั้ง 3 ท่า และผู้วิจัยจะตรวจสอบความถูกต้องของท่ารำ

3.4) เมื่อข้าพเจ้าสามารถรำไทยได้ถูกต้อง ผู้วิจัยจะให้ข้าพเจ้าทำการรำไทยทั้ง 3 ท่าพร้อมวีซีดี และผู้วิจัยจะตรวจสอบความถูกต้องของท่ารำ ขณะรำ

3.5) ข้าพเจ้าจะได้รับการ ซักประวัติ และตรวจร่างกาย หลังการรำไทย ซึ่งเป็นการตรวจร่างกายที่เคยได้รับในสัปดาห์ที่ 1

3.6) ข้าพเจ้าจะได้รับ แบบบันทึกอาการหลังรำไทย

3.7) ผู้วิจัยทำการโทรศัพท์เพื่อสอบถามอาการหลังรำไทย และหากข้าพเจ้าไม่ต้องการให้ผู้วิจัยทำการโทรศัพท์เพื่อสอบถามอาการ ผู้วิจัยจะไม่ทำการโทรศัพท์ หากเกิดอาการที่ไม่พึงประสงค์ข้าพเจ้าสามารถแจ้งให้ผู้วิจัยทราบตามที่อยู่ที่ได้รับ

4) ข้าพเจ้าจะต้องเข้าร่วมเก็บข้อมูลวิจัย จำนวน 4 ครั้ง การศึกษารวม 3 สัปดาห์ ในวันแรกของสัปดาห์ที่ 1, 2, 3 และวันสุดท้ายของสัปดาห์ที่3 เพื่อศึกษาผลการรำไทยต่อการทำหน้าที่และการตอบสนองของเส้นประสาทในผู้ที่มีกลุ่มอาการช่องข้อมือถูกกดทับ ณ คณะกายภาพบำบัดและวิทยาศาสตร์การเคลื่อนไหวประยุกต์ มหาวิทยาลัยมหิดล198/2 อาคารสำนักงานมหาวิทยาลัยมหิดล (เชิงสะพานสมเด็จพระปิ่นเกล้า) ถ.สมเด็จพระปิ่นเกล้า แขวงบางยี่ขัน เขตบางพลัด กรุงเทพฯ โดยระยะเวลาการเก็บข้อมูลวิจัยในหนึ่งครั้ง นาน 60 นาที แบ่งเป็น 2 ช่วง คือ ช่วง 20 นาทีแรกก่อนการรำไทย, ช่วงการรำไทย 5 นาที และช่วง 20 นาทีหลังการรำไทย และมีช่วงพักระหว่างการวิจัย 15 นาที

5) หากข้าพเจ้าเริ่มรู้สึกไม่สบายใดๆทั้งด้านร่างกายและจิตใจ เกิดความเครียดหรือไม่อยากเข้าร่วมในงานวิจัย ผู้วิจัยจะหยุดการวิจัยทันที และหากญาติของข้าพเจ้ารู้สึกเบื่อหน่าย เสียเวลา ญาติสามารถขอหยุดการวิจัยได้ทันที โดยไม่ต้องแจ้ง ให้ทราบล่วงหน้า และการไม่เข้าร่วมการวิจัยหรือถอนตัวออกจากโครงการวิจัยจะไม่มีผลกระทบต่อการบริการและการรักษาที่สมควรได้นับแต่ประการใด

ทั้งนี้ ข้าพเจ้าได้รับทราบข้อมูลทางวิชาการเกี่ยวกับความเสี่ยงต่ออันตรายหรือความไม่สุขสบายที่อาจจะได้ รับจากการเข้าร่วมการวิจัย คือ การรำไทยจะไม่มีความเสี่ยงใดต่อผู้ป่วยในกลุ่ม

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อาการกดทับเส้นประสาทบริเวณข้อมือ แต่ข้าพเจ้าจะได้รับการสอนและปฏิบัติอย่างถูกต้องมีประสิทธิภาพ อาจต้องใช้ระยะ เวลาในการฝึกปฏิบัติพอสมควร ซึ่งผู้วิจัยคาดว่าอาจส่งผลให้ข้าพเจ้าเกิดความอ่อนล้าหรือความเครียดจากการฝึกรำไทย ส่วนในด้านเทคนิคการตรวจวัดนั้น มีการศึกษาวิจัยด้วยเทคนิคดังกล่าวเป็นเทคนิคการตรวจที่นิยมใช้ทางคลินิกและกรวิจัย ซึ่งไม่พบรายงานการบาดเจ็บที่เกิดขึ้นกับผู้เข้าร่วมการวิจัย นอกจากนี้ การศึกษานี้ผู้วิจัยยังจัดลำดับการรำไทยจากท่าที่มีองศาการเคลื่อนไหวของเส้นประสาทมีเดียนในระดับน้อยจนถึงมากดังนี้ ท่าพรหมสี่หน้า-ยูงฟ้อนหาง, ท่าล่อแก้วและท่าชะนีร่ายไม้ อีกทั้งท่ารำไทยในการศึกษาครั้งนี้ จะไม่ให้รำท่าเดิมนาน และใช้ระยะเวลาในการรำไทยไม่นาน เพื่อป้องกันความเมื่อยล้าจากการรำไทยและป้องกันการเกิดอาการที่ไม่พึงประสงค์หลังจากการรำไทย ผู้วิจัยจึงเชื่อมั่นว่าจะมีความเสี่ยงน้อยที่สุดที่อาจ จะเกิดเหตุการณ์ไม่พึงประสงค์ต่อประชากรที่เข้าร่วมการศึกษา แต่ทั้งการรำไทยและการตรวจอาจทำให้เกิดความเครียด เบื่อหน่าย เสียเวลา ผู้วิจัยจะจัดช่วงพักระหว่างการทดสอบแต่ละครั้ง ซึ่งเป็นวิธีป้องกันความเมื่อยล้า นอกจากนี้ข้าพเจ้าจะได้รับการยืดกล้ามเนื้อแขนก่อนและหลังการทำวิจัย รวมเวลาประมาณ 15 นาที

ข้าพเจ้าได้รับทราบถึงประโยชน์โดยตรงที่ข้าพเจ้าจะได้รับ คือ ข้าพเจ้าจะได้ทราบถึงระดับความรุนแรงของอาการและความสามารถในการทำ กิจวัตรประจำวัน ความสามารถในการรับความรู้สึกสัมผัส กำลังกล้ามเนื้อมือ ความตึงตัวของเส้นประสาทมีเดียน ของตนเอง ซึ่งสามารถประเมินระดับอาการของโรคและตระหนักถึงการสนใจดูแลสุขภาพของตนเอง , สามารถปฏิบัติเทคนิคการเคลื่อนไหวเส้นประสาทด้วยวิธีรำไทยในการศึกษาครั้งนี้ ได้อย่างถูกต้องและมีประสิทธิภาพ ทั้งนี้ ประโยชน์โดยรวมของการศึกษานี้ จะเป็นข้อมูลทางวิชาการที่สามารถเผยแพร่แนะนำและเป็นแนวทางในการใช้เทคนิคการเคลื่อนไหวเส้นประสาทด้วยวิธีรำไทยด้วยตนเองสำหรับผู้ป่วยที่มีกลุ่มอาการช่องข้อมือถูกกดทับได้อย่างมีประสิทธิภาพ อีกทั้ง ผลการศึกษาครั้งนี้อาจเป็นข้อมูลสนับสนุนการนำเทคนิคการเคลื่อนไหวเส้นประสาทด้วยวิธีรำไทยด้วยตนเองไปใช้ในทางคลินิกกับผู้ป่วยที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ ซึ่งย่อมส่งผลต่อด้านงบประมาณค่าใช้จ่ายเพื่อการดูแลรักษาของผู้ป่วยและรัฐน้อยลง จากการอาการกำเริบของโรค ความถี่ของการเข้ารับการรักษาตัวในโรงพยาบาล และอาจเป็นแนวทางในการออกกำลังกายเพื่อป้องกันอาการที่เกิดจากปัญหาเส้นประสาทมีเดียนตึงตัว ทำให้เกิดผลดีในระยะยาวต่อประโยชน์โดยรวมของประเทศไทยได้ และหากการรำไทยมีประโยชน์ต่อการรักษาทางกายภาพบำบัด จะเป็นการกระตุ้นให้คนไทยเห็นถึงความสำคัญของการรำไทยและเป็นการอนุรักษ์เอกลักษณ์ของชาติให้คงอยู่สืบไป

