



**THE EFFICACY OF ORAL ALPHA-LIPOIC ACID FOR
PHYSIOTHERAPY SUPPLEMENTATION IN THE
TREATMENT OF SCIATIC NEUROPATHIC PAIN**

AREE JAROENCHAICHANA

**MASTER OF SCIENCE
IN
ANTI-AGING AND REGENERATIVE SCIENCE**

**SCHOOL OF ANTI-AGING AND REGENERATIVE MEDICINE
MAE FAH LUANG UNIVERSITY**

2012

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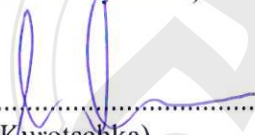
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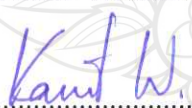
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2012

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Thesis Title	The Efficacy of Oral Alpha-Lipoic Acid for Physiotherapy Supplementation in the Treatment of Sciatic Neuropathic Pain Treatment.
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ABSTRACT

Background: One of the major health problems among workers is musculoskeletal disorders such as lower back pain, joint and muscle problems. This problem affects quality of life, physical and psychosocial activities, performance at work and everyday-life activities. Although, neuropathic pain is the most common symptom found in patients with nervous system disorder, there is little information available on neuropathic element to LBP. Alpha-lipoic acid improve peripheral neurological problems is well known many studies in the past use ALA to prevent peripheral nervous system, especially polyneuropathies in diabetic patients. ALA may also help peripheral neuropathy caused by back problems and improve their quality of life

Study Design: A randomized, double-blinded, placebo-controlled trial.

Objective: To study the efficacy of oral alpha-lipoic acid supplement to physiotherapy in the treatment of sciatic neuropathy caused by back pain problems and also in quality of life.

Method: 34 Thai patients with sciatic neuropathic pain received physical therapy twice times per week and once-daily oral dose of ALA 600 mg (n=15) or physical therapy alone (n=15) for 4 weeks. 4 of them dropped out because their personal reason. The primary outcome measures were the mean differences of modified NPS and NePIQoL questionnaire.

Result: The modified NPS score in part of total pain scale, sharp pain and intense deep pain characteristic of patients who received 600 mg oral ALA supplementation physical therapy treatment have significantly improved mean from the first week earlier than patients who received physical therapy alone (NPS; pain_wk2= 4.06 ± 1.98 , p-value < 0.001, sharp pain_wk2= 2.47 ± 2.10 , p-value < 0.05, intense deep pain_wk1 = 4.40 ± 2.03 , p-value < 0.001). The NePIQol score in part of the effects on patient's health of patients who were in experiment group has also significantly mean improved from the first week earlier than patients who received physical therapy alone (NePIQol, the effects on patient's health_wk4 = 0.93 ± 1.91 , p-value < 0.05,)

Conclusion: we suggest that this treatment program, ALA supplementation in the treatment of physical therapy may help decrease pain, sharp pain and intense deep pain earlier than physical therapy alone, and thus results in patient's better quality of life. Nevertheless, using oral ALA 600 mg for long term it cannot be help.

Keywords: Peripheral neuropathy/Sciatic neuropathic pain/Neuropathic pain/
Oral Alpha-Lipoic acid/Physical therapy

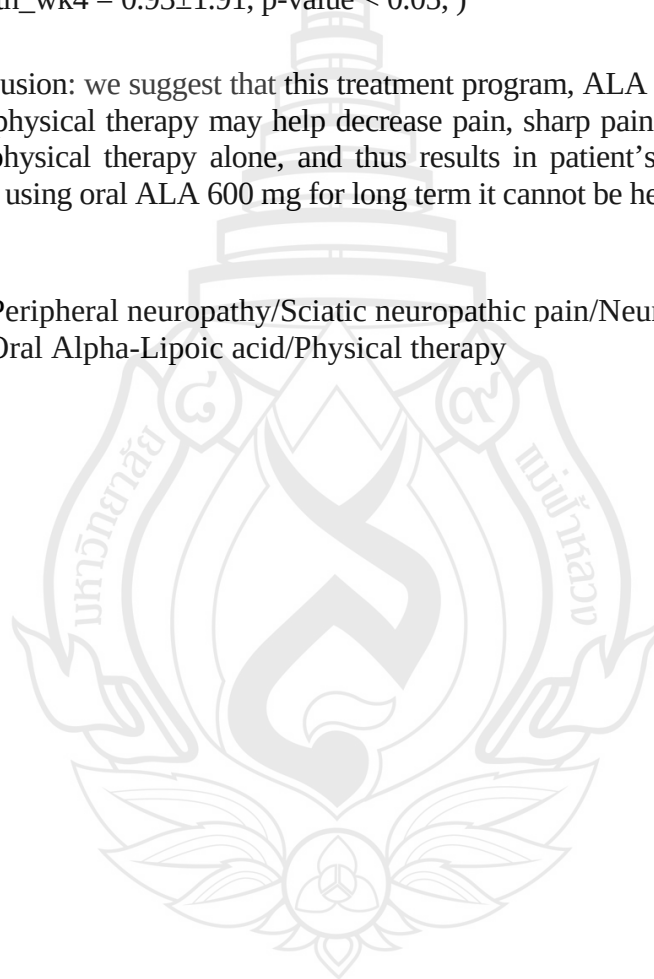


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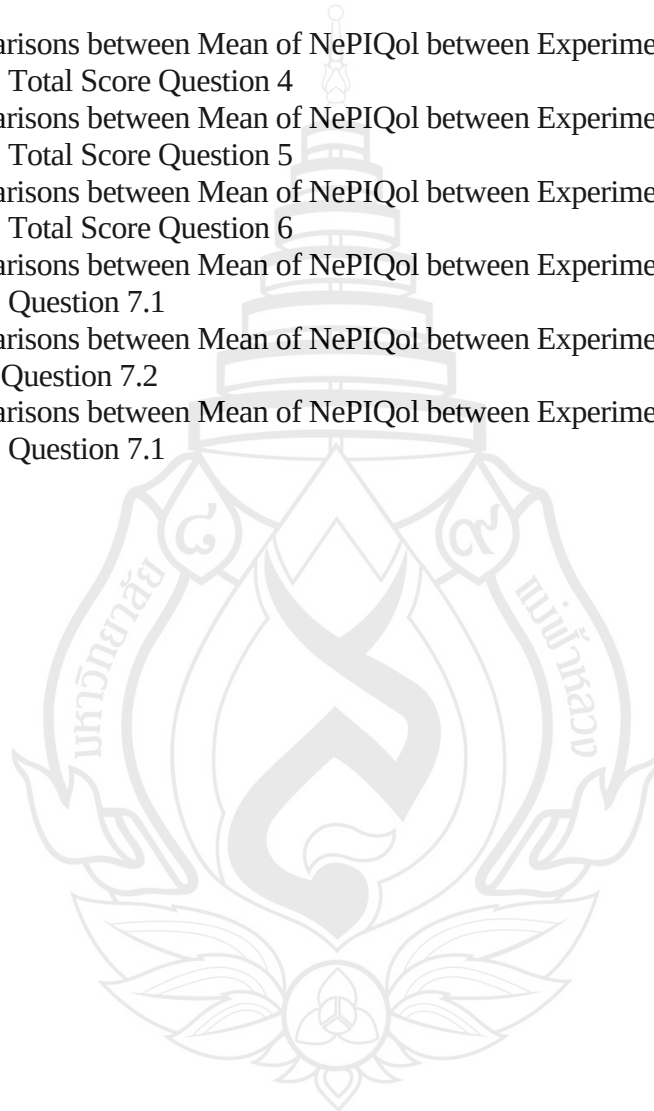
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CHAPTER 1

INTRODUCTION

1.1 Background and Rationale

Neuropathic pain syndrome is the result of nervous system from chronic noxious stimuli. It comes from central or peripheral nerve or both. After primary problems such as infection, metabolic abnormality (ie. diabetes), post brain or spinal cord trauma, chemotherapy, surgery, radiation, neurotoxins, musculoskeletal problems, it could lead to neuropathic pain (Dworkin et al., 2003).

One of the major health problems among workers is musculoskeletal disorders such as lower back pain (LBP), (Dworkin et al., 2003; Kaki, El-Yaski & Youseif, 2005), joint and muscle problems. This problem affects quality of life, physical and psychosocial activities, performance at work and everyday-life activities. Although, neuropathic pain is the most common symptom found in patient with nervous system disorder, there is little information available on neuropathic element to LBP. Small-unmyelinated nerve fiber (C) or thin myelinated nerve fiber (A_{δ}) can be stimulated by inflammation or neuropathic lesion.

A good understanding of the mechanisms and treatment for neuropathic pain syndromes is vital for the study of neuropathic pain. (Dworkin et al., 2003). Sciatic nerve is responsible for sensory impulse of lower extremity, back to spinal cord and perceived to brain. It is the mainly affected nerve in neuropathic pain. Sciatic neuropathic problem decreases quality of their life, causes poor activity daily function, decreases work performance and affects psychosocial expression of patients.

Pain is the first symptom that brings patients to seek help from doctor or therapist or even Thai masseurs. An analgesic, anti-inflammatory drug, NSAIDs, COX-2 inhibiting are main.

Choices for pain management. On the other hand, physiotherapy or alternative treatments are less popular because the use of drugs produces good results in acute pain in patients, but for chronic pain, patients have to consider carefully between benefit versus the side effects such as irritating stomach, hepatitis and heart problems. Estimation of the prevalence in neuropathic pain patients are not precise enough, however chronic neuropathic pain may be much more common than has generally been expected (Dworkin et al., 2003).

Alpha-lipoic acid (ALA) has become a common ingredient in multivitamin formulas, anti-aging supplements. There are only little side effects such as nausea and vomiting if highly does used. Alpha-lipoic acid improve peripheral neurological problems is well known. Many studies in the past use ALA to prevent central nervous system, especially polyneuropathies in diabetic patients. There are studies of the neuropathic pain

related to musculoskeletal problems, sciatic neuropathic pain. Neuropathic pain mechanism is still a mystery to us though there have been several attempts to clarify it. Is it anti-oxidant mechanism role that protect peripheral nerve cell from secondary damage that intern helps relive neuropathic pain?

This aim of study is the efficacy of alpha-lipoic acid and physiotherapy in the treatment of sciatic neuropathic pain in musculoskeletal problems. Does alpha-lipoic improve neuropathic pain and quality of life regarding musculoskeletal problems?

1.2 Research Objective and Hypothesis

1.2.1 Research Question

1.2.1.1 Does oral alpha-lipoic acid for physiotherapy supplementation improve neuropathic pain symptoms in patients in 4 weeks compared with physiotherapy alone?

1.2.1.2 Does oral alpha-lipoic acid for physiotherapy supplementation improve quality of life in patients with neuropathic pain in 4 weeks compared with physiotherapy alone?

1.2.2 Research Objective

1.2.2.1 To study the efficacy of oral alpha-lipoic acid supplement to physiotherapy in the treatment of sciatic neuropathy in lower back pain.

1.2.2.2 To study the efficacy of oral alpha-lipoic acid supplement to physiotherapy in quality of life in sciatic neuropathic pain.

1.2.3 Hypotheses

1.2.3.1 Oral alpha-lipoic acid supplement to physiotherapy can decrease neuropathic pain compare to control group.

1.2.3.2 Oral alpha-lipoic acid supplement to physiotherapy can improve quality of life in the treatment of lower back pain more than a control group.

1.3 Expected Benefits and Applications

The conclusion from this study will support the statement “oral alpha-lipoic acid and physiotherapy improve neuropathy and quality of life in neuropathic pain related to musculoskeletal disorder” If oral alpha-lipoic acid supplementation physiotherapy treatment improve neuropathic pain and quality of life, we could apply this knowledge in helping sciatic neuropathy patients caused by back problems.

1.4 Conceptual Framework

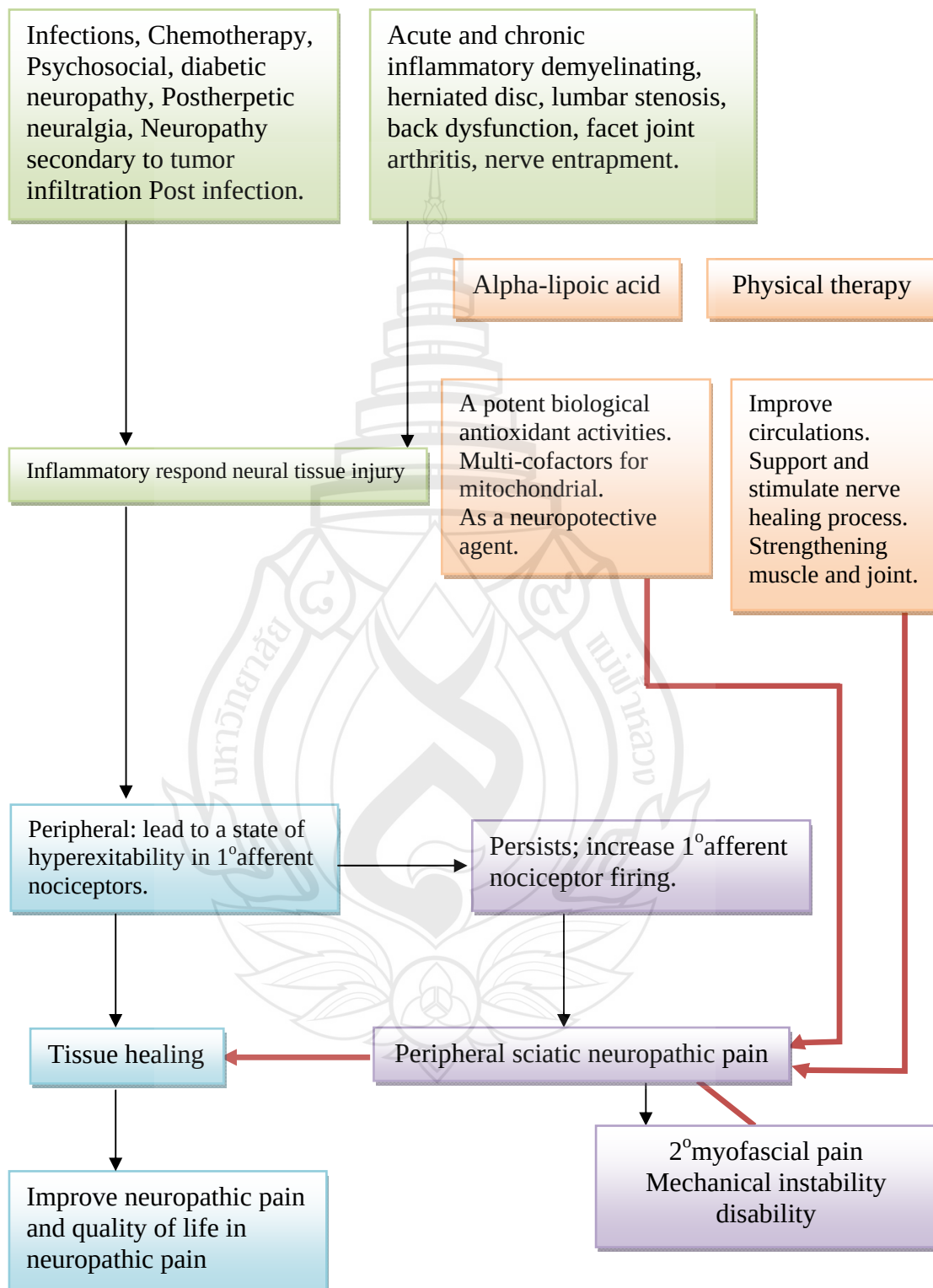


Figure 1.1 Conceptual Framework

1.5 Scope of Research

1.5.1 Populations: Thai populations

1.5.2 Human subjects: Healthy controlled subjects and patients with a diagnosis of sciatic neuropathic pain who attended the outpatient clinic, PK physiotherapy clinic, Mae Fah Luang hospital are invited to participate.

1.6 Operational Definitions

1.6.1 Pain: The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience which we primarily associate with tissue damage or describe in terms of such damage, or both.”

1.6.2 Neuropathic pain: The international association for study of pain defined neuropathic pain as “initiated or caused by primary lesion or dysfunction in the nervous system.” Neuropathic pain is a chronic pain, can be the secondary problem after primary causes or primary problem if the lesion on nervous system. Neural nerve and tissue response to injury manifest inflammation and tissue that injury reacts to inflammation lead to hyper excitability in primary nociceptor or abnormal sensation come from primary afference fiber such as allodynia. Clinical typical the symptoms and signs of neuropathic pain, include negative and positive sensory and motor

1.6.3 Sciatic neuropathic pain: Neuropathic pain is occurred on sciatic nerve.

1.6.4 Alpha-lipoic acid (ALA): ALA known as 1, 2-dithiolane-3-pentanoic acid or thioctic acid, ALA also known as a universal antioxidant. And ALA is an essential enzyme cofactor that requires covalent attachment to its cognate proteins to confer biological activities.

1.6.5 The Neuropathic Pain Scale (NPS): NPS is being increasingly used as a clinical trials measurement, the effects of pain treatments on specific pain domains. This measure include 2 global (intensity and unpleasantness) and specific ratings that assess both pain location (deep and surface) and pain quality (sharp, hot, dull, cold, sensitive, and itchy)

1.6.6 Neuropathic Pain Impact on Quality-of-Life Questionnaire (NePIQoL): a measure to assess quality of life in neuropathic pain from 4 phases.