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ข้าพเจ้าได้รับทราบถึงสิทธิ์ที่จะได้รับข้อมูลเพิ่มเติมทั้งทางด้านประโยชน์และโทษที่เกี่ยวข้องกับการวิจัยอย่างรวดเร็วโดยไม่ปิดปัง และสามารถไม่เข้าร่วมการวิจัยได้ทุกเมื่อ โดยไม่ต้องแจ้งให้ทราบล่วงหน้าและจะไม่มีผลกระทบต่อการบริการและการรักษาพยาบาลที่ข้าพเจ้าสมควรจะได้รับต่อไปในอนาคต อีกทั้งข้อมูลส่วนตัวของข้าพเจ้าจะถูกเก็บรักษาไว้ ไม่เปิดเผยต่อสาธารณะเป็นรายบุคคล แต่จะรายงานผลการวิจัยเป็นข้อมูลโดยรวม ทั้งนี้ข้อมูลเป็นรายบุคคลอาจมีคณะบุคคลบางกลุ่มเข้ามาตรวจสอบได้ เช่น สถาบันหรือองค์กรของรัฐที่มีหน้าที่ตรวจสอบ, คณะกรรมการจริยธรรมฯ เป็นต้น

หากเกิดผลข้างเคียงที่ไม่พึงประสงค์จากการวิจัย ข้าพเจ้าจะได้รับการช่วยเหลือจากผู้วิจัยและส่งปรึกษาแพทย์ผู้เชี่ยวชาญหรือนักกายภาพบำบัดต่อไป โดยจะได้รับการรักษาพยาบาลอย่างถูกต้อง เหมาะสม ทั้งนี้ผู้วิจัยจะเป็นผู้รับผิดชอบค่าใช้จ่ายนั้น ข้าพเจ้าจะได้รับค่าชดเชยสำหรับการเดินทางในการเข้าร่วมการศึกษา ครั้งละ 200 บาท, จำนวน 4 ครั้ง รวม 800 บาทตลอดการศึกษาและไม่มีค่าใช้จ่ายใดๆที่ข้าพเจ้าต้องรับผิดชอบ

หากข้าพเจ้ามีข้อข้องใจเกี่ยวกับขั้นตอนของการวิจัย หรือเกิดผลข้างเคียงที่ไม่พึงประสงค์จากการวิจัย ข้าพเจ้าจะสามารถติดต่อกับนางสาวอุษา ครุครรชิต ที่คณะกายภาพบำบัดและวิทยาศาสตร์การเคลื่อนไหวประยุกต์ ถ.สมเด็จพระปิ่นเกล้า บางยี่ขัน บางพลัด กรุงเทพฯ โทรศัพท์ 083-981-3982

โครงการนี้ได้รับการพิจารณารับรองจากคณะกรรมการจริยธรรมการวิจัยในคนของคณะแพทยศาสตร์ศิริราชพยาบาล หากข้าพเจ้าได้รับการปฏิบัติที่ไม่ตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงนี้ ข้าพเจ้าจะสามารถแจ้งให้ประธานคณะกรรมการจริยธรรมการวิจัยในคนหรือผู้แทน ทราบได้ที่สำนักงานคณะกรรมการจริยธรรมการวิจัยในคน ตึกอดุลยเดชวิกรม ชั้น 6 ร.พ.ศิริราช เบอร์โทรศัพท์ 0-2419-7000 ต่อ 6405

ข้าพเจ้าได้อ่านรายละเอียดในเอกสารนี้ครบถ้วนแล้ว

ลงชื่อ.....

(.....)

วันที่.....

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ในกรณีที่ผู้เข้าร่วมการวิจัยอ่านหนังสือไม่ออก ผู้ที่อ่านข้อความทั้งหมดแทนผู้เข้าร่วมการวิจัย คือ .....

จึงได้ลงลายมือชื่อไว้เป็นพยาน

ลงชื่อ.....พยาน/วันที่.....

(.....)

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APPENDIX D
PARTICIPANT INFORMATION SHEET

เอกสารชี้แจงผู้เข้าร่วมการวิจัย

(Participant Information Sheet)

การรำไทยในการศึกษาครั้งนี้ เป็นการออกกำลังกายด้วยวิธีการเคลื่อนไหวเส้นประสาทบริเวณแขนและมือ มีวัตถุประสงค์เพื่อลดอาการที่เกิดจากการเส้นประสาทตึงตัวถูกกดทับบริเวณมือ ท่ารำไทยที่ใช้ในการศึกษาครั้งนี้มี 3 ท่า ดังนี้

รูปที่ D1 ท่าพรหมสี่หน้า – ยูงฟ้อนหาง

รูปที่ D2 ท่า ล่อแก้ว

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รูปที่ D3 ท่าชะนีร่ายไม้
ที่มา http://www.banramthai.com

การรำไทย

1 ทำการรำไทย ตามวีซีดีที่ท่านได้รับ วันละ 1 ครั้ง ทุกวัน ติดต่อกัน เป็นเวลา 3 สัปดาห์

2 ก่อนรำไทย หากท่านมีอาการไม่พึงประสงค์ เช่น มีอาการเจ็บปวด, ตึง, ชา, ปวดเสียวซ่า หรือกล้ามเนื้อมืออ่อนแรง ขณะกำมือ หยิบจับสิ่งของ ควรรีบแจ้งผู้วิจัยตามที่อยู่ที่แจ้งไว้ เพื่อประเมินอาการและหาทางแก้ไข

3 ขณะรำไทย เพื่อให้การเคลื่อนไหวเส้นประสาทมีประสิทธิภาพ ท่านควรรำไทยให้ท่าและจังหวะถูกต้องตามวีซีดีที่ท่านได้รับ และขณะเคลื่อนไหวในแต่ละท่า ท่านควรรู้สึกตึงบริเวณแขนและมือ แต่ไม่ควรรู้สึกตึงมากเกินไปจนกระทั่งทนไม่ไหว เพราะอาจทำให้เกิดอาการเมื่อยล้าหลังจากการรำ

4 หลังรำไทย หากท่านมีอาการไม่พึงประสงค์ เช่น มีอาการเจ็บปวด, ตึง, ชา, ปวดเสียวซ่า หรือกล้ามเนื้อมืออ่อนแรง ขณะกำมือ หยิบจับสิ่งของ ควรรีบแจ้งผู้วิจัยตามที่อยู่ที่แจ้งไว้ เพื่อประเมินอาการและหาทางแก้ไข นอกจากนี้ท่านควรบันทึกอาการหลังรำไทยทุกครั้ง ซึ่งผู้วิจัยจะได้ทราบว่าท่านเกิดอาการที่ไม่พึงประสงค์หรือไม่ หากเกิดอาการที่ไม่พึงประสงค์ ผู้วิจัยจะได้ทำการหาทางแก้ไข และผู้วิจัยจะทำการประเมินว่า การรำไทยทำให้อาการของท่านเปลี่ยนแปลงอย่างไร เพื่อเป็นประโยชน์ต่องานวิจัย

ที่อยู่ของผู้วิจัย นางสาวอุษา ครุครรชิต
คณะกายภาพบำบัดและวิทยาศาสตร์การเคลื่อนไหวประยุกต์ มหาวิทยาลัยมหิดล
198/2 อาคารสำนักงานมหาวิทยาลัยมหิดล (เชิงสะพานสมเด็จพระปิ่นเกล้า)
ถ.สมเด็จพระปิ่นเกล้า แขวงบางยี่ขัน เขตบางพลัด กรุงเทพฯ 10700
โทรศัพท์ 0-2433-7092 หรือ 083-981-3982

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APPENDIX E
DATA COLLECTION FORM

Code Number…….. Date ……..……..

แบบสอบถามข้อมูลส่วนบุคคล **(กรอกโดยผู้วิจัย)**

ส่วนที่ 1 ข้อมูลทั่วไป

1) ผู้ป่วยรายที่.....

2) อายุ.....ปี เพศ หญิง ชาย

3) ถนัดมือ ขวา ซ้าย

4) อาชีพ..... ลักษณะงาน.....

ระยะเวลาการใช้งานคอมพิวเตอร์.....ชั่งโมง/ วัน

5) กิจกรรมอื่นนอกเหนือจากงานประจำหรือไม่

ไม่มี ออกกำลังกาย ประเภท.....

ความถี่.....(ครั้ง/ สัปดาห์)

หิ้วหรือยกสิ่งของหนัก ความถี่.....(ครั้ง/ สัปดาห์)

นวด บริเวณที่ได้รับการนวด.....

ความถี่.....(ครั้ง/ สัปดาห์)

อื่นๆ โปรดระบุ.....