CHAPTER 2

REVIEW LITERATURES

2.1 Alpha-Lipoic Acid

Alpha-Lipoic Acid (ALA) is an organosulfur compound derived from octanoic acid. ALA is made naturally in the body (Ghibu et al., 2009; Packer, Kraemer & Rimbach, 2001) and protect against cell damage in various conditions. Food sources rich in ALA include spinach, broccoli, and yeast (Catherine, 2010). ALA also known as “the universal antioxidant” (Catherine, 2010; Packer, Witt & Tritschler, 1995) has been used for decades in Europe, especially Germany for more than 30 years (Ghibu et al., 2009), to treat nerve conditions, including nerve damage resulting from poorly controlled diabetes (peripheral neuropathy) (Catherine, 2010; Ghibu et al., 2009). ALA was 1 of the 10 most frequently recommend dietary supplements because its efficacy in reducing high blood glucose levels (Catherine, 2010) and ALA has become a common ingredient in multivitamin formulas, anti-aging supplements (Shay, Moreau, Smith, E., Smith, A. & Hagen, 2009). It is well-defined as a therapy for preventing diabetic polyneuropathies (Mohasseb, Ebied, Yehia & Hussein, 2010), improve nerve pathophysiology (Ametov et al., 2003), enhances glucose uptake (Konrad et al., 2001) and scavenges free radicals (Ametov et al., 2003; Mohasseb et al., 2010), chelates metals (Packer et al., 1995), and restores intracellular glutathione levels (Mohasseb et al., 2010; Perera, Tan, Jeevathayaparan, Chakravarthi & Haleagrahara, 2011) which otherwise decline with age (Shay et al., 2009). There is evidence that they may have effects on regulatory proteins and on genes involved in normal growth and metabolism (Mohasseb et al., 2010). Interestingly among the public and the research community use ALA both as a nutritive supplement and as a pharmacotherapy (Shay et al., 2009), ALA to be useful or potentially.

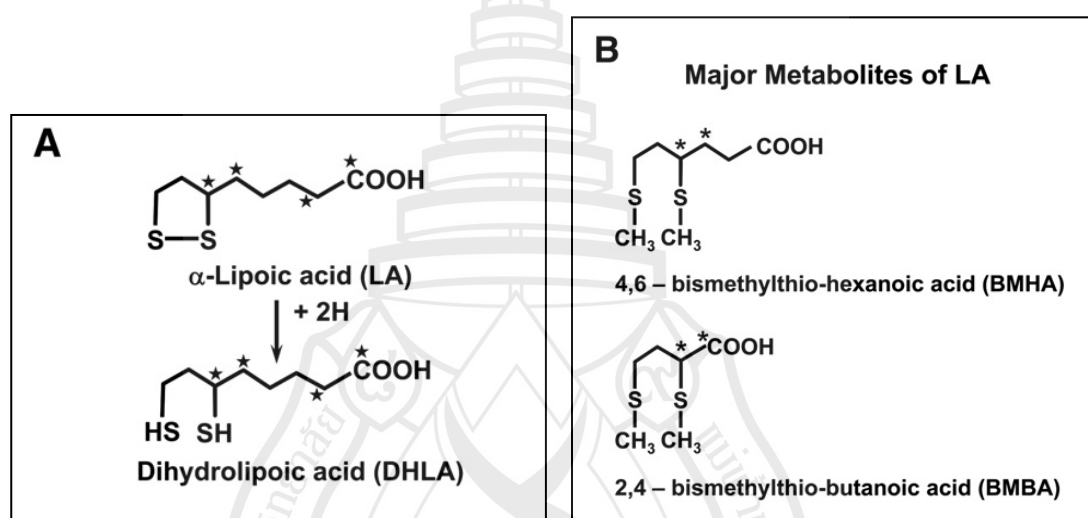
2.1.1 Related Terms of Alpha-Lipoic Acid

Alpha Lipoic Acid (ALA), also known as α -lipoic acid and Lipoic acid (LA) ALA known in many term, 1,2-dithiolane-3-pentanoic acid ($C_8H_{14}O_2S_2$), chemically named or thioctic acid, 5-(1,2 dithiolan-3-yl) valeric acid, acetate replacing factor, alpha lipoate, Berlition, Biletan, DHLA, thioctamide, thioctan, thioctic acid, Thiodamma, Tiobec (Catherine, 2010; Cremer, Rabeler, Roberts & Lynch, 2006; Konrad et al., 2001; Shay et al., 2009)

2.1.2 Chemistry and Metabolism of Alpha-Lipoic Acid

There are two form of ALA, the oxidized (disulfide) and reduced (dithiol: dihydrolipoic acid, DHLA) forms. ALA exists as 2 different enantiomers: the (R)-isomer

and the (S)-isomer (Ghibu et al., 2009; Shay et al., 2009). Commercial ALA is usually a racemic mixture of the R and S forms. The half-life of ALA in plasma is 30 minutes (Ghibu et al., 2009). When ALA is administered in the diet, it accumulates in several tissues and a substantial part is converted to DHLA via a lipoamide dehydrogenase. In the reduction reaction, the mitochondrial reduced form of nicotinamide adenine dinucleotide-dependent lipoamide dehydrogenase exhibits a marked preference for R (+)-ALA, whereas cytosolic reduced form of nicotinamide adenine dinucleotide-dependent glutathione reductase shows greater activity toward the S (2)-ALA stereoisomer. The activity of this reductase is important in the heart, the kidney, and liver (Ghibu et al., 2009).



From. Packer, L., Kraemer, K. & Rimbach, G. (2001). Molecular aspects of lipoic acid in the prevention of diabetes complications. **Nutrition**, 17(10), 888-895.

Stabler, S. P., Sekhar, J., Allen, R. H., O'Neill, H. C. & White, C. W. (2009). Alpha-Lipoic acid induces elevated S-adenosylhomocysteine and depletes S-adenosylmethionine. **Free Radical Biology & Medicine**, 47(8), 1147-1153.

Figure 2.1 (A) The Structures of Alpha-Lipoic Acid (ALA) and the Reduced Form Dihydrolipoic (DHLA) Acid are Shown. (B) Two of the Major Metabolites of ALA are Shown: 4, 6-Bismethylthiohexanoic Acid (BMHA) and 2, 4-Bismethylthiobutanoic Acid (BMBA)

ALA found in vegetable and animals tissue, the most vegetable sources of R-ALA are spinaches, broccolis, and tomatoes. In animal tissues, the highest concentration of lipoyllysine is found in kidney, heart, and liver. ALA is both water and lipid soluble

and is widely distributed in cellular membranes, cytosol, and extracellular spaces. ALA readily crosses the blood-brain barrier.

Table 2.1 ALA Found in Vegetable and Animals Tissue

Average Amounts of Lipoyllysine* in Food	
Food	Lipoyllysine (mg/g Dry Weight)
Beef kidney	2.6
Beef heart	1.5
Beef liver	0.9
Spinach	3.2
Broccoli	0.9
Tomato	0.6
Peas	0.4
Brussels' sprouts	0.4
Rice	0.2
Egg yolk	0.05

Note. Lipoyllysine x 0.62 = ALA.
Adapted from Lodge et al.

From. Ghibu, S., Richard, C., Vergely, C., Zeller, M., Cottin, Y. & Rochette, L. (2009). Antioxidant properties of an endogenous thiol: Alpha-lipoic acid, useful in the prevention of cardiovascular diseases. **J Cardiovasc Pharmacol**, 54(5), 391-398.

2.1.3 Alpha-Lipoic Acid as Multi-Cofactors

Mitochondria are important regulators of cell death and mitochondrial dysfunction has been reported in various studies. ALA is a necessary cofactor for mitochondrial α -ketoacid dehydrogenases, and thus serves a critical role in mitochondrial energy metabolism (Jordan & Cronan, 1997; Konrad et al., 2001; Packer et al., 1995; Shay et al., 2009). ALA induces elevated S-adenosylhomocysteine and depletes S-adenosylmethionine (Stabler et al., 2009). The direct roles of ALA as a cofactor are well understood, less is known about the precise metabolic functions of orally supplied ALA (Shay et al., 2009).

ALA is an essential enzyme cofactor that requires covalent attachment to its cognate proteins to confer biological activity (Jordan & Cronan, 1997; Perera, Tan, Jeevathayaparan, Chakravarthi & Haleagrahara, 2011; Shay et al., 2009). A naturally occurring compound synthesized in small quantities by most plants and animals (Perera et al., 2011). In humans, ALA is synthesized in the mitochondria from octanoic acid (Jordan & Cronan, 1997; Perera et al., 2011; Shay et al., 2009) and also absorbed intact from

dietary sources (Shay et al., 2009; Packer et al., 1995); it transiently accumulates in many tissues. ALA has one chiral center and therefore exists in both R- and S-enantiomeric forms

Enzymes containing lipoamide are typically mitochondrial multi-enzyme complexes that catalyze the oxidative decarboxylation of α -keto acids (e.g. pyruvate dehydrogenase, 2-oxo-glutarate dehydrogenase, and transketolase) and glycine cleavage (Shay et al., 2009; Packer et al., 1995). Though de novo synthesis appears to supply all the necessary ALA needed for its role in intermediary metabolism (Jordan & Cronan, 1997; Shay et al., 2009).

2.1.4 Alpha-Lipoic Acid as a Potent Biological Anti-Oxidant

ALA has been described as a potent biological antioxidant (Ghibu et al., 2009; Konrad et al., 2001; Packer et al., 1995; Shay et al., 2009), a universal antioxidant (Catherine, 2010; Packer et al., 1995). The chemical reactivity of ALA is mainly conferred by its dithiolane ring. The oxidized (ALA) and reduced (DHLA) forms create a potent redox couple (Packer et al., 1995). In fact, there is evidence that both ALA and DHLA are capable of scavenging a variety of reactive oxygen species (Ghibu et al., 2009; Packer et al., 1995; Shay et al., 2009). ALA has a beneficial effect in reversing the age-related abnormalities seen in aging (Savitha, Tamilselvan, Anusuyadevi & Panneerselvam, 2005), to protect erythrocytes against the oxidative damage (Desouky, Selim, Elbakrawy & Rezk, 2011), and have metal-chelating activity (Packer et al., 1995).

2.1.4.1 Specificity of free radical scavenging

Both ALA and DHLA may scavenge hydroxyl radicals and hypochlorous acid (Packer et al., 1995), while ALA may scavenge LDL-oxidative molecules, and urinary isoprostanes (Marangon, Devaraj, Tirosh, Packer & Jialal, 1999). ALA and especially DHLA, has the ability to prevent protein carbonyl formation by scavenging hypochlorite (Packer et al., 1995).

Alpha-Lipoic Acid Scavenge Reactive Oxygen Species (ROS)

Reactive oxygen species (ROS)
 Hypochlorite (Packer et al., 1995)
 hydroxyl radicals
 hypochlorous acid
 singlet oxygen
 peroxynitrite (ONOO²)
 nitric oxide (-NO)
 superoxide anion (O₂⁻)
 lipid peroxidation (Marangon et al., 1999)

Table 2.2 ALA and DHLA Scavenge Reactive Oxygen Species

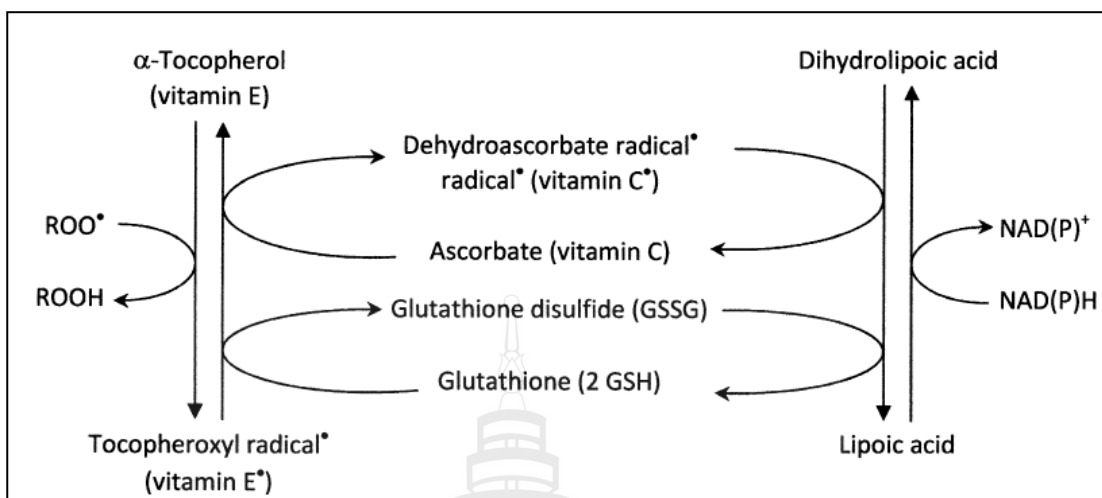
Overview of reactive oxygen species scavenged by Lipoic Acid and Dihydrolipoic Acid		
Oxidant	Lipoic acid	Dehydrolipoic acid
Hydrogen peroxide	Yes	Yes
Singlet oxygen	Yes	No
Hydroxyl radical	Yes	Yes
Nitric oxide radical	Yes	Yes
Superoxide radical	No	Yes
Hypochlorous acid	Yes	Yes
Peroxynitrite	Yes	Yes

From. Packer, L., Kraemer, K. & Rimbach, G. (2001). Molecular aspects of lipoic acid in the prevention of diabetes complications. **Nutrition**, 17(10), 888-895.

2.1.4.2 Regenerating other antioxidants

Furthermore, DHLA appears to regenerate other endogenous antioxidants (e.g. vitamins C and E) and has the salubrious property of neutralizing free radicals without itself becoming one in the process (Ghibu et al., 2009). ALA and DHLA acts synergistically and regenerate with other antioxidants, indicating that it is capable of regenerating other antioxidants from their radical or inactive forms (Mohasseb et al., 2010; Packer et al., 1995). Also protects membranes by interacting with vitamin C and glutathione, which may in turn recycle vitamin E (Mohasseb et al., 2010; Packer et al., 1995).

Superoxide dismutase (SOD) and glutathione peroxidase (GPx) are important antioxidant enzymes (Majstereka et al. 2011; Mohasseb et al., 2010) and are two major enzymes that scavenge harmful reactive oxygen species (ROS) in the body (Majstereka et al., 2011; Mohasseb et al., 2010). SOD catalyses the conversion of superoxide free radical to hydrogen peroxide and water (Majstereka et al., 2011). ALA significantly reversed the oxidative effects caused by oxidative damage, increase level of super oxide dismutase (SOD) and glutathione peroxidase (GPx) (Majstereka et al., 2011; Mohasseb et al., 2010; Perera et al., 2011).



From. Ghibu, S., Richard, C., Vergely, C., Zeller, M., Cottin, Y. & Rochette, L. (2009). Antioxidant properties of an endogenous thiol: Alpha-lipoic acid, useful in the prevention of cardiovascular diseases. *J Cardiovasc Pharmacol*, 54(5), 391-398.

Figure 2.2 ALA Increases the Efficiency of Vitamin C Cycle, Glutathione and Activates Vitamin E Cycle

In 2010 Magda Mohasseb et al. assess oxidative damage and its effect on germ cell apoptosis in testes of streptozotocin (STZ)-induced diabetic rats with antioxidant supplementation with a mixture, vitamins E and C and ALA. They found that testicular oxidative damage and germ cell apoptosis in diabetes-induced infertility could be suggested treatment with antioxidants, a protective effect by restoring SOD and GPx antioxidant enzymatic activity (Mohasseb et al., 2010).

2.1.4.3 Concentration in the intracellular compartment and extracellular fluid

ALA is water soluble and lipid soluble can cross cell membranes, blood brain barrier, therefore ALA can prevent lipid peroxidation on cell membrane (Ghibu et al., 2009).

2.1.5 Alpha-Lipoic Acid is a Neuroprotective Agent

ALA has been used for decades in Europe, especially Germany, to treat nerve conditions, burning mouth syndrome (Shivpuri, Sharma, Trehan & Gupta, 2011), including nerve damage resulting from poorly controlled diabetes (peripheral neuropathy (Catherine, 2010). There is strong evidence that ALA may help treat type 2 diabetes and neuropathy (Catherine, 2010). A study of ALA with diabetes neuropathy in oxidative stress mechanism, the researcher found that ALA have significantly reduced oxidative stress damage (Ziegler, 2008). Hyperglycemia induces an increased production of free oxygen radicals in the mitochondria (oxidative stress), which leads to the

activation of the four known pathways to hyperglycemic damage. These lead to damage of endothelial and neuronal cells.

ALA helps glucose metabolism, act as anti-hyperglycemic drug in clinical trials (Konrad et al., 2001), ALA improved glucose metabolism (Jacob et al., 1999; Mijnhout, Alkhalaf, Kleefstra & Bilo, 2010), increasing glucose uptake in insulin-sensitive and insulin-resistant muscle tissues (Mijnhout et al., 2010) in patients with type 2 diabetes. The cofactor of mitochondrial dehydrogenase complexes and potent antioxidant ALA has been shown to lower blood glucose in diabetic animals in vivo study in 2001, Daniel Konrad et al. suggest that inhibition of 2-deoxyglucose uptake in response to ALA by inhibitors of p38 MAPK is independent of an effect on GLUT4 translocation. Instead, it is likely that regulation of transporter activity is sensitive to these inhibitors (Konrad et al., 2001).