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ส่วนที่ 2 ข้อมูลเกี่ยวกับการรักษา

1) อาการสำคัญที่มารับการรักษา

ปวด ชา เสียวซ่า กล้ามเนื้อมืออ่อนแรง

2) ระยะเวลาที่เริ่มมีอาการดังกล่าว.....เดือน

3) ระยะเวลาที่เริ่มรักษาจนถึงปัจจุบัน.....เดือน

4) ความถี่ของการเข้ารับการรักษา..... (ครั้ง/ สัปดาห์)

5) การรักษาที่ได้รับ

รับประทานยา ประเภท.....

ความถี่.....(ครั้ง/วัน)

ฉีดยา ประเภท.....

ความถี่.....ครั้ง

การใช้อุปกรณ์พยุงข้อมือ (Splint) ความถี่.....(ชั่วโมง/วัน)

นวด บริเวณที่ได้รับการนวด.....

ความถี่.....(ครั้ง/ สัปดาห์)

แผ่นร้อน(Hot pack) บริเวณที่ได้รับ.....

ความถี่.....(ครั้ง/ สัปดาห์)

การทำอัลตร้าซาว (Ultrasound) บริเวณที่ได้รับ.....

ความถี่.....(ครั้ง/ สัปดาห์)

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การดัด ดึง กระดูกข้อมือ (Carpal bone mobilization) ความถี่..... (ครั้ง/ สัปดาห์)

อื่นๆ โปรดระบุ.....

ความถี่.....(ครั้ง/ สัปดาห์)

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APPENDIX F
QUESTIONNAIRE FOR ASSESSMENT OF SEVERITY OF SYMPTOMS AND FUNCTIONAL STATUS

Code Number…….. Date ……

เพื่อให้ข้อมูลจากการวิจัยเกิดประโยชน์ ขอให้คุณตอบแบบสอบถามทุกข้อตามความเป็นจริง ผู้วิจัยขอขอบคุณในความร่วมมือเป็นอย่างยิ่ง

แบบสอบถามเพื่อประเมินระดับความรุนแรงของอาการและความสามารถในการทำกิจวัตประจำวัน

แบบสอบถามชุดที่ 1 เพื่อประเมินระดับความรุนแรงของอาการ

คำถามต่อไปนี้แสดงอาการ24 ชั่วโมงของคุณภายหลังรำไทย 1 สัปดาห์ (วงกลมล้อมรอบคำตอบเพียงข้อเดียว ในแต่ละคำถาม)

ข้อ 1 คุณมีระดับอาการปวดบริเวณมือหรือข้อมือในช่วงกลางคืนอย่างไร

1 ไม่มีความปวด

2 ปวดเล็กน้อย

3 ปวดปานกลาง

4 ปวดมาก

5 ปวดมากที่สุด

ข้อ 2 คุณมีความถี่ของการตื่นนอนเนื่องจากอาการปวดบริเวณมือหรือข้อมือในช่วงกลางคืนภายหลังรำไทย 1 สัปดาห์อย่างไร

1 ไม่เคยตื่นนอน

2 ตื่นนอน 1 ครั้ง

3 ตื่นนอน 2-3 ครั้ง

4 ตื่นนอน 4-5 ครั้ง

5 ตื่นนอน มากกว่า5 ครั้ง

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ข้อ 3 คุณมีอาการปวดบริเวณมือหรือข้อมือในช่วงกลางวันหรือไม่

1 ฉันไม่เคยมีอาการปวด

2 ฉันมีอาการปวดเล็กน้อย

3 ฉันมีอาการปวดปานกลาง

4 ฉันมีอาการปวดมาก

5 ฉันมีอาการปวดมากที่สุด

ข้อ 4 คุณมีความถี่ของอาการปวดบริเวณมือหรือข้อมือในช่วงกลางวันอย่างไร

1 ไม่เคยมีอาการปวด

2 มีอาการปวด1-2 ครั้งต่อวัน

3 มีอาการปวด3-5 ครั้งต่อวัน

4 มีอาการปวดมากกว่า 5 ครั้งต่อวัน

5 มีอาการปวดตลอดเวลา

ข้อ 5ระยะเวลาที่คุณมีอาการปวดในช่วงกลางวันเป็นอย่างไร

1 ฉันไม่เคยมีอาการปวดในช่วงกลางวัน

2 มีอาการปวดน้อยกว่า 10 นาที

3 มีอาการปวด 10- 60 นาที

4 มีอาการปวดมากกว่า 60 นาที

5 มีอาการปวดตลอดเวลา

ข้อ 6คุณมีอาการชาหรือสูญเสียการรับความรู้สึกบริเวณมือของคุณหรือไม่

1ไม่มีอาการชา

2 ฉันมีอาการชาเล็กน้อย

3 ฉันมีอาการชาปานกลาง

4 ฉันมีอาการชามาก

5 ฉันมีอาการชามากที่สุด

ข้อ 7 คุณมีภาวะกล้ามเนื้ออ่อนแรงบริเวณมือหรือข้อมือของคุณหรือไม่

1 ไม่มีภาวะกล้ามเนื้ออ่อนแรง

2 มีภาวะกล้ามเนื้ออ่อนแรงเล็กน้อย

3 มีภาวะกล้ามเนื้ออ่อนแรงปานกลาง

4 มีภาวะกล้ามเนื้ออ่อนแรงมาก

5 มีภาวะกล้ามเนื้ออ่อนแรงมากที่สุด

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ข้อ 8 คุณมีความรู้สึกปวดเสียว (Tingling) บริเวณมือของคุณหรือไม่

1 ไม่เคยมีความรู้สึกปวดเสียว

2 มีความรู้สึกปวดเสียวเล็กน้อย

3 มีความรู้สึกปวดเสียวปานกลาง

4 มีความรู้สึกปวดเสียวมาก

5 มีความรู้สึกปวดเสียวมากที่สุด

ข้อ 9 คุณมีอาการชา (สูญเสียการรับความรู้สึก) หรือมีความรู้สึกปวดเสียว ในช่วงกลางคืนอย่างไร

1 ไม่เคยมีอาการ

2 มีอาการเล็กน้อย

3 มีอาการปานกลาง

4 มีอาการมาก

5 มีอาการมากที่สุด

ข้อ 10 คุณมีความถี่ของการตื่นนอนเนื่องจากอาการชาหรือปวดเสียวบริเวณมือในช่วงกลางคืน ภายหลังรำไทย 1 สัปดาห์อย่างไร

1 ไม่เคยตื่นนอน

2 ตื่นนอน 1 ครั้ง

3 ตื่นนอน 2-3 ครั้ง

4 ตื่นนอน 4-5 ครั้ง

5 ตื่นนอน มากกว่า 5 ครั้ง

ข้อ 11 คุณมีความยากลำบากในการหยิบจับสิ่งของขนาดเล็กเช่น กุญแจ หรือปากกาหรือไม่

1 ไม่มีความยากลำบาก

2 มีความยากลำบากเล็กน้อย

3 มีความยากลำบากปานกลาง

4 มีความยากลำบากมาก

5 มีความยากลำบากมากที่สุด

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Code Number…….. Date ……..……..

เพื่อให้ข้อมูลจากการวิจัยเกิดประโยชน์ ขอให้คุณตอบแบบสอบถามทุกข้อตามความเป็นจริง ผู้วิจัยขอขอบคุณในความร่วมมือเป็นอย่างยิ่ง

แบบสอบถามชุดที่ 2 เพื่อประเมินความสามารถในการทำกิจวัตรประจำวัน

ภายหลังรำไทย 1 สัปดาห์อาการบริเวณมือและข้อมือของคุณเป็นสาเหตุทำให้คุณมีความยากลำบากในการทำกิจกรรมดังต่อไปนี้หรือไม่ กรุณาวงกลมล้อมรอบคำตอบเพียงข้อเดียวในแต่ละกิจกรรมตามความสามารถของคุณ

กิจกรรม	ไม่ยาก	ยากเล็กน้อย	ยากปานกลาง	ยากมาก	ไม่สามารถทำได้เนื่องจากมีอาการที่มือหรือข้อมือ
การเขียน	1	2	3	4	5
ติดกระดุมเสื้อ	1	2	3	4	5
ถือหนังสือขณะอ่าน	1	2	3	4	5
จับหูโทรศัพท์	1	2	3	4	5
เปิดเหยือก	1	2	3	4	5
งานบ้าน	1	2	3	4	5
หิ้วถุงใส่ของชำ	1	2	3	4	5
อาบน้ำและแต่งตัว	1	2	3	4	5

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APPENDIX G
DIARY SYMPTOM COLLECTION FORM

Code Number…….. Date ……..……..