In another animals studied (Perera et al., 2011), Joachim Perera et al. evaluates the protective effect of ALA against haloperidol-induced oxidative stress in the rat brain. Haloperidol treatment significantly decreased levels of the brain antioxidant enzymes super oxide dismutase and glutathione peroxidase and concurrent treatment with alpha lipoic acid significantly reversed the oxidative effects of haloperidol.

In human clinical studied, A randomized placebo control trial studied of ALA (600 mg) in 120 diabetic patients with symptomatic (stage 2) diabetic sensorimotor polyneuropathy (DSPN) (Ametov et al., 2003), they found that ALA can improve positive neuropathic sensory symptoms as pain and several other neuropathic, including pain, paresthesias, and numbness. This improvement of symptoms was attributed to improved nerve pathophysiology, not to increased nerve fiber degeneration because ALA, as a potent antioxidant, prevents or improves nerve conduction attributes, endoneurial blood flow, and nerve ($\text{Na}^+ \text{K}^+$ ATPase) activity in experimental diabetes and in humans and improve positive neuropathic sensory symptoms. Because of its safety profile and its effect on positive neuropathic sensory symptoms and other neuropathic end points, this drug appears to be a useful treatment for the symptoms of diabetic polyneuropathy.

In 2010 Mijnhout et al. made a systemic review of alpha lipoic acid as a new treatment for neuropathic pain in patients with diabetes (Mijnhout et al., 2010). A significant improvement was reported in four of the RCTs. An oral or intravenous ALA dose of at least 600 mg per day resulted in a 50% reduction in the Total Symptom Score (TSS). ALA leads to a significant and clinically reduction in neuropathic pain.

Although these antioxidant attributes, a number of experimental and clinical studies have been carried out which show ALA to be useful as a therapeutic agent in such conditions as diabetes, ischemia-reperfusion injury, heavy-metal poisoning, radiation, HIV infection and damage, neurodegeneration, especially neuroprotective in diabetic neuropathic pain (Packer et al., 1995) but there a few literature that study about neuropathy in the cause of chronic back disorder. A randomized double-blind trial study in sciatic neuropathy caused by disc (Memeo & Loiero, 2008), compare between Acetyl-L-Carnitine (ALC) 1180 mg/day and ALA 600 mg/day. The secondary efficacy endpoint was improvement in neurological deficit (as measured by electromyography) compared with baseline. Both treatments produced significant improvements from baseline in neuropathy, ALA produced significantly greater mean improvements than ALC.

2.1.6 Safety dose of Oral Alpha-Lipoic Acid

There are many papers finding conformation on the usefulness of ALA administration in humans in a very common (Jacob et al., 1999; Memeo & Loiero, 2008; Mijnhout et al., 2010).

Studied in animals, (Cremer et al., 2006) that support the safe of oral ALA in rats, there was no evidence of genotoxic activity in a mouse with a 4-week. In safety human ALA studies, Memeo and Loiero (Memeo & Loiero, 2008) also use Thiocctic acid or ALA 600 mg/day in their studied and found the good result and no side effect.

There are many research and clinical studies use oral ALA, there found good results and minimal side effects, (Marangon et al., 1999) a comparison of the effect of ALA and Alpha-Tocopherol (AT), the aim of this study was to assess the effect of oral supplementation with 600 mg/d LA alone and in combination with AT on measures of oxidative stress. They found that LA supplementation functions as an antioxidant, because it decreases plasma- and LDL-oxidation and urinary isoprostanes. A doses studies of ALA is a multicenter studied (Ziegler et al., 2006), randomized, doubleblind, placebo-controlled trial, 181 diabetic patients in Russia and Israel received once-daily oral doses of 600 mg ($n=45$), 1,200 mg ($n=47$), and 1,800 mg of ALA ($n=46$) or placebo ($n=43$) for 5 weeks after a 1-week placebo run-in period. Their primary outcome measure was the change from baseline of the Total Symptom Score (TSS), including stabbing pain, burning pain, paresthesia, and asleep numbness of the feet. Secondary end points included individual symptoms of TSS, Neuropathy Symptoms and Change (NSC) score, Neuropathy Impairment Score (NIS), and patients' global assessment of efficacy. The results is mean TSS did not differ significantly at baseline among the treatment groups and on average decreased by 4.9 points (51%) in ALA600, 4.5 (48%) in ALA1200, and 4.7 (52%) in ALA1800 compared with 2.9 points (32%) in the placebo group (all $P \leq 0.05$ vs. placebo). The corresponding response rates ($\geq 50\%$ reduction in TSS) were 62, 50, 56, and 26%, respectively. Significant improvements favoring all three ALA groups were also noted for stabbing and burning pain, the NSC score, and the patients' global assessment of efficacy. The NIS was numerically reduced. Safety analysis showed a dose-dependent increase in nausea, vomiting, and vertigo. Oral treatment with ALA for 5 weeks improved neuropathic symptoms and deficits in patients with DSP. An oral dose of 600 mg once daily appears to provide the optimum risk-to-benefit ratio.

2.2 Neuropathy

The international association for study of pain defined neuropathic pain as “initiated or cause by primary lesion or dysfunction in the nervous system” (Dworkin, 2002; Dworkin et al., 2003). Chronic neuropathic pains caused by lesion in peripheral or central nervous system (Arnstein, 2010; Dworkin, 2002; Dworkin et al., 2003), come in many from; these include infections, trauma, metabolic abnormalities, chemotherapy, surgery, radiation, neurotoxins, nerve compression, inflammation, arthritis, and tumor infiltration (Dworkin et al., 2003). High intensity neuropathic pain interferes with daily living and has been linked to a loss of muscle, bone and brain mass (Arnstein, 2010) that is affected quality of life. Peripheral and central neuropathic pain syndromes separately, but it is very likely that peripheral and central mechanisms both contribute to the

persistence of pain in many of these syndromes (Dworkin et al., 2003). Typically neuropathic pains have both negative and positive symptoms and signs. Non-sensory symptom and sign depend on underlying cause, severity of effected and may independently to pain and disability. Precise estimates of the prevalence of neuropathic pain are not available, however, chronic neuropathic pain may be much more common than has generally been appreciated (Dworkin et al., 2003).

2.2.1 Etiology

Neuropathic pain can be the secondary problem after primary causes or primary problem if the lesion on nervous system (Bouhassira et al., 2005). The peripheral neuropathy most common found in diabetic in western countries (Yasuda et al., 2003) but there are many causes cloud be, patients history is the one important tool to evaluate and treatment neuropathy.

Table 2.3 Primary Causes Neuropathic Pain Syndromes

Primary causes neuropathic pain syndromes
Peripheral neuropathic pain syndromes
Acute and chronic inflammatory demyelinating, i.e polyradiculopathy. (Dworkin et al., 2003)
Complex regional pain syndrome (Dworkin, 2002; Dworkin et al., 2003; Fishbain et al., 2008)
HIV sensory neuropathy (Dworkin, 2002)
Neuropathy secondary to tumor infiltration (Dworkin, 2002)
Painful diabetic neuropathy (Dworkin, 2002; Yasuda et al., 2003)
Phantom limb pain (Dworkin, 2002; Dworkin et al., 2003)
Postherpetic neuralgia (Dworkin, 2002; Bouhassira et al., 2004)
Postmastectomy pain (Dworkin, 2002)
Trigeminal neuralgia; burning moth syndrome (Dworkin, 2002; Shivpuri et al., 2011)
Central neuropathic pain syndromes (Dworkin, 2002)
Central poststroke pain
Multiple sclerosis pain
Parkinson disease pain
Spinal cord injury pain

From. Dworkin, R. H. (2002). An overview of neuropathic pain: Syndromes, symptoms, signs, and several mechanisms. **Clinical Journal of Pain**, 18(6), 343-349.

There are many causes due to occur neuropathic pain both central and peripheral neuropathic pain but peripheral neuropathic pain is emphasized, it is more prevalent and

has received greater attention in the research literature than central nervous system (Dworkin, 2002). Finally, there are a variety of clinical conditions that appear to have neuropathic features but that are problematic to the definition of neuropathic pain because they do not appear to involve an injury or dysfunction of the nervous system (Audette, Emenike & Meleger, 2005).

2.2.2 Anatomy and Pathophysiology of Pain

The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience which we primarily associate with tissue damage or describe in terms of such damage, or both.” This recognizes that pain is a perception and not a sensation. There is a reason that pain may or may not correlate with an identifiable source of injury (Evans, 2007).

Nociceptive pain occurs from noxious or thermal or chemical stimuli (Helms & Barone, 2008) on thinly myelinated (A_δ) fibers. Nociceptive pain can also be initiated by tissue injury and generate physical and behavioral response. This pain type has also been term inflammatory involve acute or chronic inflammation (Evans, 2007; Helms & Barone, 2008; Sinatra, de Leon-Cassasola, Ginsberg & Viscusi, editors, n.d.). neurogenic inflammation stimuli free nerve ending release pro inflammatory such as substance P, serotonin, histamine, acetylcholine, bradykinin and prostagland (Helms & Barone, 2008) as an chemical stimuli on unmyelinated (C) fibers, that make more and continuous pain. Inflammatory substances also activate other nearly nociceptive receptor generate pain impulse to spinal cord and perceive at brain (Evans, 2007; Helms & Barone, 2008)

Small-unmyelinate (C) nerve fibers and thinly-myelinate (A_δ) nerve fibers are two type fibers that involve pain sensation (Helms & Barone, 2008). Nociceptors or pain receptors are free nerve ending that responding to painful stimuli. This impulse pass through spinal cord to mid brain and the brain can perceive at hypothalamic of brain (Helms & Barone, 2008) that why we perceive the area of pain. A_δ fibers is the first conducting pain impulse, chap pain and responsible to physical respond also known as physical protective mechanism reaction as the results. C fiber is the slow second impulse generating dull pain sensations and difficult to define the area of pain (Helms & Barone, 2008). It may be stimulated by chemical, pro-inflammatory substances, release when tissue damage occurs. Low back pain such as disc herniated is a chronic nociceptive pain, can be continues pain (arthritis, tendinitis, muscle tear) or intermittent.

2.2.3 Mechanisms of Neuropathic Pain

It's difficult to explain and prove pathomechanical of chronic neuropathic pain. A simple focal peripheral nerve injury unleashes a range of peripheral or central those contribute to persistent. Neural nerve and tissue response to injury manifest inflammation and tissue that injury reacts to inflammation lead to hyper excitability in primary nociceptor (Bouhassira et al., 2005). Peripheral and central sensitization is the terms that call this phenomenon. Normally this reaction is the phenomenon that activates healing process themselves and the inflammation is subsiding. However, if this inflammation and excitation state is continuing, nervous process will go to adaptation states (see figure 2.3)

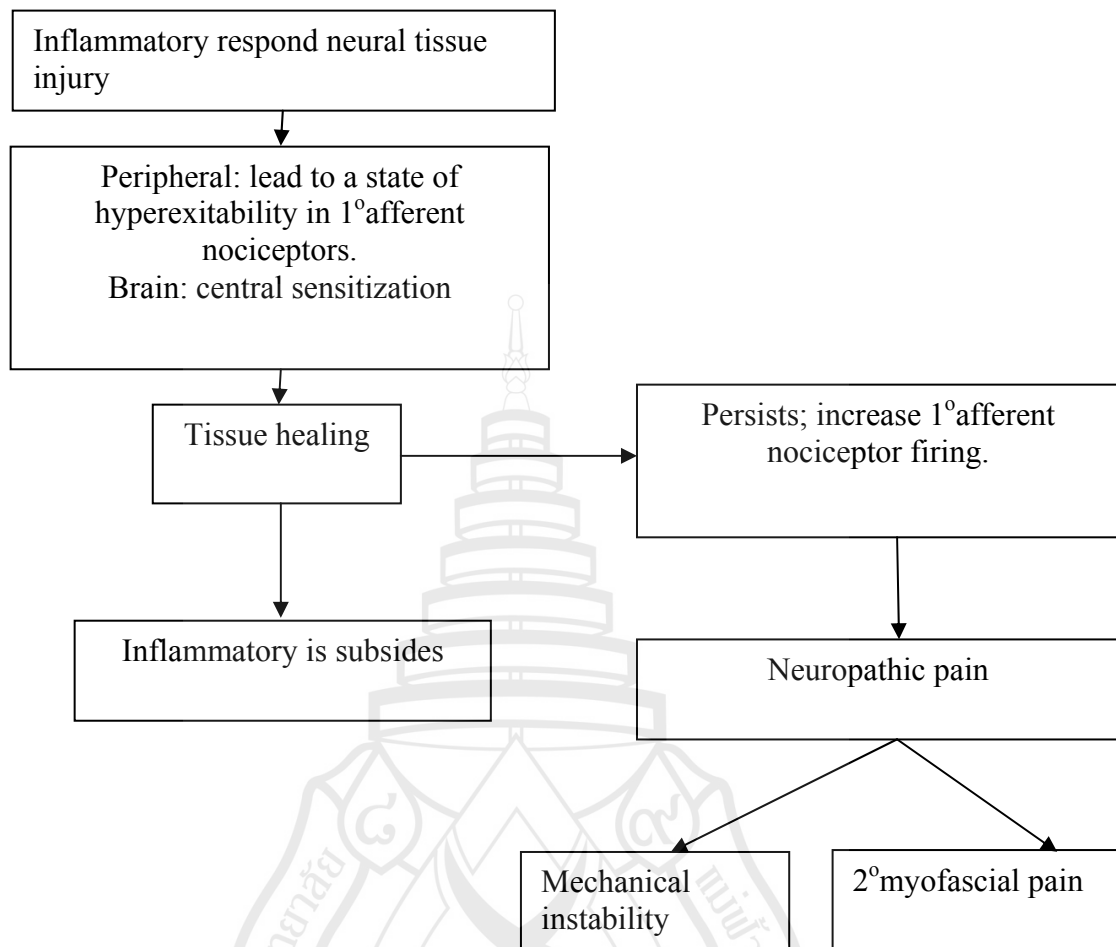


Figure 2.3 Adaptation Mechanisms of Neuropathic Pain

The qualitative of symptoms and signs may explain these different neuropathy mechanisms that base on pain mechanisms that occur from pathomechanical of nervous system. There are several kinds of regeneration patterns, including axonal sprouting from the transected ends of axons, collateral sprouting from nodes of Ranvier and other sites along uninterrupted fibers, and terminal sprouting from synaptic endings (Yasuda et al., 2003). In studies by Fields, Rowbotham and Baron (1998) one of the best examples that there are at least three separate mechanisms involved in PHN. In the first group patients have prominent allodynia and minimal sensory deficits. In these patients, initiated a state of central sensitization that is maintained by abnormal activity in primary afferent nociceptors (see picture 8, above). The second group patients with spontaneous pain, little or no allodynia, and marked sensory deficits in the areas of greatest pain. The contribution of primary afferent nociceptors to pain in these patients appears to be minimal, which suggests that their spontaneous pain is caused by perhaps central hyperactivity resulting from deafferentation (see picture 8, middle). The third group includes patients with both sensory deficits and allodynia, a pattern of signs and symptoms that may be explained by yet another mechanism-deafferentation accompanied

by central reorganization involving sprouting of large myelinated fibers into the substantia gelatinosa where contact is made onto neurons that were formerly innervated only by nociceptors (see figure 2.4).