เพื่อให้ข้อมูลจากการวิจัยเกิดประโยชน์ ขอให้คุณตอบแบบสอบถามทุกข้อตามความเป็นจริง ผู้วิจัยขอขอบคุณในความร่วมมือเป็นอย่างยิ่ง

แบบบันทึกอาการใน 1 สัปดาห์ขณะเข้าร่วมการรำไทย

วันที่เข้าร่วมการรำไทย	การเข้าร่วมรำไทย		อาการที่เปลี่ยนแปลงหลังรำไทย	
	รำ	ไม่รำ	ปวด / เจ็บ	ชา
2				
3				
4				
5				
6				
7				

การเข้าร่วมรำไทย

ให้คุณทำเครื่องหมาย ✓ ในช่องรำ หมายถึง คุณได้ทำการรำไทยตามVCD

หรือ ✓ ในช่องไม่รำ หมายถึง คุณไม่ได้ทำการรำไทยตามVCD

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อาการที่เปลี่ยนแปลงหลังรำไทย

ให้คุณเขียนตัวเลขลงในช่องอาการปวด/ เจ็บ, ชา เพื่อแสดงอาการที่ของคุณภายหลังการรำไทย

0 หมายถึง ไม่มีอาการที่เปลี่ยนแปลงหลังรำไทย

-1 หมายถึง มีอาการแย่ลงเล็กน้อย หรือ พัก 10 นาทีอาการจึงเป็นปกติ

-2 หมายถึง มีอาการแย่ลงมาก หรือ พัก 30 นาทีอาการจึงเป็นปกติ

-3 หมายถึง มีอาการแย่ลงจนไม่สามารถทำกิจวัตรประจำวันได้ หรือ มีอาการคงค้างตลอดเวลา

1 หมายถึง มีอาการดีขึ้นเล็กน้อย

2 หมายถึง มีอาการดีขึ้นมาก แต่ยังไม่สามารถทำกิจวัตรประจำวันได้ดี

3 หมายถึง มีอาการดีขึ้นมาก และสามารถทำกิจวัตรประจำวันได้ดี

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APPENDIX H
DATA COLLECTION FORM

Code Number…….. Date ……..……..

เพื่อให้ข้อมูลจากการวิจัยเกิดประโยชน์ ขอให้คุณตอบแบบสอบถามทุกข้อตามความเป็นจริง ผู้วิจัยขอขอบคุณในความร่วมมือเป็นอย่างยิ่ง

แบบบันทึกการรักษาและกิจกรรมภายใน 1 สัปดาห์ขณะเข้าร่วมการรำไทย

1 คุณมีกิจกรรมอื่นนอกเหนือจากงานประจำหรือไม่

ไม่มี ออกกำลังกาย ประเภท.....

ความถี่.....(ครั้ง/ สัปดาห์)

หิ้วหรือยกสิ่งของหนัก ความถี่.....(ครั้ง/ สัปดาห์)

นวด บริเวณที่ได้รับการนวด.....

ความถี่.....(ครั้ง/ สัปดาห์)

อื่นๆ โปรดระบุ.....

2 คุณได้รับการรักษาอื่นนอกเหนือจากการรักษาที่เคยได้รับหรือไม่

ไม่มี รับประทานยา/ฉีดยา ประเภท.....

ความถี่.....(ครั้ง/วัน)

นวด บริเวณที่ได้รับการนวด.....

ความถี่.....(ครั้ง/ สัปดาห์)

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การใช้อุปกรณ์พยุงข้อมือ (Splint) ความถี่.....(ชั่วโมง/วัน)

อื่นๆ โปรดระบุ.....

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APPENDIX I
INTERVIEW FORM

บทสัมภาษณ์ทางโทรศัพท์เพื่อสอบถามอาการเปลี่ยนแปลงหลังรำไทย

สวัสดีค่ะ ดิฉัน นางสาวอุษา ครุครรชิต นักศึกษาปริญญาโท สาขากายภาพบำบัด ซึ่งได้ทำการวิจัยเรื่อง ผลของการรำไทยต่อการตอบสนองทางประสาทพลศาสตร์ ในผู้ที่มีกลุ่มอาการกดทับเส้นประสาทบริเวณข้อมือ ไม่ทราบว่าคุณ..... สะดวกที่จะให้ข้อมูลเกี่ยวกับอาการเปลี่ยนแปลงหลังรำไทยหรือไม่ค่ะ ซึ่งจะใช้เวลาประมาณ 5 นาทีค่ะ

1 กรณีผู้เข้าร่วมวิจัยสะดวกในการให้ข้อมูล

คุณ..... เกิดอาการเปลี่ยนแปลงหลังรำไทยในครั้งแรกอย่างไรบ้างค่ะ เช่น อาการปวด เจ็บ ตึง ชา กล้ามเนื้อมืออ่อนแรง หยิบจับสิ่งของไม่สะดวกหรือไม่ค่ะ หากเกิดอาการดังกล่าวสามารถโทรศัพท์แจ้งดิฉันตามเบอร์โทรนี้ (083-9813982) ได้ตลอดเวลา เพื่อหาสาเหตุและแนวทางแก้ไขค่ะ

1) กรณีผู้เข้าร่วมวิจัยไม่เกิดเหตุการณ์ที่ไม่พึงประสงค์ (ในการรำไทยครั้งแรก)

คุณ..... ได้ทำการรำไทยตามVCD ด้วยตนเอง หรือยังค่ะ ไม่ทราบว่าเกิดอาการเปลี่ยนแปลงหลังรำไทยอย่างไรบ้างค่ะ

1.1) กรณีผู้เข้าร่วมวิจัยไม่เกิดเหตุการณ์ที่ไม่พึงประสงค์ (ในการรำไทยด้วยตนเอง)

ดิฉันขอขอบคุณที่ให้ข้อมูลค่ะ สวัสดีค่ะ

1.2) กรณีผู้เข้าร่วมวิจัยเกิดเหตุการณ์ที่ไม่พึงประสงค์ (ในการรำไทยด้วยตนเอง)

อาการคงค้างที่เกิดขึ้นต้องใช้เวลานานเท่าไหร่ อาการจึงหายไปค่ะ และเกิดอาการก่อนหรือหลังรำไทยค่ะ ในขณะรำให้แขนและมือรู้สึกตึงมากเกินไปหรือไม่ค่ะ ในการรำไทยครั้งต่อไปให้แขนและมือรู้สึกตึงแต่ไม่มากเกินไปนะคะ คุณ.....ได้ทำกิจกรรมอื่นนอกเหนือจากชีวิตประจำวันหรือไม่ค่ะ เช่น การหิ้วหรือยกของหนัก หากคุณ.....ได้ทำกิจกรรมเหล่านี้จะทำให้อาการของคุณเพิ่มขึ้นได้ค่ะ คุณจึงควรหลีกเลี่ยงกิจกรรมดังกล่าวค่ะ ดิฉันขอขอบคุณที่ให้ข้อมูลค่ะ สวัสดีค่ะ

2) กรณีผู้เข้าร่วมวิจัยเกิดเหตุการณ์ที่ไม่พึงประสงค์ (ในการรำไทยครั้งแรก)

ผู้วิจัยจะสัมภาษณ์เช่นเดียวกับข้อ 1.2)

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2 กรณีผู้เข้าร่วมวิจัยไม่สะดวกในการให้ข้อมูล

ไม่ทราบว่าคุณ.....สะดวกให้ดิฉันโทรศัพท์เพื่อสอบถามข้อมูลได้เมื่อไหร่ค่ะ หรือว่าไม่สะดวกให้ดิฉันโทรศัพท์ค่ะ หากเกิดอาการใดๆเพิ่มขึ้นหลังรำไทย สามารถโทรศัพท์แจ้งดิฉันตามเบอร์โทรนี้ (083-9813982) ได้ตลอดเวลา เพื่อหาสาเหตุและแนวทางแก้ไขค่ะ ขอบคุณค่ะ สวัสดีค่ะ

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APPENDIX J
DATA COLLECTION FORM

Code Number…….. Date ……..……..

Week ……..

Before / After Thai dance

Tests	Left hand	Right hand
Phalen's test		
Tinel's test		
SWMT		
Hand grip strength		
Tip to tip pinch strength		
ULNT 1		

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APPENDIX K
OPINION OF PARTICIPANTS FORM

Code Number…….. Date ……..……..

เพื่อให้ข้อมูลจากการวิจัยเกิดประโยชน์ ขอให้คุณตอบแบบสอบถามทุกข้อตามความเป็นจริง ผู้วิจัย ขอขอบคุณในความร่วมมือเป็นอย่างยิ่ง

แบบสอบถามเพื่อประเมินความพึงพอใจต่อการรำไทย

โปรดระบุความพึงพอใจโดยรวมต่อการรำไทย ที่คุณได้ฝึกปฏิบัติจากการวิจัยครั้งนี้

หัวข้อ	5 มากที่สุด	4 มาก	3 ปานกลาง	2 น้อย	1 น้อยที่สุด
1) ความง่ายของท่ารำไทย					
2) ความสามารถในการรำไทยตามระยะเวลาที่กำหนด					
3) ประโยชน์ที่ได้รับจากการรำไทย					
4) ความพึงพอใจกับการรำไทย					

หัวข้อ	ใช่	ไม่แน่ใจ	ไม่ใช่
5)คุณจะรำไทยตามโปรแกรมต่อไปใช่หรือไม่			
6) คุณจะแนะนำให้ผู้อื่นรำไทยใช่หรือไม่			

ข้อเสนอแนะ (ถ้ามี)

.....

.....

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APPENDIX L
RELIABILITY OF TINEL'S TEST

Intra-tester reliability of Tinel's test

Aim

To ensure that the researcher perform the test and measure the distance responded from the participants, with acceptable reliability.

Procedure

1. The participants were tapped over the transverse carpal ligament by researcher's fingertip.
2. The test was recorded position if the participant experiences tingling in at least one of three radial digits.
3. The researcher recorded distance from the point that the participant experiences tingling to transverse carpal ligament.
4. The measurement was performed three times. The distance by the participant's response positive Tinel's test is shown in table L

Table L The distance by the participant's response positive Tinel's test (cm)

Number of participants	Trial 1	Trial 2	Trial 3
1	0.5	0.5	0.5
2	0.8	0.8	0.9
3	0.7	0.8	0.8
4	1.0	1.0	1.0
5	0.6	0.5	0.6
6	1.2	1.2	1.2
7	0.8	0.8	0.8
8	0.5	0.5	0.5
9	1.1	1.2	1.2
10	0.8	0.8	0.8

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Data Analysis

The Intraclass Correlation Coefficient ($ICC_{3, 1)}$ is used to determine the intratester reliability for the distance by the participant's response positive Tinel's test.

Results

The distance by the participant's response positive Tinel's test is shown in table L. The Intraclass Correlation Coefficient ($ICC_{3,1}$) of the distance by the participant's response positive Tinel's test is 0.994.

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APPENDIX M
RELIABILITY OF SWMT

Intra-tester reliability of Semmes-Weinstein monofilament test (SWMT)

Aim

To test the intra-tester reliability of light touch using SWMT was examined on the participant with CTS.

Procedure

1. The researcher was explained about the reasons and the procedures used SWMT.
2. The researcher and the participants sat across a table. The participants were asked to close eyes.
3. Firstly, the smallest monofilament, 2.83, was applied on the participant's finger tip randomly for two seconds.
4. The result was recorded only index finger.
5. If the participant felt the smallest monofilament, the researcher recorded the size of that monofilament. If the participant did not respond to this monofilament, the next longer monofilament was used until the participant responded and the size of monofilament was than recorded.
6. The testing was performed three times with the interval between each test not less than five minutes. The testing was done in a quiet room. The results of the intra-tester reliability of SWMT is shown in table M.

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Table M The size of monofilament

Number of participants	Trial 1	Trial 2	Trial 3
1	3.22	3.22	3.22
2	3.22	3.22	2.83
3	3.61	3.22	3.61
4	3.61	3.61	3.61
5	2.83	2.83	2.83
6	3.22	3.61	3.61
7	2.83	3.22	3.22
8	2.83	2.83	2.83
9	3.61	3.61	3.22
10	3.22	3.22	3.22

2.83 = Normal
3.61 = Diminished light touch
4.31 = Diminished protection sensation
4.56 = Loss of protective sensation
6.65 = Untested able

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APPENDIX N
RELIABILITY OF ULNT1

Intra-tester reliability of Upper limb neurodynamic test 1 (ULNT1)

Aim

To test the intra-tester reliability of the elbow extension angle measurement measured by the researcher.

Procedure

1. The researcher was explained about the reasons and the procedures used for ULNT1.
2. Participants were asked to supine lie with elbow flexed.
3. Participants were marked the line from the medial side of the upper arm (parallel to the humerus) to the medial epicondyle of humerus and from the medial epicondyle of humerus to over the ulnar styloid process. The universal goniometer was placed parallel these line; the stationary arm was on the line from the medial side of the upper arm (parallel to the humerus) to the medial epicondyle of humerus. The movable arm was on the line from the medial epicondyle of humerus to the ulnar styloid process and the axis was on the level of the medial epicondyle of humerus.
4. Participants were asked to relax as much as possible during tested then the value of elbow extension angles were recorded.
5. The test was performed three times with the interval between each test not less than five minutes. The test was performed in a quiet room. The results of the intra-tester reliability of ULNT1 is shown in table N.

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Table N range of motion (degree) of the elbow extension angle measured

Number of participants	Trial 1	Trial 2	Trial 3
1	130	140	140
2	150	150	150
3	180	180	180
4	130	135	135
5	160	160	165
6	180	180	180
7	140	145	140
8	120	130	130
9	160	160	160
10	170	180	180

Data Analysis

The Intraclass Correlation Coefficient ($ICC_{3, 1)}$ is used to determine the intratester reliability for the elbow extension angle.

Results

The elbow extension angle is shown in table N. The Intraclass Correlation Coefficient ($ICC_{3,1}$) of elbow extension angle measurement is 0.993.

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APPENDIX O
RESULT OF PILOT STUDY

Table O.1 Characteristics of the participants including gender, age, occupation and hand domination

Participants	Gender	Age(years)	Occupation	Affected hand	Hand domination
1	Female	50	Sedentary	Right side	Right side
2	Female	45	House worker	Right side	Right side
3	Female	41	House worker	Right side	Right side
4	Female	53	Sedentary	Right side	Right side
5	Female	57	Sedentary	Right side	Right side

Table O.2 The characteristics of the participants by duration of CTS illness and symptoms

Participant	Duration of illness (months)	Symptoms
1	9	numbness
2	7	numbness
3	10	Weakness and numbness
4	9	numbness
5	8	numbness

Table O.3 The characteristics of the participants by treatment

Participants	Oral medication	Wrist splint	Superficial heat	Ultrasound	Massage	Wrist stretching	Carpal bone mobilization	Nerve mobilization
1	√		√	√	√	√		
2			√	√	√	√		
3		√	√	√	√	√	√	
4			√	√	√	√		
5			√	√	√	√		√

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Table O.4 The SSS data of the participants

Participants	1st week	2nd week	3rd week	Last day of 3rd week
1	23	21	20	16
2	27	22	17	15
3	23	22	15	15
4	23	21	20	17
5	28	22	20	15

Table O.5 Means and standard deviation of SSS

Week	**Mean(score)**	**Standard deviation**
1st week	24.8	2.2
2nd week	21.6	0.5
3rd week	18.4	2.3
Last day of 3rd week	15.6	0.9

Table O.6 The FSS data of the participants

Participants	1st week	2nd week	3rd week	Last day of 3rd week
1	19	14	12	10
2	20	19	16	15
3	22	21	19	18
4	25	25	23	20
5	21	19	17	17

Table O.7 Means and standard deviation of FSS

Week	**Mean(score)**	**Standard deviation**
1st week	21.4	2.3
2nd week	19.6	4
3rd week	17.4	4
Last day of 3rd week	16	3.8

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Table O.8 The time response to the positive Phalen test data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	35	48	45	55	55	60	50	60
2	30	38	35	40	40	50	45	55
3	20	30	20	30	20	40	30	40
4	24	40	50	50	60	60	60	60
5	20	30	20	30	35	40	45	58

Table O.9 Means and standard deviation of time response to the positive Phalen test

Week	**Mean(second)**	**Standard deviation**
Pre_1st week	25.8	6.6
Post_1st week	37.2	7.6
Pre_2nd week	34	13.9
Post_2nd week	41	11.4
Pre_3rd week	42	16
Post_3rd week	50	10
Last-pre_3rd week	46	10.8
Last-post_3rd week	54.6	8.4

Table O.10 The distance response to the positive Tinel's test data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	1.8	1.8	1.8	1.8	1.5	1.5	1.5	1.5
2	0	0	0	0	0	0	0	0
3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
4	2	2	2	2	1.8	1.8	1.5	1.5
5	2	2	2	2	1.8	1.8	1.8	1.8

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Table O.11 Means and standard deviation of distance by the participant's response positive Tinel's test