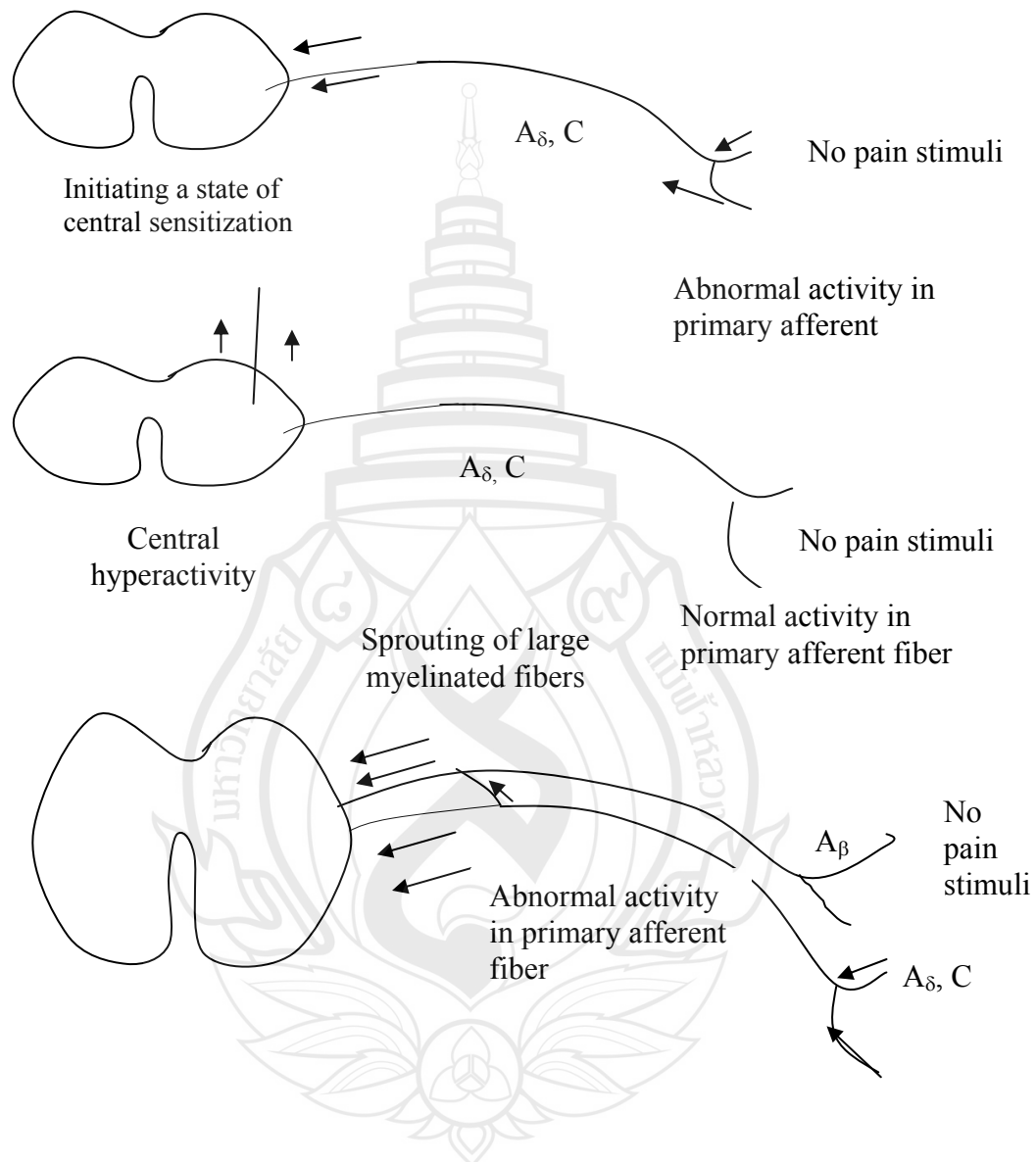


Figure 2.4 Neurological Adaptations

Figure 2.4, prominent allodynia and minimal sensory deficits, initiated a state of central sensitization that is maintained by abnormal activity in primary afferent nociceptors. Middle; spontaneous pain, the contribution of primary afferent nociceptors to pain appears to be minimal, caused by central hyperactivity resulting from deafferentation. Below; both sensory deficits and allodynia, by central reorganization involving sprouting of large myelinated fibers into the substantia

gelatinosa where contact is made onto neurons that were formerly innervated only by nociceptors. A_{β} -fiber is mechanoreceptor, which are normally activate by nonpainful mechanical stimuli, and A_{δ} , C-fiber nociceptor, which are normally activate by pain stimuli.

2.2.3.1 Remodeling of spinal cord circuitry

Functional changes in central synapses (Navarro, Vivó & Valero-Cabré, 2007)

2.2.3.2 Remodeling of spinal cord circuitry

1. Central sprouting of afferent projections (Yasuda et al. 2003; Navarro et al., 2007)

2. Changes in spinal cord neurons (Navarro et al., 2007)

3. Changes in intraspinal inhibitory pathways (Navarro et al., 2007)

2.2.4 Symptoms and Signs

In considering, because neuropathic pain is result of disease or injury to nervous system, clinical typical the symptoms and signs of neuropathic pain, include negative and positive sensory and motor (Dworkin et al., 2003). Therefore positive neuropathic pain classification, there are spontaneous pain that is stimulus independent and stimulus-evoked pain, which is important to distinguish (Bouhassira et al., 2004; Dworkin, 2002; Dworkin et al., 2003).

2.2.4.1 Spontaneous pain

Spontaneous pain is present in the absence of any stimulation, and it can be either continuous or intermittent. Physical history is very important, difference pain quality (e.g., burning, throbbing, shooting, stabbing, or electric like (Dworkin, 2002; Dworkin et al., 2003). In addition, spontaneous paresthesias and dyesthesias manifest as abnormal sensations, including clawing, numbness, itching, and tingling (Dworkin et al., 2003). Spontaneous continuous pain is present all or almost all of the time, although patients typically report that it varies in intensity (Dworkin et al., 2003).

2.2.4.2 Stimulus evoked pain.

Stimulus evoked pain. As can be seen from picture 9, The stimuli that have been used in evaluating stimulus-evoked pain are of many types, including thermal, vibration, dynamic, and static (punctate or blunt). Dynamic allodynia can be elicited by lightly moving a paint brush or a cotton swab across the skin (Dworkin et al., 2003), static allodynia can be elicited by light blunt pressure with a finger or light punctate pressure with a von Frey filament (Dworkin et al., 2003), and thermal allodynia can be assessed by heating or cooling a tuning fork or by brief application of ice (Dworkin et al., 2003).

Table 2.4 Neuropathic Pain Term

Pain term (Dworkin et al., 2003)	Definition
Allodynia	Pain due to a stimulus that does not normally provoke pain (Dworkin, 2002)
Analgesia	Absence of pain in response to stimulation that would normally be painful (Dworkin, 2002)

Table 2.4 (Continue)

Pain term (Dworkin et al., 2003)	Definition
Hyperalgesia	An increased response to a stimulus that is normally painful (Dworkin, 2002)
Hyperesthesia	Increased sensitivity to stimulation, excluding the special senses (Dworkin, 2002)
Hyperpathia	A painful syndrome characterized by an abnormally painful reaction to a stimulus, especially a repetitive stimulus, as well as an increased threshold (Dworkin, 2002)
Hypoalgesia	Diminished pain in response to a normally (Dworkin, 2002) painful stimulus
Hypoesthesia	Decreased sensitivity to stimulation, excluding the

2.2.5 Identifying Neuropathic Pain Among Patients with Chronic Lower Back Pain

Little information is available about the contribution of the neuropathic element to Lower back pain (LBP), in 2005 Kaki, El-Yaski and Youseif was designed to investigate the prevalence of neuropathic pain among a sample of chronic LBP patients by use of the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) pain scale. The results is the LANSS pain scale, 639 patients (54.7%) had scores of 12 points or more, which suggested a neuropathic type of pain, and 530 patients (45.3%) had scores of less than 12, which suggested a nociceptive type of pain. The Conclusion of this study, neuropathic pain is a major contributor to chronic LBP, and the LANSS pain scale is a useful tool to distinguish patients with neuropathic pain from those with nociceptive pain.

2.2.6 Effect of Neuropathic Pain on Quality of Life

Chronic neuropathic pain has significant negative effect on quality of life (Dworkin et al., 2003; Poole, Murphy & Nurmikko, 2009; Ziegler, 2008), affecting physical, social, and psychological functioning. The potential impact that chronic musculoskeletal pain can have on an individual's quality of life (QoL) in terms of psychological, social, and physical functioning is well documented.

2.2.7 Evaluation of Neuropathic Pain and Other Symptoms

Therefore neuropathic pain is pathophysiology of nervous system responded to injury itself or continues chemical or noxious stimuli (Arnstein, 2010; Dworkin et al., 2003). And can come from many causes, there is not only one test to evaluate neuropathic pain (Dworkin et al., 2003). No lesion can be demonstrated, the limit of current diagnosis technology do not always allow the possibility of neuropathic pain (Dworkin et al., 2003). So patient's history has to examine, sensory and motor symptoms and sign are include (Arnstein, 2010).

2.2.7.1 Patient history

Neuropathic pain base on a medical history, review of system should be concern. Patients were given a diagnosis of neuropathic pain if they fulfilled one of the following criteria: pain and abnormal sensory symptoms in association with either absence of normal sensation or the presence of normally heightened sensation (as above, 2.1.4); or pain and abnormal sensory symptoms in association with neurological signs indicative of motor or autonomic dysfunction. It is to be noted that similar criteria have recently been suggested to define neuropathic pain (Fishbain et al., 2008)

1. Chief complaint(s) (Bickley & Szilagyi, 2007)

Make every attempt to quote the patient's own words.

2. Present illness. (Bickley & Szilagyi, 2007)

This section of the history is a complete, clear, and chronologic account of problems the patient seek care. The principle symptoms should be well characterized, with descriptions of (1) location, (2) quality; (3) quantity and severity; (4) timing, including onset, duration, and frequency; (5) the setting in which they occur; (6) factors that have aggravated and relieved the symptoms; and (7) associated manifestations.

3. Past history. (Bickley & Szilagyi, 2007)

Medical, surgery dates and type

2.2.7.2 Physical examination

1. Neurological examinations

Neurological examination can help determine where the lesion is; explain by the area that is impaired, distribution of terminal nerve ending. Sensation impaired can be dermatome or peripheral sensation pattern. Dermatome is an impairment sensation area refers to level of nerve lesion, occurred at nerve root. Peripheral sensation pattern refer to lesion along peripheral nerve.

1) Pinprick sensation. (Spinothalamic tracts) use a sharp safety pin, ask the patient, "is this sharp or dull?" or, when making compare normal side, "does this feel the same as this"

2) Light touch sensation (Spinothalamic tracts) use a broken cotton swab, ask the patient, "is this light?" or, when making compare normal side, "does this feel the same as this"

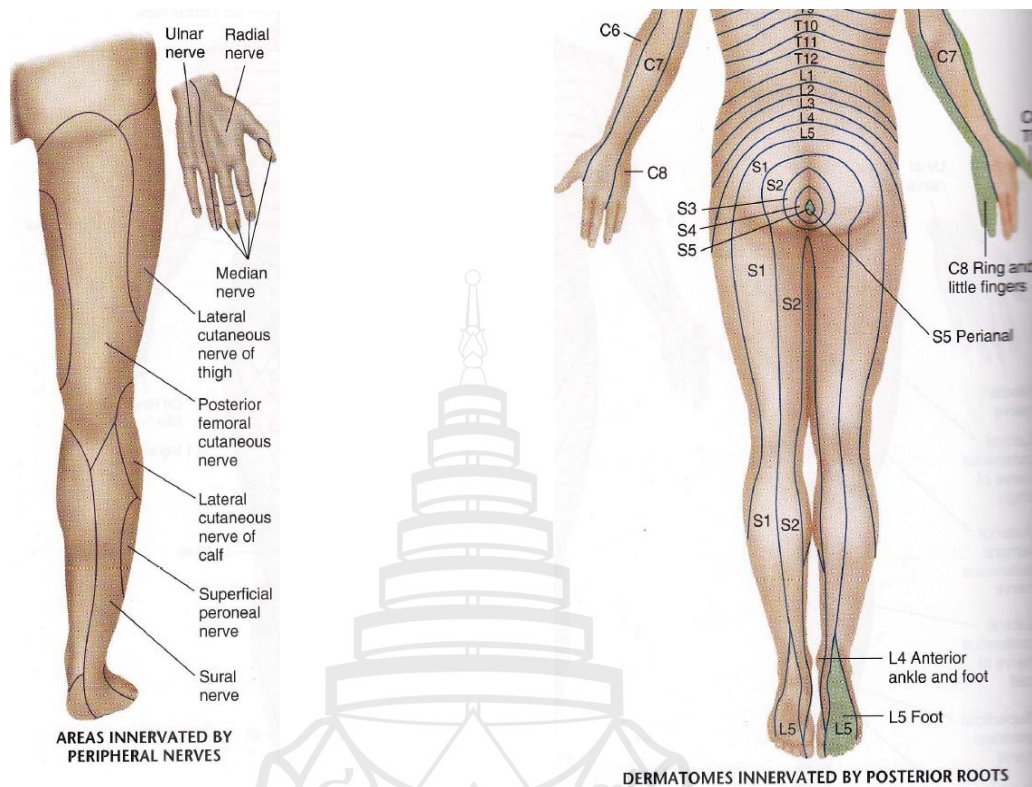
3) Deep tendon reflex.

Marked plastic changes in the connections and function of spinal reflexes occur after nerve injuries in parallel to peripheral axonal regeneration and target reinnervation. Such changes may play important effects on movement control and sensory processing, if they remain permanent especially when reinnervation is incomplete or defective (Navarro et al., 2007).

The knee reflex (L2, L3, L4), patient lie on his or her back. Supporting both knees at once, as shown below, briskly tap the patellar tendon just below patella.

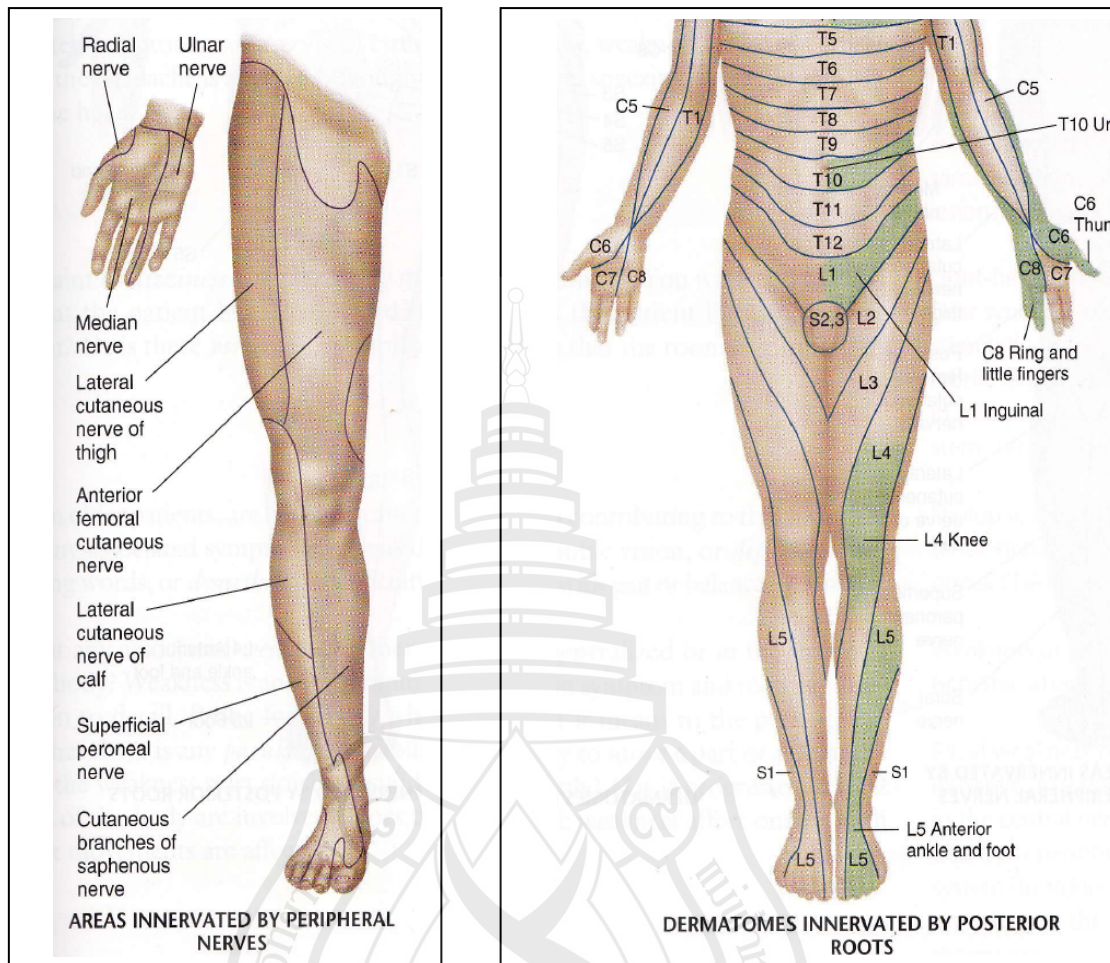
The ankle reflex (primarily S1), If the patient is sitting, dorsiflex the foot at the ankle. Persuade the patient to relax. Strike the Achilles tendon. Watch and feel for plantar flexion at the ankle. Note also the speed of relaxation after muscular contraction.

When the patient is lying down, flex one leg at both hip and knee and rotate it externally so that the lower leg rests across the opposite the opposite shin. Then rsiflex the foot at the ankle and strike the Achilles tendon (Bickley & Szilagyi, 2007)



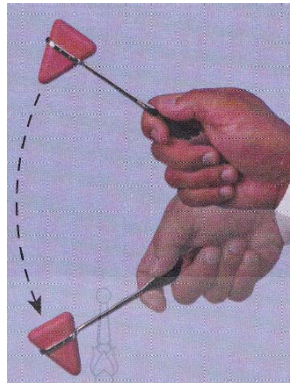
From. Bickley, L. S. & Szilagyi, P. G. (2007). **Bates' guide to physical examination and history taking**. Philadelphia: Lippincott Williams & Wilkins.

Figure 2.5 Sensory Innervations, Posterior View Left Hand Side is the Areas Innervated by Peripheral Nerves, Right Hand Side is Sensory Area that Innervated by Posterior Root



From. Bickley, L. S. & Szilagyi, P. G. (2007). **Bates' guide to physical examination and history taking.** Philadelphia: Lippincott Williams & Wilkins.

Figure 2.6 Sensory Innervations, Anterior View Left Hand Side is the Areas Innervated by Peripheral Nerves, Right Hand Side is Sensory Area that Innervated by Posterior Root



From. Bickley, L. S. & Szilagyi, P. G. (2007). **Bates' guide to physical examination and history taking.** Philadelphia: Lippincott Williams & Wilkins.

Figure 2.7 Jerk, Deep Tendon Reflex Examination

Scale for grading reflexes (Bickley & Szilagyi, 2007)

4+ Very brisk, hyperactive, with clonus
3+ Brisker than average; possibly but not necessarily indicative of disease

2+ Average; normal

1+ Somewhat diminished; low normal

0 No response

2. Muscle power testing

Evaluating motor system (Bickley & Szilagyi, 2007), muscles are supplied by peripheral nerve, if there is a damage lesion at nervous system, the muscles would be affected, muscle atrophy and weakness (Ziegler, 2008) that sciatic nerve supplies such as Extensor hallucis longus, Tibialis anterior, Peroneus longus. Muscle power testing is the standard muscle testing that is used in wide clinical evaluation which means diagnosis can take form this test.

Scale for grading muscle strength (Bickley & Szilagyi, 2007)

0 No muscular contraction detected

1 A barely detectable flicker or trace of contraction

2 Active movement of the body part with gravity eliminated

3 Active movement against gravity

4 Active movement against gravity and some resistance

5 Active movement against full resistance without evident fatigue.

This is normal muscle strength

Motor system: type of weakness (Bulters & Shenouda, 2009)

UMN Increased tone, increased reflexes, pyramidal pattern

LMN Wasting, fasciculation, decreased tone, reduced reflexes

NMJ Fatigued weakness, normal tone and reflexes

Muscle Wasting, decreased tone, reduced reflexes

UMN: Upper Motor Neurone; LMN: Lower Motor Neurone; NMJ: Neuromuscular Junction.

2.3 Neuropathic Treatment

In 2004 Patrick, Altmaier and Found, studied long term outcome in multidisciplinary treatment program. The standard program contained physical therapy, aerobic exercises and educational lectures on good and bad posture, physical activities and pain management

2.4 Outcome Measurement

Several tools are available to evaluate neuropathic pain; the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS), the Neuropathic Pain Scale (NPS) and the Douleur Neuropathique en 4 questions (DN4) (Arnstein, 2010; Fishbain et al., 2008). Tools that combine self-report and physical examination are more precise than one tool alone (Arnstein, 2010).

Development of pain questionnaires for specific chronic neuropathic pain, it started with the McGill Pain questionnaire (MPQ) is the most frequency use to clinical assess pain (Patrick et al., 2004), which includes sensory, affective, and evaluative descriptors of pain (R. 1975). Melzeck developed another pain assessment questionnaire, the Short-form McGill Pain Questionnaire (SF-MPQ) for taking less time for some patient. Neither both questionnaires are specific to neuropathic pain. So there are many researchers develop another more specific chronic neuropathic pain questionnaires; LANSS NPS (Galer & Jensen, 1997) and DN4. Many recent studies tested validity and reliability of both those questionnaires (Arnstein, 2010; Galer & Jensen, 1997), and claim those questionnaires can discriminated (Arnstein, 2010; Fishbain et al., 2008; Jensen et al., 2005; Kaki et al., 2005) non neuropathic and neuropathic pain, diagnosis with patient's pain condition could be neuropathic or not (Fishbain et al., 2008) and follow up after treatment (Arnstein, 2010; Jensen et al., 2005). Because neuropathic pain is related with patient's quality of life so development of chronic neuropathic pain in quality of life questionnaire was studied, the Neuropathic Pain Impact on Quality-of-Life questionnaire (NePIQoL) (Poole et al., 2009).

2.4.1 Visual Analogue Scale (VAS) and Numerical Rating Scale (NRS)

The two most commonly used methods to assess pain intensity are the visual analogue scale (VAS) and numerical rating scale (NRS) (Ostelo & de Vet, 2005). AVAS consists of a line, usually 100-mm long, with ends labelled as the extremes of pain (e.g. 'no pain' to 'pain as bad as it could be').

The VAS has a high number of response categories: because it is usually measured in millimeters, a 100-mm VAS can be considered as having 101 response levels. This makes the VAS potentially more sensitive to changes in pain intensity than

measures with a more limited number of response categories. Although research comparing the VAS to other measures indicates minimal differences in sensitivity to change most of the time, when differences are found the VAS is usually more sensitive than number of response categories. Although the VAS is easy to administer, investigators who plan to use other measures, especially those with a limited use VAS measures must explain the measurement scale and procedures carefully to decrease failures (Ostelo & de Vet, 2005)

2.4.2 The McGill Pain Questionnaire (MPQ)

The MPQ is a multidimensional measure of pain that includes word descriptors to measure subjective pain experience, ratings of pain intensity, and drawings of pain location. For pain intensity, patients were asked to indicate a number-word combination to describe their pain at the present time. Responses can range from 1 (“mild”) to 5 (“excruciating”). For pain ratings, patients were asked to select certain words to describe their pain. The word descriptors are organized into 20 groups; 10 represent sensory aspects of pain, 5 represent affective aspects, 1 represents cognitive-evaluative aspects, and 4 represent miscellaneous aspects. Patients may select one or more of the words within each group (Patrick et al., 2004).

2.4.3 The Neuropathic Pain Scale (NPS)

The recognition that neuropathic pain syndromes were very common necessitated the development of pain scales specific to neuropathic pain. The NPS is one such scale developed by Galer and Jensen (1997).

The Neuropathic Pain Scale is being increasingly used as a clinical trials measurement, the effects of pain treatments on specific pain domains. This measure include 2 global (intensity and unpleasantness) and specific ratings that assess both pain location (deep and surface) and pain quality (sharp, hot, dull, cold, sensitive, and itchy).

2.4.3.1 How to use of the NPS:

An introduction of The NPS begins with describes how people often experience pain sensations differently, and how pain unpleasantness differs from pain intensity. Rating this score can explain, the severity of each of 10 pain domains by using 0 to 10 numeric rating scales, where 0 is “no pain” or “not [sensation/item]” and 10 is “the most [descriptor] pain sensation imaginable.” The NPS items can be scored individually (to help identify a “profile” associated with a specific diagnosis or of the effects of a treatment on pain qualities) or can be combined into composite scores to determine the effects of treatments on pain quality overall (Jensen et al., 2005).

2.4.3.2 Utilities of the NPS :

The NPS can discriminate between neuropathic and non-neuropathic pain syndromes. The classify study of chronic neuropathy and non neuropathy in 2008 (Fishbain et al., 2008). The result is significant discriminate of NPS able to separate chronic pain patients into neuropathic pain and non-neuropathic pain subtypes. The derived cut-off score from the model was 5.53; the NPS more than 5.53, this pain could diagnose neuropathic pain, if it less than 5.52, this pain is non neuropathic pain.

NPS has been utilized as a tool for treatment outcome for various pain qualities, thus allowing differentiation of therapeutic effects. In 2005 (Jensen et al., 2005), Lable 5% lidocain path is the treatment of chronic neuropathic and nociceptive pain in patients 3 classify groups, first group is 133 patients with peripheral neuropathic pain

(PNP), second group is 175 lower back pain, and the last group is osteoarthritis. Lable 5% lidocain path is the treatment they found that there are significant different NPS between before and after treatment in three groups but there are no different changed of the pattern pain qualities across three diagnoses.

2.4.4 The Leeds Assessment of Neuropathic Symptoms and Signs (LANSS)

The study in identifying neuropathic pain patients with CLB (Kaki et al., 2005), suggested the LANSS pain scale is a useful tool to distinguish patients with neuropathic pain from those with nociceptive pain.

The LANSS Pain Scale has seven items (5 symptoms and 2 physical exam findings) to determine if pain is nociceptive or neuropathic.

2.4.5 The Douleur Neuropathique en 4 Questions (DN4)

DN4 or neuropathic pain four questions in French consisting of both sensory descriptors and signs related to bedside sensory examination (Bouhassira et al., 2005). The psychometric

properties of this instrument were specifically analyzed since it could represent a useful tool for the diagnosis of neuropathic pain.

The validity, inter-reliability of DN4, Didier , et comparison of non neuropathic pain syndromes and neuropathic pain syndrome the results is support this questionnaire validity and suggest that DN4 might be helpful both in clinical research and daily practice (Bouhassira et al., 2005).

Two questions (I and II) were based on the interview of the patient and two questions (III and IV) were based on a standardized clinical examination. Question I included 5 items related to the description of pain: ‘Does your pain have one or more of the following characteristics?——’ 1—burning (‘bru`lure’), 2—squeezing (‘sensensationde serrrement’), 3—painful cold (‘sensation de froiddouloureux’), 4—‘electric shock’ (‘de`charges e`lectriques’), 5—‘lancinating’ (‘e`lancements’). Question II included 4 items related to the association ofparesthesia/dysesthesia within the painful area: ‘Is the pain associated with one or more of the following symptoms in the same area? ——’ 6—pins and needles (‘picotements’), 7—tingling, (‘fourmillements’), 8—numbness (‘engourdissement’), 9—itching (‘de`mangeaisons’). Question III included 4 items related to sensory deficits: ‘Is the pain located in an area where the physical examination may reveal one or more of the following characteristics? ——’ 10—touch hypoesthesia (‘hypoesthe`sie au tact’), 11—pricking hypoesthesia (‘hypoesthe`sie a` la piqu`re’), 12—heat hypoesthesia (‘hypoesthe`sie a` la chaleur’), 13—cold hypoesthesia (‘hypoesthe`-e`sie au froid’).

Question IV included 4 items related to evoked pains: ‘In the painful area, can the pain be caused or increased by any of the following? ——’ 14—brushing (‘frottement’), 15—pressure (‘pression’), 16—contact with cold (‘contact avec le froid’), 17— contact with heat (‘contact avec le chaud’). Examination of sensitivity to touch and pricking was made by means of a soft brush and a Von Frey hair (no. 13, Somedic), DN4 Questionnaire.

Table 2.5 Comparison of Pain Syndromes Associated with Nervous or Somatic Lesions and Development of a New Neuropathic Pain Diagnostic Questionnaire (DN4)

Symptom / Sign	No = 0 Yes = 1
Does the pain have the following characteristic? Burning?	
Does the pain have the following characteristic? Painful cold?	
Does the pain have the following characteristic? Electric shocks?	
Does the area of pain also have the following? Tingling?	
Does the area of pain also have the following? Pins & needles?	
Does the area of pain also have the following? Numbness?	
Does the area of pain also have the following? Itching?	
Exam: Decrease in touch sensation (soft brush)?	
Exam: Decrease in prick sensation (von Frey hair #13)?	
Exam: Does movement of a soft brush in the area cause or increase pain?	
0 – 3 = likely nociceptive pain	Total:
≥4 = likely neuropathic pain	

Note. Adapted from:

Bouhassira, D., Attal, N., Alchaar, H., Boureau, F., Brochet, B., Bruxelle, J., Cunin, G., Fermanian, J., Ginies, P., Grun-Overdyking, A., Jafari-Schluep, H., Lanteri-Minet, M., Laurent, B., Mick, G., Serrie, A., Valade, D. & Vicaut, E. (2005). Comparison of pain syndromes associated with nervous or somatic lesions and development of a new neuropathic pain diagnostic questionnaire (DN4). *Pain*, **114**(1-2), 29-36.

2.4.6 The Neuropathic Pain Impact on Quality-of-Life Questionnaire (NePIQoL)

Neuropathic pain is frequently associated with negative effects on quality of life (QoL), affecting physical, social, and psychological functioning. The development and preliminary psychometric evaluation of the Neuropathic Pain Impact on Quality-of-Life questionnaire (NePIQoL) (Poole et al., 2009) were reports on the NePIQoL, Poole et al. (2009) developed a measure to assess quality of life in neuropathic pain from 4 phases. The revised NePIQoL was administered to a further 110 patients on two occasions to examine validity and test-retest reliability. Qualitative and quantitative pretesting led to extensive revision, resulting in a final measure of 42 items. The authors conclude that the NePIQoL is an acceptable, patient-derived, neuropathic painspecific measure with evidence of reliability, validity, and temporal stability.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

A randomized, double-blind, placebo controlled trial

3.2 Population and Samples

3.2.1 Population

Thai male and female aged between 22-60 years.

3.2.2 Sample

Patients with a diagnosis of sciatic neuropathic pain who wanted to receive the treatment in a clinic were invited for participation. The diagnosis of sciatic neuropathic pain conducting would be based on clinical feature (Dworkin, 2002; Rowbotham, Petersen & Fields, 1998) by physiotherapist. Clinical evaluation is the most important.

3.2.3 Sample Size Determination (Two Samples)

Precision 90% CI (specify α error)

$$n = \frac{2Z_{\alpha}^2 (pq)}{d^2}$$

α = Probability of type I error (1-sided) = 0.1; $z_{0.1} = 1.28$

$p = 0.93$

$q = 1-p = 1-0.93 = 0.07$

d = Allowable error in estimating (margin of error) = 0.12

$$n = \frac{2(1.28)^2 (0.93*0.07)}{(0.12)^2} = 26$$

Drop out 20%: $n=32$

3.2.4 Sample Selection

Because sciatic nerve is the largest and important peripheral nerve that most commonly have lesion caused by primary back problems, that why the researcher select sciatic neuropathic pain in this study.

3.2.4.1 Inclusion criteria

1. Participants with sciatic neuropathic pain caused by back problems, i.e. herniated disc, lumbar spinal stenosis, back dysfunction, radiculopathy, aged between 22-60 years
2. Participants would be fulfilled one of the following criteria;
 - 1) Pain and abnormal sensory symptoms in association with either absence of normal sensation.
 - 2) The presence of normally heightened sensation or pain.
 - 3) Abnormal sensory symptoms in association with neurological signs indicative of motor or autonomic dysfunction.
3. Any genders
4. Health control participants.
5. Participants were informed and consent.

3.2.4.2 Exclusion criteria

1. Participants who had muscle weakness grade 0, I, II.
2. Severe disc extrusion patients.
3. Other severe neurological deficits such as spinal bifida.
4. Pregnant and breastfeeding women.
5. Participants took supplement known to alter neuropathy such as vitamin B within 2 weeks before this study program.
6. Patients who had extreme condition which need to be cured in hospital.
7. Diabetes, multiple sclerosis.
8. Patients who were diagnosed cancer.
9. Alcoholic

3.2.4.3 Discontinuation criteria

1. Participants who had side effect from supplementary diets such as nausea or vomiting
2. Participants who did not continue with the treatment.
3. Participants who wanted to drop out.
4. Participants who took NSAID and other pain killer medicine between study programs..
5. Participants took supplement known to alter neuropathy such as vitamin B between study programs.

3.3 Limitation of This Study

3.3.1 Limitation of financial support.

3.3.2 This study had limit time to study. There was flood in Bangkok in October to November. It's make the study time more tight.

3.3.3 Activity of participating were hard to control.

3.4 Equipments

3.4.1 Observation & Measurement

3.4.1.1 Research variables:

1. Independent variable: oral alpha-lipoic acid 600 mg, R-isomer, certificate of analysis from China Jiangsu International Economic Technical Cooperation and placebo, Maltodextrin, certificate of analysis from Shandong Xiwang imp and exp. trade co.ltd

2. Dependent variables: Modified the Neuropathic Pain Scale (NPS) and Modified Neuropathic Pain Impact on Quality-of-Life Questionnaire (NePIQoL), improvement of sensory area deficit.

1) Modified the Neuropathic Pain Scale (NPS), it was modified from the Neuropathic Pain Scale (NPS) (Fishbain et al., 2008) for more exquisite and suitable with patients. Consist of pain sharpness, heat/cold, dullness, intensity, overall unpleasantness, surface and deep pain. The researcher interviewed participants or patients. Each question there are 10 scale, modified from comparative pain scale (Harich, 2002)

2) Modified Neuropathic Pain Impact on Quality-of-Life Questionnaire (NePIQoL), a measure to assess quality of life in neuropathic pain. NePIQoL is an acceptable, patient-derived, neuropathic pain specific measure with evidence of reliability, validity, and temporal stability (Poole et al., 2009).

3. Controlled variables: no significant differences in severity of disorder, age and working conditions between control group and studied group.

3.4.1.2 Equipments:

1. Consent form and Participant Information Sheet.

2. Alpha-lipoic acid 600 mg and placebo. The pill bottle will be marked A and B and neither the patients nor the researcher will know if the samples are taking alpha-lipoic acid or placebo

3. Data collection forms

1) Patient demographic information, collecting participants' demographic data such as age, gender, Body Mass Index, and occupation.

2) Data record form; this part is collecting from to evaluate first visit and 3 follow up of participants including patients' history, chief complaint, and physical examination such as functional examination, neurological examination, and deep tendon reflex (DTR).