Week	Mean (cm.)	Standard deviation
Pre_1st week	1.32	0.89
Post_1st week	1.32	0.89
Pre_2nd week	1.32	0.89
Post_2nd week	1.32	0.89
Pre_3rd week	1.18	0.76
Post_3rd week	1.18	0.76
Last-pre_3rd week	1.12	0.73
Last-post_3rd week	1.12	0.73

Table O.12 The hand light touch sensation data of participants

Subjects	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	3.61	3.61	3.61	3.61	3.61	3.22	3.22	3.22
2	3.61	3.22	3.61	3.22	3.22	3.22	3.22	3.22
3	3.61	3.61	3.61	3.22	3.22	3.22	3.22	2.83
4	4.08	3.61	3.61	3.22	3.22	3.22	3.22	3.22
5	3.61	3.61	3.61	3.22	3.61	3.22	3.22	3.22

Table O.13 Percentile 25th, 50th and 75th of hand light touch sensation value forSWMT

Week	Percentile 25th	Percentile 50th	Percentile 75th
Pre_1st week	3.61	3.61	3.90
Post_1st week	3.61	3.61	3.61
Pre_2nd week	3.61	3.61	3.67
Post_2nd week	3.22	3.22	3.61
Pre_3rd week	3.22	3.61	3.61
Post_3rd week	3.22	3.22	3.61
Last-pre_3rd week	3.22	3.22	3.61
Last-post_3rd week	3.12	3.22	3.22

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Table O.14 The grip strength data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	20	22	23	25	25	28	30	32
2	30	30	30	32	30	32	34	34
3	26	26	26	26	26	28	26	28
4	20	20	20	22	20	22	21	22
5	25	26	26	28	30	30	30	30

Table O.15 Means and standard deviation of hand strength value for grip strength test

Week	**Mean (kg.)**	**Standard deviation**
Pre_1st week	24.2	4.2
Post_1st week	24.8	3.9
Pre_2nd week	25	3.7
Post_2nd week	26.6	3.7
Pre_3rd week	26.2	4.1
Post_3rd week	28	3.7
Last-pre_3rd week	28.2	4.9
Last-post_3rd week	29.2	4.6

Table O.16 The tip to tip pinch strength data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	4	5	5	6	6	7	7	7
2	5	6	6	7	7	7	7	8
3	5	6	6	6	6	7	6	7
4	3	3	3	4	4	4	4	4
5	2	3	3	3	3	4	3	4

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Table O.17 Means and standard deviation of hand strength value for tip to tip pinch strength test

Week	Mean (kg.)	Standard deviation
Pre_1st week	3.8	1.3
Post_1st week	4.6	1.52
Pre_2nd week	4.6	1.52
Post_2nd week	5.2	1.64
Pre_3rd week	5.2	1.64
Post_3rd week	5.8	1.64
Last-pre_3rd week	5.4	1.82
Last-post_3rd week	6	1.87

Table O.18 The elbow extension degree data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	120	125	120	130	120	130	125	130
2	140	145	135	145	138	145	140	145
3	145	150	145	150	145	150	150	155
4	135	145	140	150	160	170	168	175
5	120	120	120	125	120	125	120	125

Table O.19 Means and standard deviation of elbow extension degree for ULNT1

Week	Mean(degree)	Standard deviation
Pre_1st week	132	11.5
Post_1st week	137	13.5
Pre_2nd week	132	11.5
Post_2nd week	140	11.7
Pre_3rd week	137	17.1
Post_3rd week	144	17.8
Last-pre_3rd week	141	19.4
Last-post_3rd week	146	20

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APPENDIX P
SAMPLE SIZE CALCULATION

Sample Size Calculation

The sample size for this study was calculated using the following equation:

$$N = \left\{ \frac{(Z_\alpha + Z_\beta)\sigma_d}{\Delta} \right\}^2$$

Where;

N = sample size

Z_α = Z-value when the confidence equal to 95% or significance level at 0.05 ($\alpha = 0.05$) = 1.96

Z_β = Z-value when set the power of testing equal to 80% ($\beta = 0.2$) = 0.84

σ_d = Standard deviation of mean difference of elbow extension degree using ULNT1 between before and after performing Thai dance from the pilot study

Δ = the mean difference of elbow extension degree using ULNT1 between before and after performing Thai dance from the pilot study

The specific objective of this study aimed to investigate the effect of Thai dance on neuromechanical tension in the median nerve distribution by using ULNT1 in the participants with carpal tunnel syndrome. Thus, the comparison of the elbow extension degree using ULNT1 between before and after performing Thai dance from the pilot study used to calculate the sample size.

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σ_d = 14.75

Δ = 14

$$N = \left\{ \frac{(1.96 + 0.84)14.75}{14} \right\}^2$$

$$= 8.7$$

However, a drop-out rate of 20% is expected. From the sample size calculation, the appropriate sample size in this study is at least twelve the participants.

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APPENDIX Q
RAW DATA OF THE STUDY

Table Q.1 Characteristics of the participantts including gender, age, occupation and hand domination

Participants	Gender	Age(years)	Occupation	Affected hand	Hand domination
1	Female	45	Sedentary	Right side	Right side
2	Female	52	House worker	Right side	Right side
3	Female	48	Sedentary	Bilateral side	Right side
4	Female	43	Sedentary	Right side	Right side
5	Female	51	Sedentary	Right side	Right side
6	Female	49	Sedentary	Right side	Right side
7	Female	58	Merchant	Right side	Right side
8	Female	50	House worker	Left side	Left side
9	Female	54	Sedentary	Right side	Right side
10	Female	38	Sedentary	Bilateral side	Left side
11	Male	55	Merchant	Right side	Right side
12	Female	51	Sedentary	Right side	Right side

Table Q.2 The characteristics of the participants by duration of CTS illness and symptoms

Participants	Duration of illness (months)	Symptoms
1	5	numbness
2	11	weakness
3	10	weakness
4	5	numbness
5	8	numbness
6	10	weakness
7	3	numbness
8	11	pain and numbness
9	10	numbness
10	8	numbness
11	4	numbness
12	9	numbness

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Table Q.3 The characteristics of treatments that the participants received

Participants	Oral medication	Wrist splint	Superficial heat	Ultrasound	Massage	Wrist stretching	Carpal bone mobilization	Nerve mobilization
1			√	√	√	√		
2	√		√	√	√	√		√
3	√	√	√	√	√	√		√
4			√	√	√	√		
5			√	√	√	√		√
6	√		√	√	√	√		√
7			√	√	√	√		
8	√		√	√	√	√		√
9			√	√	√	√	√	
10		√	√	√	√	√	√	
11			√	√	√	√		
12			√	√	√	√	√	

Table Q.4 The SSS data of the participants

Participants	1st week	2nd week	3rd week	Last day of 3rd week
1	28	20	18	15
2	28	22	20	15
3	23	20	15	15
4	25	23	20	16
5	23	21	20	16
6	25	20	17	15
7	25	22	17	12
8	25	23	20	11
9	20	18	17	15
10	18	16	15	13
11	23	22	17	17
12	15	13	12	11

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Table Q.5 The FSS data of the participants

Participants	1st week	2nd week	3rd week	Last day of 3rd week
1	16	13	12	11
2	18	18	16	13
3	25	17	15	13
4	26	25	17	15
5	19	14	12	10
6	20	15	14	10
7	19	16	15	15
8	20	20	17	14
9	18	16	16	14
10	15	13	12	10
11	24	19	19	19
12	14	12	12	10

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Table Q.6 The time response to the positive Phalen test data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	12	18	20	30	20	30	20	40
2	20	30	20	30	20	40	30	40
3/Lt	24	40	50	50	60	60	60	60
3/Rt	24	40	50	50	60	60	60	60
4	15	20	20	28	30	42	40	50
5	18	25	29	38	35	40	40	50
6	30	39	40	45	40	50	50	50
7	28	35	40	48	50	50	50	50
8	40	50	45	50	60	60	60	60
9	38	45	45	50	50	50	60	60
10/ Lt	40	50	50	50	60	60	60	60
10/Rt	40	50	50	50	60	60	60	60
11	45	50	50	50	60	60	60	60
12	32	45	40	48	50	60	60	60

Table Q.7 The distance response to the positive Tinel's test data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	2	2	2	2	1.8	1.8	1.8	1.8
2	0	0	0	0	0	0	0	0
3/Lt	0	0	0	0	0	0	0	0
3/Rt	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
4	2	2	2	2	1.8	1.8	1.5	1.5
5	2.3	2.3	2	2	1.8	1.8	1.8	1.8
6	2	2	2	2	1.8	1.8	1.5	1.5
7	1.8	1.8	1.8	1.8	1.5	1.5	1.3	1.3
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10/ Lt	0	0	0	0	0	0	0	0
10/Rt	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0