3) Modified the Neuropathic Pain Scale (NPS), measuring: pain sharpness, heat/cold, dullness, intensity, overall unpleasantness, surface and deep pain. The NPS begins with an introduction that describes how people often experience pain sensations differently, and how pain unpleasantness differs from pain intensity. After the introduction, the NPS asks respondents to rate the severity of each of 10 pain domains by using 1 to 10 numeric rating scales, where 1 mean "no pain" or "not [sensation/item]" and 10 mean "the most [descriptor] pain sensation imaginable. The derived cut-off score, neuropathic and non neuropathic pain from the model is 5.53 (Jensen et al., 2005). The participants have to record every visit in 5 weeks, 4 visits. (See Appendix C)

1. Please use the scale below to tell us how intense your pain is. Place an “X” through the number that best describes the intensity of your pain												
No pain at all	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px; text-align: center;">1</td> <td style="width: 20px; height: 20px; text-align: center;">2</td> <td style="width: 20px; height: 20px; text-align: center;">3</td> <td style="width: 20px; height: 20px; text-align: center;">4</td> <td style="width: 20px; height: 20px; text-align: center;">5</td> <td style="width: 20px; height: 20px; text-align: center;">6</td> <td style="width: 20px; height: 20px; text-align: center;">7</td> <td style="width: 20px; height: 20px; text-align: center;">8</td> <td style="width: 20px; height: 20px; text-align: center;">9</td> <td style="width: 20px; height: 20px; text-align: center;">10</td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	The most intense pain sensation imaginable
1	2	3	4	5	6	7	8	9	10			

Figure 3.1 Example of Modified the Neuropathic Pain Scale (NPS)

4) Modified Neuropathic Pain Impact on Quality-of-Life Questionnaire (NePIQoL), a measure to assess quality of life in neuropathic pain. NePIQoL is an acceptable, patient-derived, neuropathic pain specific measure with evidence of reliability, validity, and temporal stability (Poole et al., 2009). There are 7 category questions; the first category is symptoms, these were related to descriptions of pain and other sensory symptoms, their unpredictability, and “strangeness.” The second category is relationships, these included narratives on the extent to which neuropathic pain had changed relationships with friends, family, and colleagues as well as discussion about intimacy with partners. Third category is psychological; these were described in terms of feelings such as distress, low mood, worry, anger, and guilt. The fourth is social activity; these were related to enjoyment and achievement. The fifth category is physical change; these incorporated discourse on poor memory, confusion, and slowed-down thinking processes. The sixth category is personal care, these involved daily activities such as washing, bathing, dressing, etc. the last category is the overall health and overall quality of life. The participants choose 1 to 5. The participants have to record every visit in 4 weeks, 4 visits. (See Appendix C)

Table 3.1 Modified Neuropathic Pain Impact on Quality-of-Life Questionnaire

1. Symptoms	None	Least	Little	Moderate	High	Severe
1.1 Cold weather results in more pain.	0	1	2	3	4	5

5) Needle and cotton (Dworkin, 2002) are used to assess sensory area deficit. Neurological examination can help determine where the lesion is; explain by the area that is impaired, and distribution of terminal nerve ending. Sensation impaired can be dermatome or peripheral sensation pattern. Dermatome is an impairment sensation area which refers to level of nerve lesion, occurred at nerve root. Peripheral sensation pattern refer to lesion along peripheral nerve. Find out if the participants have any loss of sensation. Pinprick sensation tests patients sensory perception by using a safety pin. When using a sharp end, the researcher will ask the

patient, “is this sharp or dull?” a comparison with a normal (dull) side, “Does this feel the same as before?” Light touch sensation use a broken cotton swab, and asks the patient if it is light. Then, when making compare normal side, the researcher asks if the normal side make any differences. Lastly, fill the body chart in the Data record form.

6) Ultra sound and traction



Figure 3.2 Physical Therapy Equipment: Traction 1



Figure 3.3 Physical Therapy Equipment: Traction 2



Figure 3.4 Physical Therapy Equipment: Ultrasound

3.5 Methodology (see figure 3.6)

First visit

3.5.1 Patients who came to clinic would be asked for the symptoms and their background behavior and causes of the symptoms. Then, PT assessment and diagnosis were made. Sciatic neuropathy patient conforming to the inclusion criteria would be considered.

3.5.2 The researcher explained the research objectives, and research methodology as well as expected results and side effects of using vitamins. The patients received and read participant information sheet.

3.5.3 Accepting patients will sign the consent form.

3.5.4 The participating patients will answer the patient demographic form.

3.5.5 The participating patients were randomly put into 2 groups (use Random Allocation Software Version 1.0, May 2004); control group and studied group (see figure. 3.7). The researcher also did not know which patients belong to which group.

3.5.6 The participating patients answered the following questionnaires; NPS, and NePIQoL before physical therapy treatment.

3.5.7 The participants were allocated participant's numbers to treat with 5 physiotherapists (table 3.2).

3.5.8 The participating patients received physiotherapy treatment.

Follow up

3.5.9 Next visits, the participating patients turned over another therapist until the end for protected bias from physiotherapy treatments.

3.5.10 Every participant received the physiotherapy treatment twice a week, 4 weeks. Physical therapy included mobilization technique use for their joint stiffness, ultrasound use for their inflammations and adhesion area, traction use for improve lumbar spine circulation, lumbar stabilization exercises and ergonomic educations.

3.5.11 Follow up the participating patients on weekly basis. There are 4 visits and before each therapy the patients did questionnaires and pre-therapy checkup. The 4 visits done on 4 consecutive weeks.

3.5.12 After 4 weeks, the researcher took data into SPSS statistical analysis, descriptive statistic and independent t-test and pair t test.



Figure 3.5 Mobilization Technique



Figure 3.6 Lumbar Stabilization Exercises

First visit

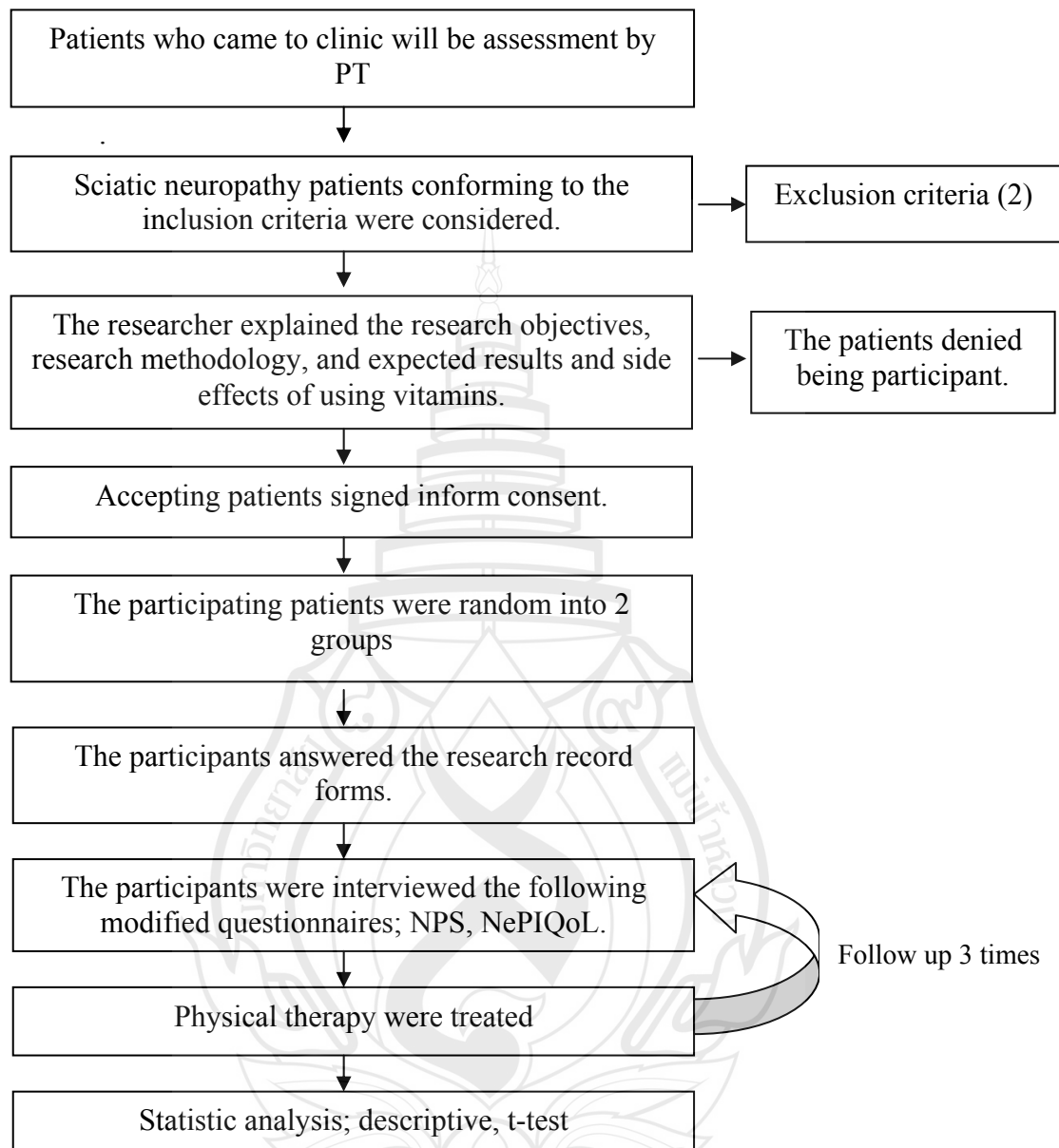


Figure 3.7 Research Methodology Diagram 1

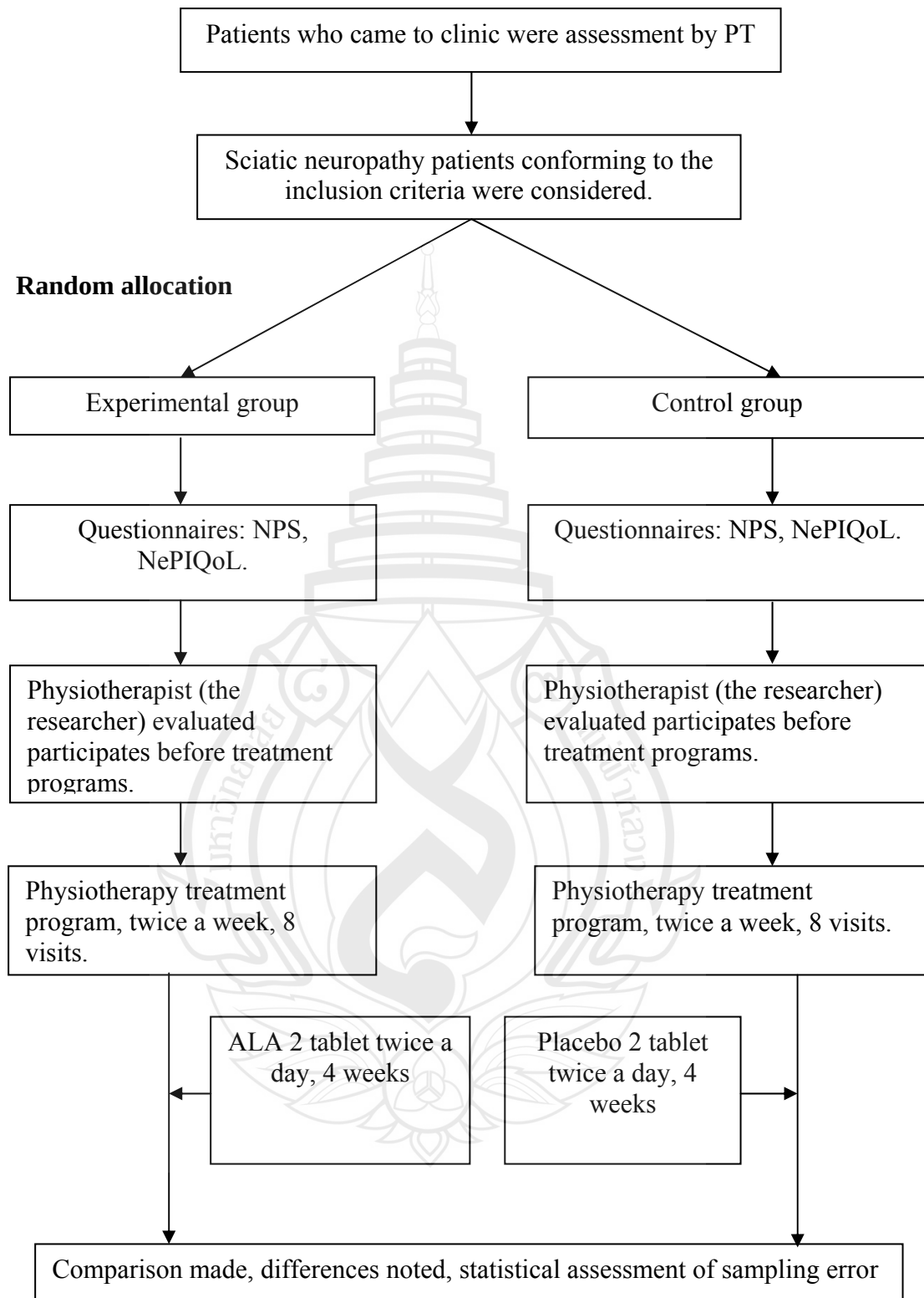


Figure 3.8 Research Methodology Diagram 2

Table 3.2 First Visit, Physiotherapist Selection

Physical therapy/ interventions	PT1	PT2	PT3	PT4	PT5
A	S1	S2	S3	S4	S5
B	S6	S7	S8	S9	S10
A	S11	S12	S13	S14	S15
B	S16	S17	S18	S19	S20
A	S21	S22	S23	S24	S25
B	S26	S27	S28	S29	S30
A	S31	S32	S33	S34	S35
B	S36	S37	S38	S39	S40

The participants were randomized participant's number to treat with 5 physiotherapists and next visits turn over another 3 therapists until the end for protected bias from treatments.

S= participating patient.

PT = Physical therapist,

First visit, the first participating received the treatment with the first physical therapist (PT1) and supplement PN1. The second participating received treatment with the second physical therapist (PT2) and supplement PN2. The third participating received treatment with the third physical therapist (PT3) and supplement PN3, until the last one (PN34) for preventing bias from personal physical therapist. Every participating takes supplement A or B, 600 mg after meal in the morning one tablet per day, every day, and 4 weeks. If any of them forgot, she or he has to take the supplement in the next meal (lunch). Everyone was continuing their supplement and follow physical therapy treatments every week, two times per week for 4 weeks.

3.6 Data Collection

3.6.1 Someone who did involve in this study randomly, blind name of all bottoms of supplement to numbers, PN1, PN2, . . . PN34. It was put participating patients in two groups; control and experiment.

3.6.2 The researcher interviewed and evaluated all participating patients, recorded their demographic information; such as name, gender, age and data into the demographic form; patient history, the body areas affected by neuropathic pain, physical examination, the body sensation effected area. One clinician evaluate for decreasing human bias. Both the researcher and all patient sides do not know which one gets ALA or placebo.

3.6.3 The severity of the neuropathic pain was evaluated by the researcher interviewing and recording modified NPS and NePIQoL questionnaire, 4 visits.

3.6.4 The physiotherapists also did not know whether patients take ALA or placebo.

3.7 Data Analysis

3.7.1 Participants' demographic data were presented by using descriptive analysis including Percentage, mean, and standard deviation evaluate distribution of data.

3.7.2 Compare post treatment symptom between ALA and physiotherapy, experiment group and only physiotherapy, control group. Data analysis was based on KS statistic test to evaluate distribution of data. All of data shows normal distribution, independent t-test was used, p-value 0.05.

3.7.3 Compare post treatment symptom between before and after, in both experiment and control groups. Data analysis was based on KS statistic test to evaluate distribution of data. All of data had normal distribution, paired t-test was used, p-value 0.05.

3.8 Ethic Considerations

This study has been approved by Ma Fah Loung ethic committee, approval number 55/2554. That this is human experiment study of two groups; experiment group taking ALA and control group taking placebo that had not show side effect. However, both groups received standard treatment for neuropathic pain equally and sufficiently for physiotherapy purpose. All of the participating patients had to participate to get in this experiment study.

It is found in many studies with the use of 600 oral ALA (chapter 2) that there are benefits of using ALA in many health problems, especially in diabetes neuropathic pain. There was a study evaluating the safety of using oral ALA, 600 mg, 800 and 1,200 mg, and the recommendation for use is at 600 mg.

Importantly, this processing study and research method followed good clinical practice: GCP, which is standard ethical for clinical human experiment study. The practice in this study was ensured that safety and wellbeing of participants were concerned following the declaration of Helsinki. All clinical practices, treatments, looking after and compensation and solution in case there was any side effect from the experiment shall be considered. Participants could stop their participation at they would at anytime if they face any difficulties or unwanted effects from the experiments. The researcher would respond to the expenses of medical treatments incurred as a result of this experimental study. All other ethical considerations of participants were kept secret and have never be exposed to the public. Results from this study will be presented as overall subjects not individually.

CHAPTER 4

RESULTS

The study was a randomized double blind placebo controlled trial study. The study was initiated under a hypothesis that oral alpha-lipoic acid supplement to physiotherapy can decrease neuropathic pain and improve quality of life more than physiotherapy only. Modified Neuropathic Pain Scale questionnaire (modified NPS) and modified Impact of Neuropathic Pain on Quality-of-Life Questionnaire (modified NePIQoL) were used.

4.1 Patients' Demography

Thirty four Thai participants with neuropathic pain were recruited from the outpatient department OPD of PK physiotherapy clinic, Mae Fah Luang University Hospital and by local advertisement. The diagnosis of neuropathic pain caused by back problem is based on clinical features by physiotherapist who has nine years of experience in orthopedics field.

There were 30 participants finished the study and 4 dropped out participants, accounting for 11.76%. 25% of dropped out participants were due to inconvenience to travel, 25% did not continue the treatment and 50% taking natural pain killer drug for relieve their fever. (See table 4.1)

Table 4.1 Drop Out Participants

Participants drop out reason	n	%
Wanting to drop out, far from home	1	2.94
Did not continue with the treatment	1	2.94
Taking paracetamol, had a fever	2	5.88
Total	4	11.76

Randomized 34 participants with sciatic neuropathic pain complete the study. 15 participants were in experiment group, oral ALA 600 mg supplementation physiotherapy and 15 participants were in control group, physiotherapy alone. Patient's gender is considered no effect to the treatment. From both control and experiment groups, 66.67% of the participants are female and 33.33% are male. The majority of participants in this

studied had normal weight range classification by WHO. Participant's age ranged as shown the table 4.2 (See table 4.2)

Table 4.2 Participant's Demography; Sex, Marital Status, BMI and Age

		Experiment group		Control group	
		n	%	n	%
participant's gender	male	5	33.33	5	33.33
	female	10	66.67	10	66.67
	Total	15	100.00	15	100.00
BMI classifications	under weight	1	6.67	0	.00
	normal weight	10	66.67	14	93.33
	overweight	4	26.67	1	6.67
	Total	15	100.00	15	100.00
participant's age	30-37 years	4	26.67	3	20.00
	38-45 years	3	20.00	5	33.33
	46-50 years	1	6.67	4	26.67
	51-60 years	7	46.67	3	20.00
	Total	15	100.00	15	100.00
marital status	Single	8	53.33	6	40.00
	Married	7	46.67	9	60.00
	Total	15	100.00	15	100.00

There were no difference between mean of weight and BMI in both control and experimental groups, except height. (See table 4.3)

Table 4.3 Participant's Demography: Mean Difference of Weigh, Height and BMI

participant's characteristic	experiment group (n=15)		control group (n=15)		p-value
	Mean	SD	Mean	SD	
weigh	57.94	9.72	59.80	8.26	0.58
height	1.59	0.07	1.64	0.07	0.05*
BMI	22.89	3.11	22.13	1.76	0.42

Note. a. Test distribution is normal
 b. *significant (p-value<0.05)

Table 4.4 Participant's Demography: Occupation and Type of Work

participant's characteristic		experiment group % (n=15)	control group % (n=15)
occupation	government officer	40	26.67
	company employee	20	26.67
	Housewife	6.67	6.67
	business owner	26.67	20
	Specialist	6.67	20
type of work	Sitting	46.67	53.33
	Standing	6.67	13.33
	Uncertainty	46.67	33.33

From table 4.4 Participants aged between 22-60 years have similar working activities. For those over 60 years of age would have extreme activity differences from the younger group. In addition, the neuromuscular structure would be degenerative change, and is different from the first group also.

Out of the participants whose age is between 22-29 years which account for 10.7% of total participants, it is found that 66.67% are company employees and 33.33% are government officers. In the light of work of participants in this age range, 66.67% work under uncertainly working condition and 33.33% working by sitting.

The participants with the age between 30-37 years account for 25% of all participants. Accounts for 42.86% are specialist, 28.57% are government officer and 28.57% are company employee. And type of work in this group, account for 28.57% of this age range, their type of work is sitting, 28.57% walking and 42.86% uncertainly worked.

The participants who are 38-45 years old are 25% of all participants. 57.14% of this group is government officers, 28.57% are business owner and 14.29% are specialists. All of their working nature is by sitting. (See table 4.5 and 4.6)

Table 4.5 Percentage Associated Participants Anemography; Occupational and Age

		participant's age (n=30)					Total
		22-29 years	30-37 years	38-45 years	46-50 years	51-60 years	
occupation	government officer	33.33%	28.57%	57.14%	0.00%	30.00%	35.71%
	company employee	66.67%	28.57%	0.00%	0.00%	20.00%	21.43%
	housewife	0.00%	0.00%	0.00%	0.00%	20.00%	7.14%
	business owner	0.00%	0.00%	28.57%	100.00%	30.00%	21.43%
	specialist	0.00%	42.86%	14.29%	0.00%	0.00%	14.29%

The participants whose age is between 46-50 years were 3.6% of all participants. And all of them are business owner with uncertainly working activities.

The last group is the participants who age between 51-60 years old, or 37.7% of all participants. 30% of this age group is government officers, 20% are company employees, 30% are business owners, and 20% are housewives. 60% of this age group has uncertainly working type, 30% have sitting work typing nature and 10% of this group and standing working type. (See table 4.5 and 4.6)

Table 4.6 Percentage Associated Participants Demography; Type of Work and Age

		participant's age (n=30)					Total
		22-29 years	30-37 years	38-45 years	46-50 years	51-60 years	
Type of work	sitting	33.33%	28.57%	100.00%	0.00%	30.00%	46.43%
	standing	0.00%	0.00%	0.00%	0.00%	10.00%	3.57%
	walking	0.00%	28.57%	0.00%	0.00%	0.00%	7.14%
	uncertainty	66.67%	42.86%	0.00%	100.00%	60.00%	42.86%
	Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 4.7 shows associated percentage between type of work and BMI. The results show that 80% of the participants with sitting type of work are associated with overweight BMI while 54.55% of the participants who have normal weight work with uncertainty working conditions. (See table 4.7)

Table 4.7 Association of Percentage between Type of Work and BMI Classifications

		BMI classifications (n=30)			Total
		under weight	normal weight	overweight	
type of work	sitting	100.00%	36.36%	80.00%	46.43%
	standing	0.00%	0.00%	20.00%	3.57%
	walking	0.00%	9.09%	0.00%	7.14%
	uncertainly	0.00%	54.55%	0.00%	42.86%
Total		100.00%	100.00%	100.00%	100.00%

Interestingly some correlation between their occupational and their type of work can be found. It can be noticed that participant's occupation are related with type of work. For example, 100% of housewives correlate with uncertainly type of work, 80% of government officer had correlation with sitting and 20% had correlation with uncertainly type of work. Unlike with 50% company employee had correlation with uncertainly, type of work, 33.33% had correlation with sitting and 16.67% had correlation with walking. 50% Business owner had correlation with uncertainly, type of work, 33.33% had correlation with sitting also the government officer. In addition 50% the participants who were specialist had correlation with type of work uncertainly. (See table 4.7 and 4.8)

Table 4.8 The Association between Participant's Occupation and Type of Work

		Occupation					Total
		government officer	company employee	housewife	business owner	specialist	
type of work	Sitting	80.00%	33.33%	0.00%	33.33%	25.00%	46.43%
	Standing	0.00%	0.00%	0.00%	16.67%	0.00%	3.57%
	Walking	0.00%	16.67%	0.00%	0.00%	25.00%	7.14%
	uncertainty	20.00%	50.00%	100.00%	50.00%	50.00%	42.86%
	Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Considering their health behavior, it is found that only 13.33 % in both experimental group and control group smoke, 6.67% always drink, 20% sometime drink in control group, and more than 60% of both groups do not drink at all. Exercise habit is low in both groups. (See table 4.9)

Table 4.9 Participant's Demography: Smoking, Drinking and Exercises

		experiment group % (n=15)	control group % (n=15)
smoking		(2) 13.33	(2) 13.33
drinking	yes	0.0	(1) 6.67
	some time	(6) 40	(3) 20
	no	(9) 60	(11) 73.33
exercises	no	(5) 33.33	(8) 53.33
	some time	(8) 53.33	(7) 46.67
	often	(2) 13.33	0

4.2 Clinical Characteristics of Patients

Data participants characteristic recording, there were 2 parts. First part, participants characteristic about participant's history illness recording by therapist i.e. Patients history, chief complain (cc1, cc2, cc3), the area of their pain, their aggravating factor and patient's impairment were examined and diagnosed by the therapist. Second part is physical examination also by the therapist who treated them. Physical examination included observation, functional testing, active and passive range of motion, neurodynamic examination and neurological examination. This data collecting part would help the therapist diagnosis impairment and treatment.

There were 5 physical therapists who in the studied. Graduated bachelor degree also graduated Diploma Program in Manipulative Physical Therapy certificate from Mahidol University. They have worked in orthopedic field at list for 2 to 9 years.

4.2.1 First part

4.2.1.1 Participant's chief complain (cc)

The therapist asked them about their illness. How the illness occurred and How long? What were words exactly you feel, dull pain, sharp pain, numbness, itching, fatigue, tightness, cramp, cold or burning sensation? Point your body area that you feel uncomfortable. What were your behaviors that make its worst? And if an uncomfortable symptom occurred what did you do?

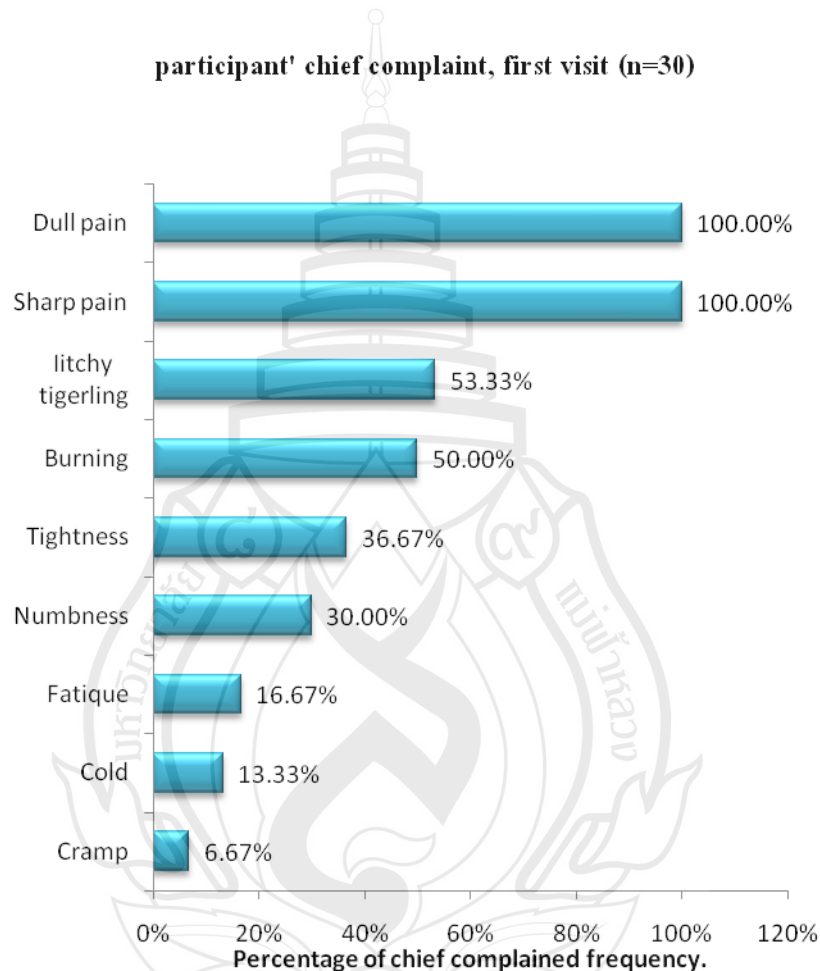


Figure 4.1 Participant' Chief Complained Characteristics, First Visit

Figure 4.1 shows first visit patients' chief complain. It is found that all of participants describing their symptoms as sharp and dull pain. 53.33% of them complained litchi and triggering. Burning symptom accounts for 50% of total chief complaint. Other symptoms, tightness, numbness, fatigue, cold and cramp were 36.67%, 30%, 16.67%, 13.33% and 6.67%.

participant' chief complaint, second visit (n=30)

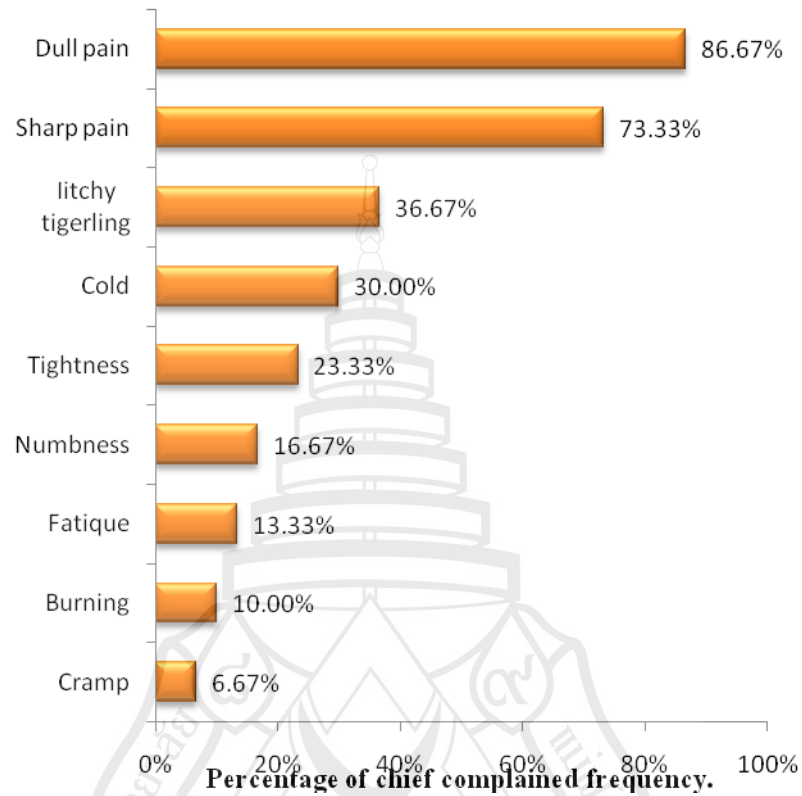


Figure 4.2 Participant' Chief Complained Characteristics, Second Visit

In the second visit, the most chief complain characteristic were still dull pain, 86.67%. The second was sharp pain, 73.33%. The third was litchy and triggering, 36.67%, decreasing from the first visit. Tightness and fatigue was 23.33% and 13.33%. But burning and numbness were 10% and 20%. Those seem increasing from first visit. (See figure 4.2)

participant' chief complaint, third visit (n=30)

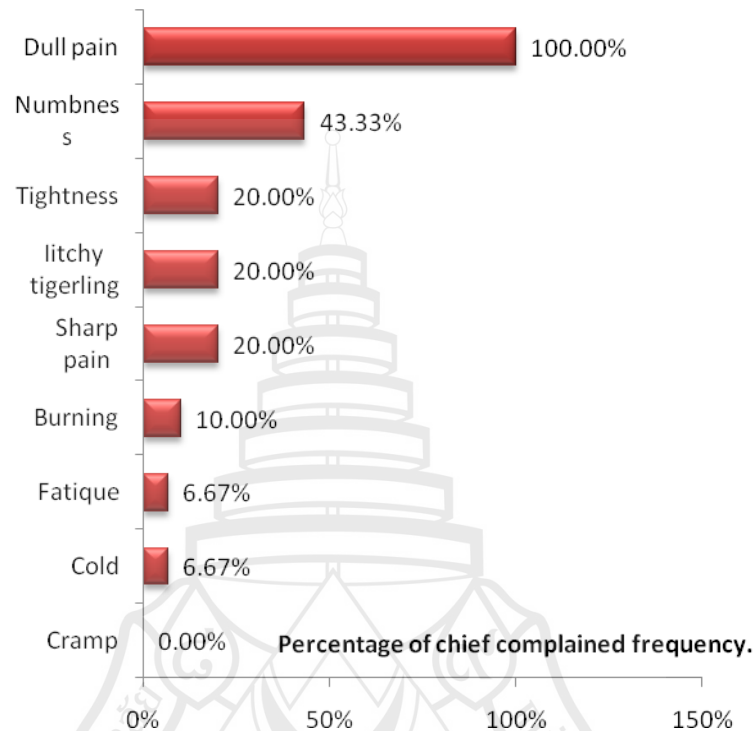


Figure 4.3 Participant' Chief Complained Characteristics, Third Visit

For the third visit, the most characteristic of participants' chief complaint was dull pain. They had got this symptom more than the second visit. In these results, the second chief complained characteristic was numbness, 43.33%. Sharp pain in this visit decreased from the second visit, it had only 20% as same as level with itchy triggering symptom and tightness. Other symptoms, burning, fatigue, cold were 10%, 6.67%, 6.67% respectively. and the last chief complained characteristic, cramp was appear in this visit. (See figure 4.3)

participant' chief complaint, fourth visit (n=30)

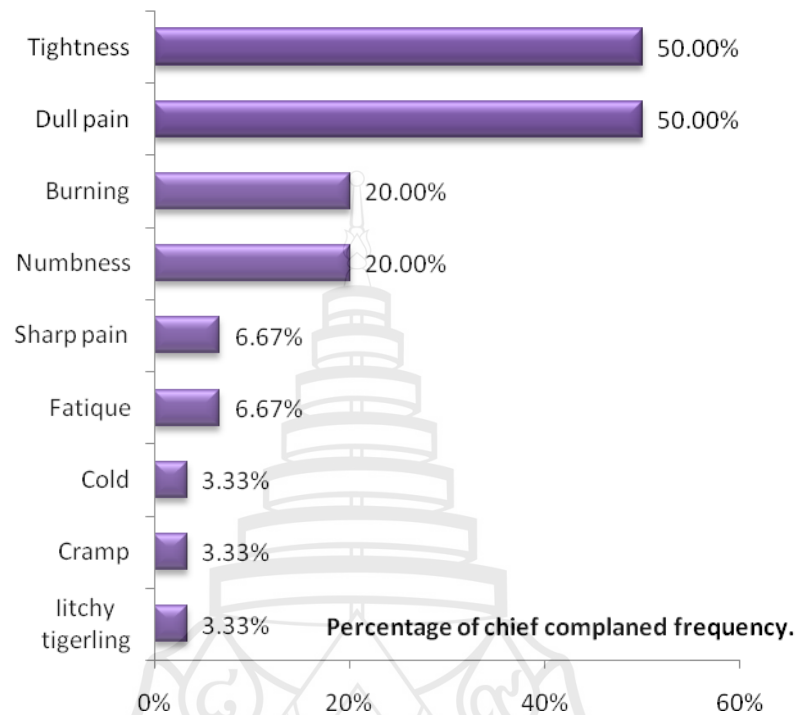


Figure 4.4 Participant' Chief Complained Characteristics, Final Visit

Figure 4.4 shows that tightness was the most chief complain characteristic, 50%. Cold burning sensation was the second and third characteristic, 30%, 20% respectively. Other characteristic were dull pain, cramp, sharp pain, litchi triggering, accounting for 13.33%, 6.67%, 6.67%, 6.67% and 3.33% respectively. In this visit, the results show decreases in all of the participant's chief complain characteristic from previous weeks and did not show any decreases of fatigue complained characteristic. (See figure 4.4)