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Table Q.8 The hand light touch sensation data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	4.08	3.61	3.61	3.61	3.61	3.22	3.61	3.22
2	3.61	3.22	3.61	3.22	3.22	3.22	3.22	3.22
3/Lt	3.61	3.61	3.61	3.22	3.22	3.22	3.22	2.83
3/Rt	3.61	3.61	3.61	3.22	3.22	3.22	3.22	2.83
4	3.61	3.61	3.61	3.22	3.61	3.22	3.22	3.22
5	3.61	3.61	3.61	3.22	3.61	3.22	3.22	3.22
6	3.84	3.61	3.84	3.61	3.61	3.61	3.61	3.22
7	3.84	3.84	3.84	3.84	3.84	3.61	3.61	3.22
8	4.17	4.08	3.84	3.61	3.84	3.61	3.61	3.61
9	4.08	3.61	3.61	3.61	3.61	3.61	3.61	3.22
10/ Lt	3.61	3.61	3.61	3.22	3.22	3.22	3.22	3.22
10/Rt	3.61	3.61	3.61	3.22	3.22	3.22	3.22	3.22
11	3.61	3.22	3.61	3.22	3.22	2.83	2.83	2.83
12	3.61	3.61	3.61	3.61	3.61	3.22	3.22	3.22

Table Q.9 The grip strength data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	30	30	30	30	30	32	30	32
2	30	30	30	32	30	32	34	34
3/Lt	24	24	26	26	26	26	26	28
3/Rt	26	26	26	26	26	28	26	28
4	10	10	10	12	10	12	11	12
5	0.5	2	2	2	3	3	3	3
6	24	26	26	30	28	30	30	32
7	26	30	28	30	30	30	30	32
8	26	28	28	30	30	30	30	30
9	22	26	28	30	30	30	30	30
10/ Lt	22	26	26	26	26	28	28	28
10/Rt	22	24	24	24	24	26	26	26
11	25	30	30	34	35	38	38	40
12	16	18	18	18	18	20	20	20

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Table Q.10 The tip to tip pinch strength data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	4	6	5	6	7	8	7	8
2	5	6	6	7	7	7	7	8
3/Lt	4	4	4	4	5	6	5	6
3/Rt	4	6	6	6	6	7	6	7
4	3	3	3	4	4	4	4	4
5	2	3	3	3	2	4	3	4
6	6	6	6	8	6	8	8	8
7	6	8	6	8	8	8	8	8
8	6	8	7	8	8	8	8	8
9	4	6	6	7	8	8	8	8
10/ Lt	4	6	4	6	6	7	7	7
10/Rt	4	4	4	6	6	7	7	7
11	6	8	8	8	8	10	10	10
12	4	5	5	5	6	6	6	7

Table Q.11 The elbow extension degree data of the participants

Participants	1st week		2nd week		3rd week		Last day of 3rd week	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	140	160	150	165	160	170	170	180
2	150	160	155	170	160	170	170	180
3/Lt	160	170	170	180	170	180	180	180
3/Rt	140	150	160	170	170	180	180	180
4	130	140	140	150	150	170	160	170
5	120	140	140	150	140	160	160	170
6	140	160	150	160	170	170	180	180
7	150	170	160	170	170	180	180	180
8	140	160	160	170	170	180	180	180
9	160	170	160	170	180	180	180	180
10/ Lt	140	150	150	165	180	180	180	180
10/Rt	150	160	160	170	180	180	180	180
11	150	170	170	180	180	180	180	180
12	150	170	160	170	170	180	180	180

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APPENDIX R

COMPARISONS BETWEEN NERVE MOBILIZATION AND WITHOUT NERVE MOBILIZATION

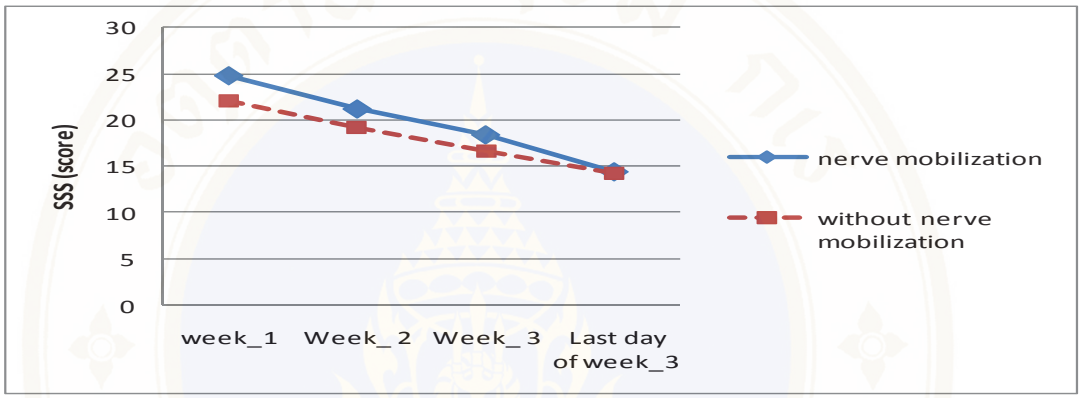

Figure R.1 Comparison of Severity of symptoms scale (SSS)

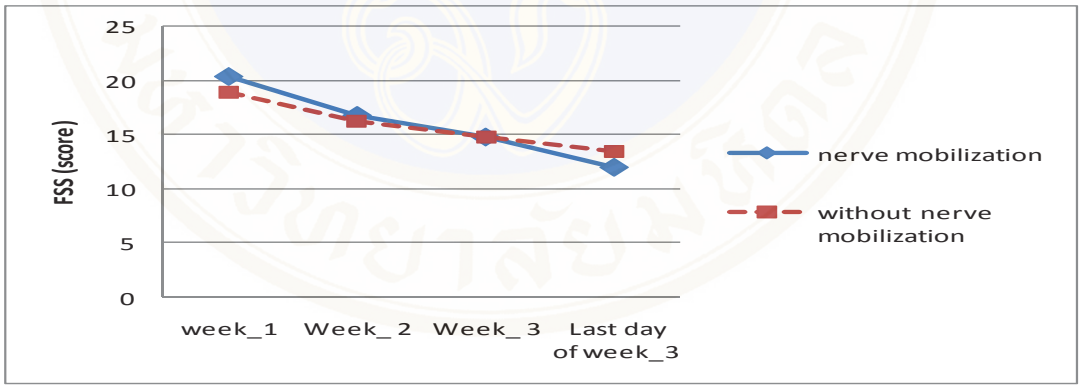

Figure R.2 Comparison of Functional status scale (FSS)

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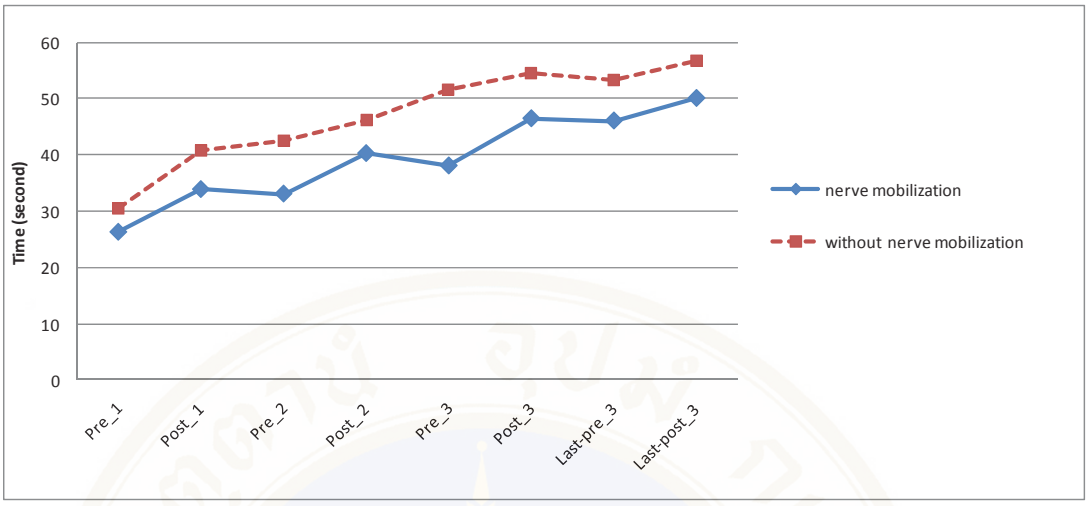

Figure R.3 Comparison of time response to positive Phalen test

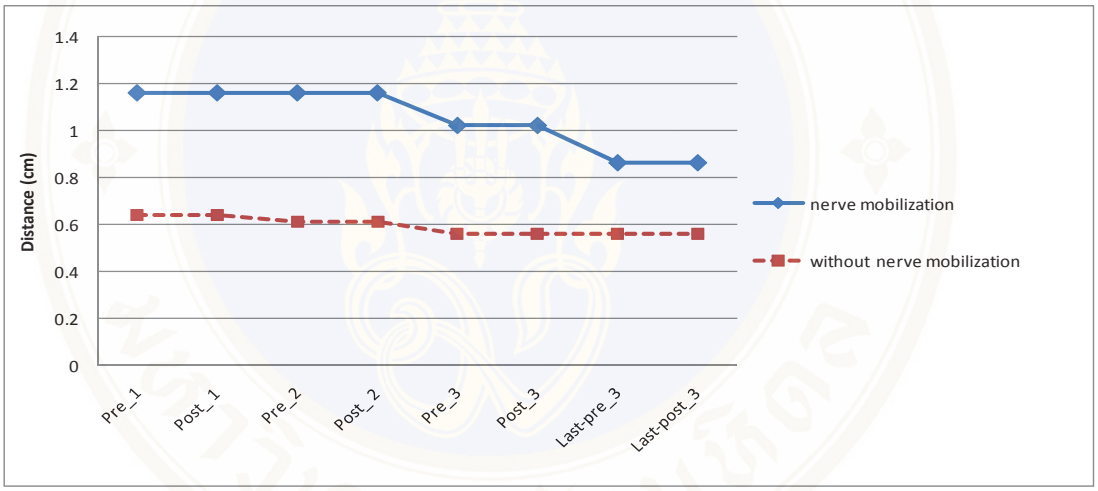

Figure R.4 Comparison of distance by the participant's response positive Tinel's test

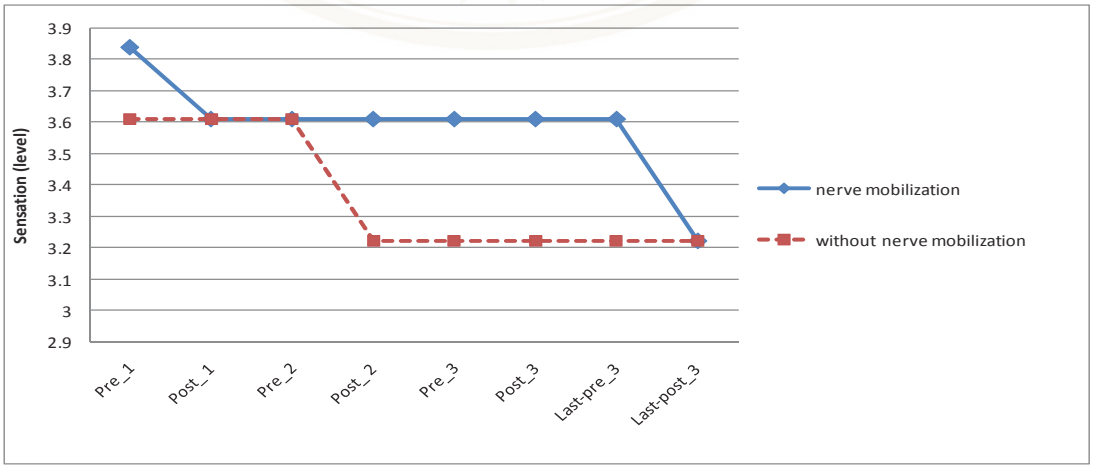

Figure R.5 Comparison of hand light touch sensation value for SWMT

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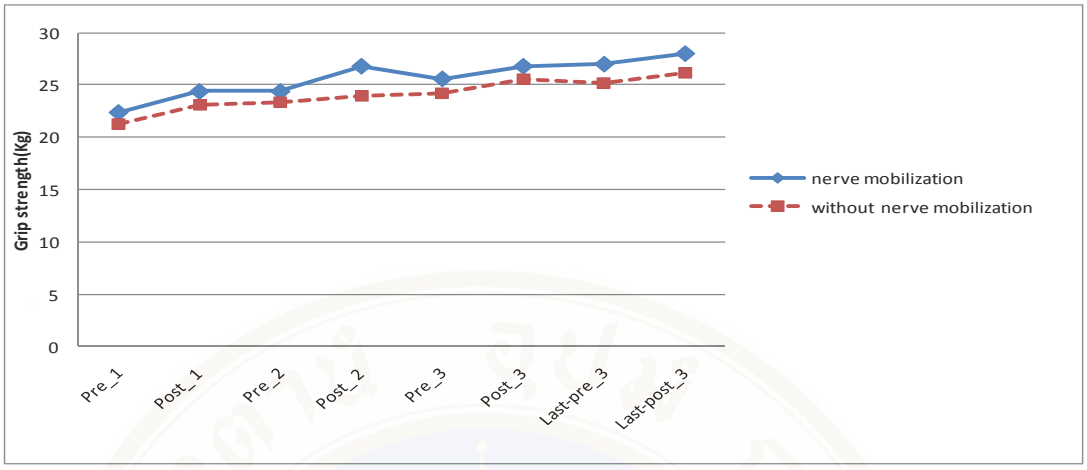

Figure R.6 Comparison of hand strength value for grip strength test

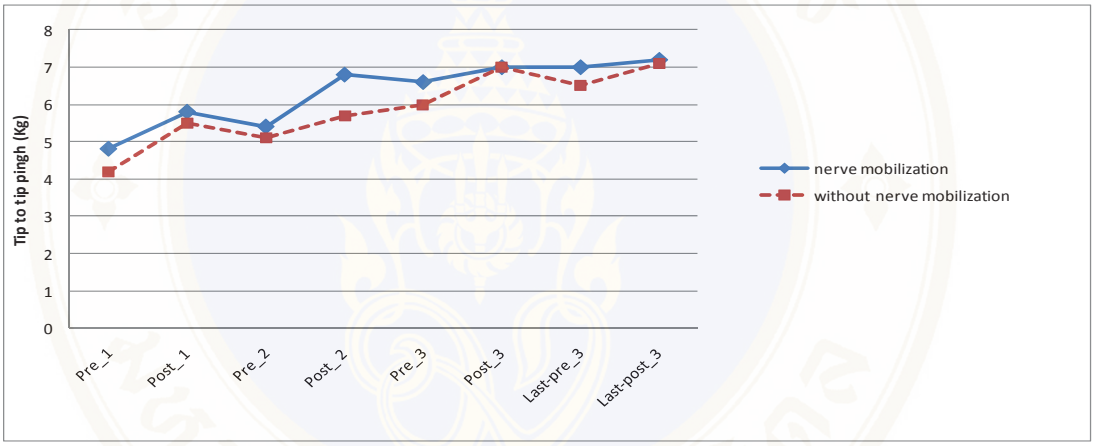

Figure R.7 Comparison of tip to tip pinch strength test

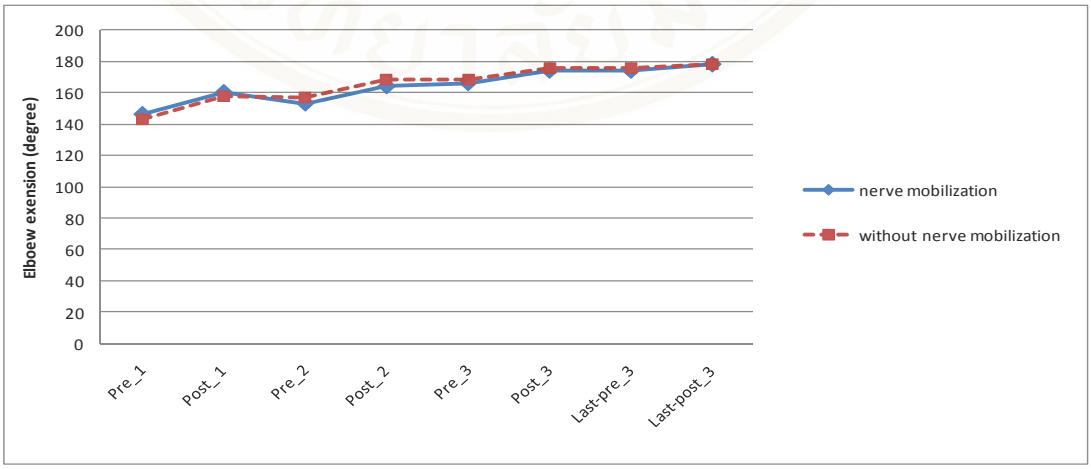

Figure R.8 Comparison of elbow extension degree for ULNT1

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