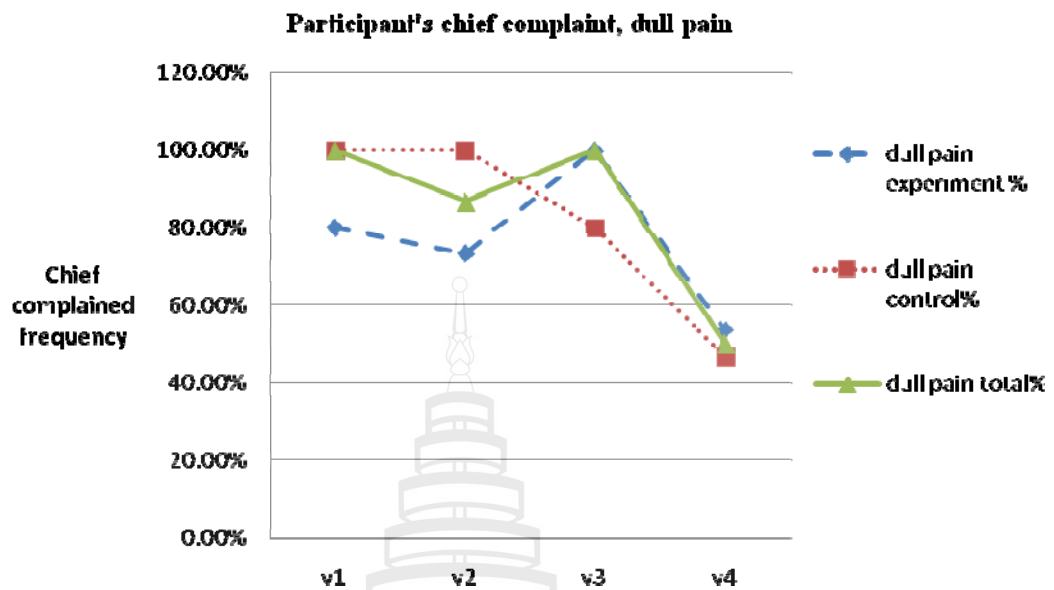


Figure 4.5 Participant's Chief Complained Characteristic in Four Times Visits, Dull Pain

Figure 4.5 shows that the participant's chief complained characteristic is divided into two groups, experiment and control group. In order to show improvements of characteristic symptoms clearly, we presented these results graphically. From figure 4.5 shows decreasing frequency of dull pain in each visit for both groups, excepted experiment group in third visit. (See figure 4.5)

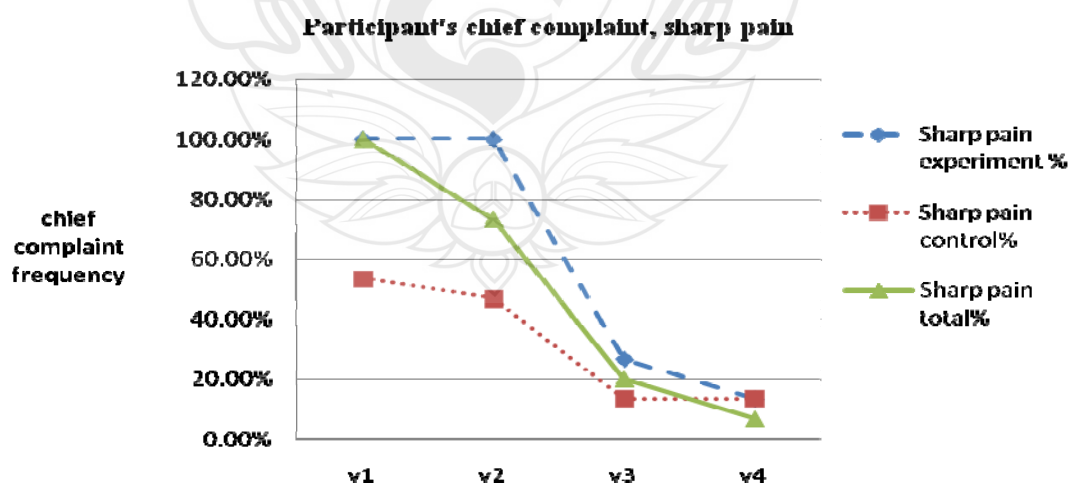


Figure 4.6 Participant's Chief Complained Characteristic in Four Times Visits, Sharp Pain

All of participants explained that their chief complaints were sharp pain and dull pain. This characteristic was decreased in third visit more than first second and fourth visits excepted in third visit, control group. Spectacularly, even if the frequency of the experiment group's complaint was more than control group in the beginning, but next week visited decreasing of complaint could low as the same frequency level as the control group in the final visit. (See figure 4.6)

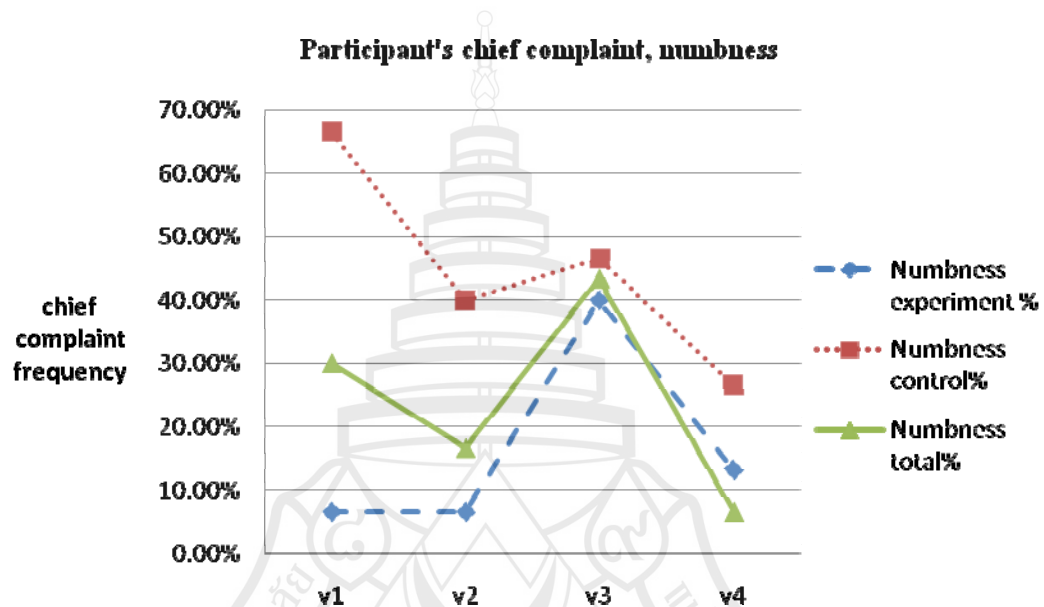


Figure 4.7 Participant's Chief Complained Characteristic in Four Times Visits, Numbness

Unexpected value is numbness, chief complained participant's characteristic. The results show increased number of complaint in the third visit especially experiment group and decreased in the final visit. (See figure 4.7)

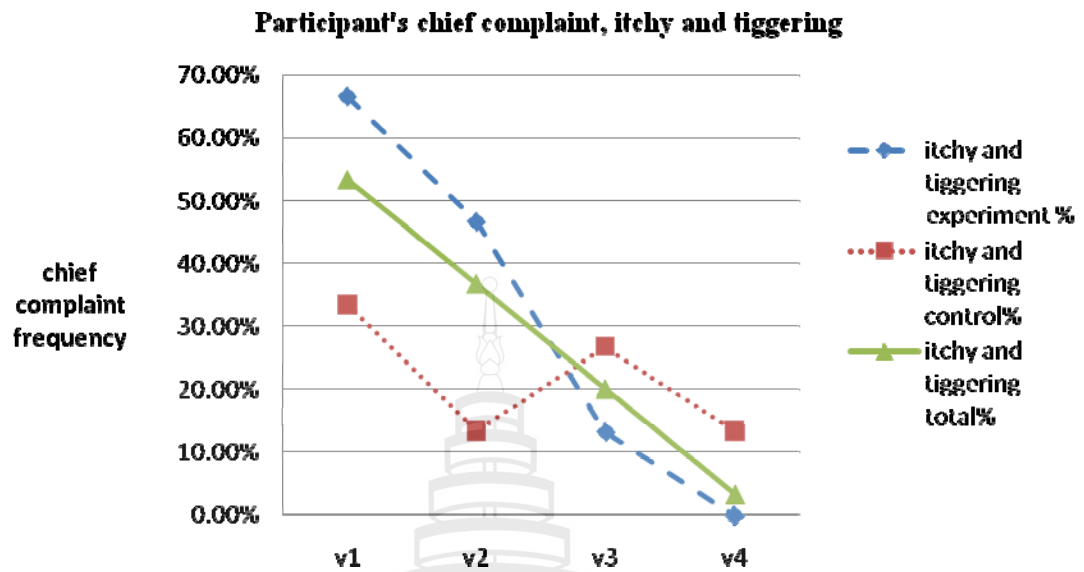


Figure 4.8 Participant's Chief Complained Characteristic in Four Times Visits, Itchy and Triggering

For itchy and triggering symptoms, experiment group found decreased frequency complaints every visit until the last visit, there was not any complaint from the participants. Control group, the results decreased in the second visit and the last visit but increased in the third visit. Even though the starting point, frequency of participant's chief complaint in experiment group was higher more than control group but it declined below than controlled group in final visit. (See figure 4.8)

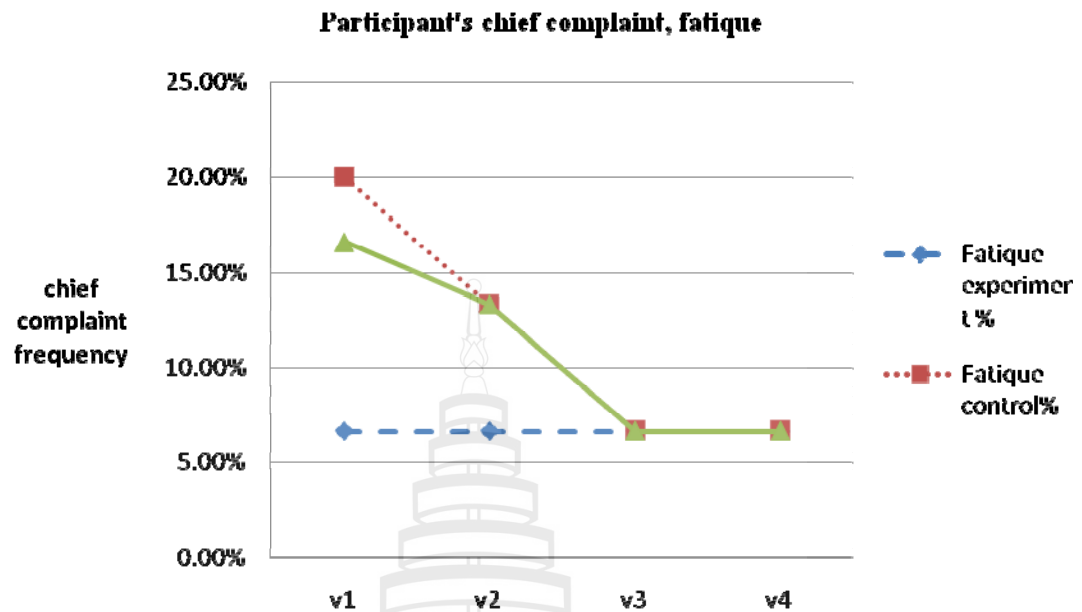


Figure 4.9 Participant's Chief Complained Characteristic in Four Times Visits, Fatigue

From Figure 4.9 Shows that Chief Complained Characteristic in Control Group was decreasing in every weeks except the final visit. In experiment group the fatigue characteristic symptom would not change through the last visit. (See figure 4.9)

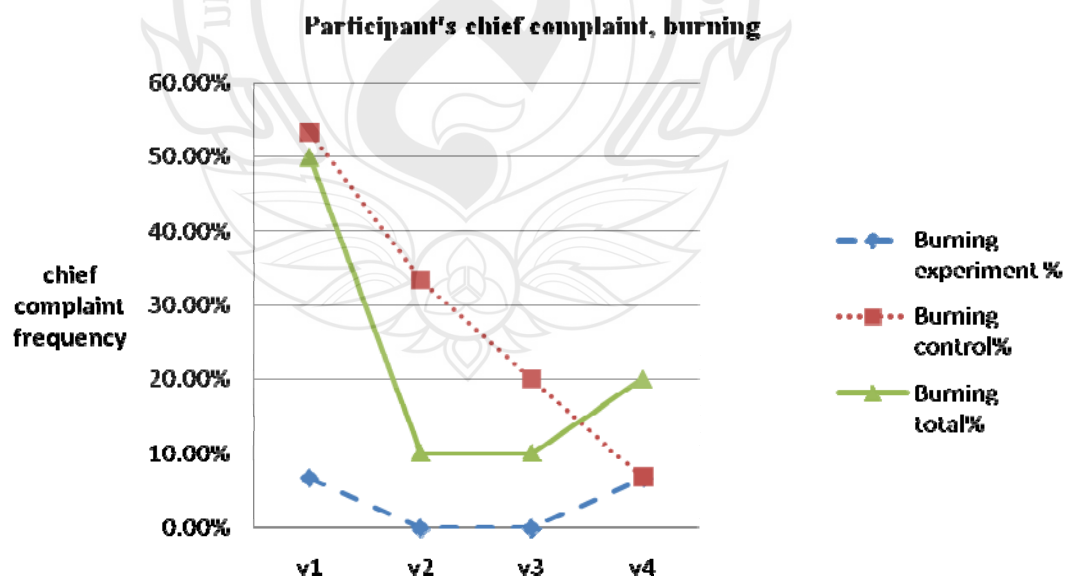


Figure 4.10 Participant's Chief Complained Characteristic in Four Times Visits, Burning

Burning in both groups was decreasing except experiment group's chief complained in the last visit. Increasing number of complaint was showed. (See figure 4.10)

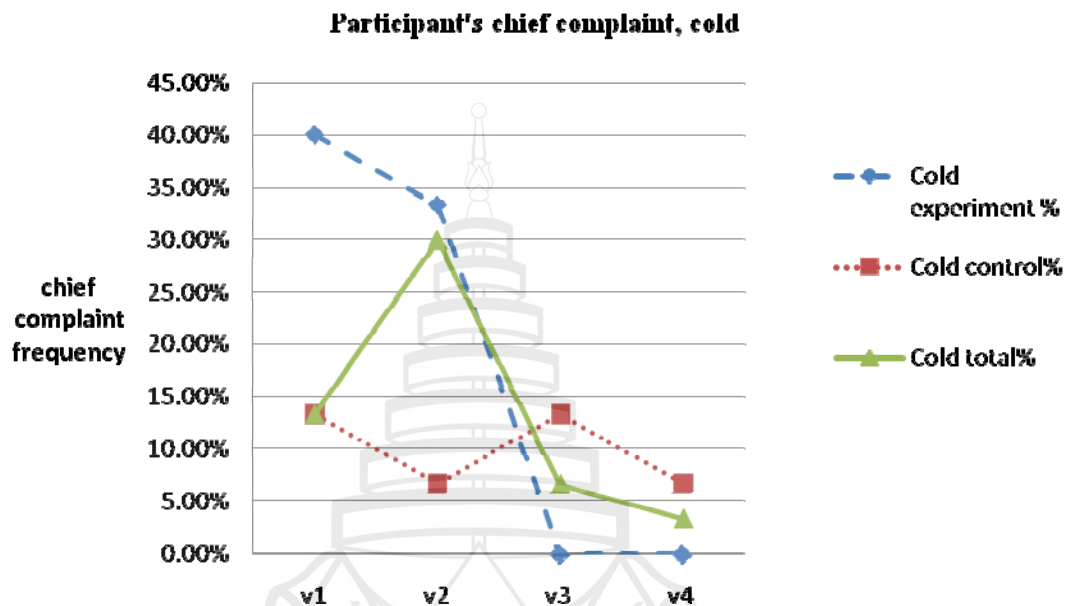


Figure 4.11 Participant's Chief Complained Characteristic in Four Times Visits, Cold

Participant's chief complained characteristic, cold is like itchy and triggering. frequency of compliant in experiment group event thought the starting in this characteristic more than control group but the decreasing in the third and the last visit appeared while control group still was not difference, compared with the first and the second week. (See figure 4.11)

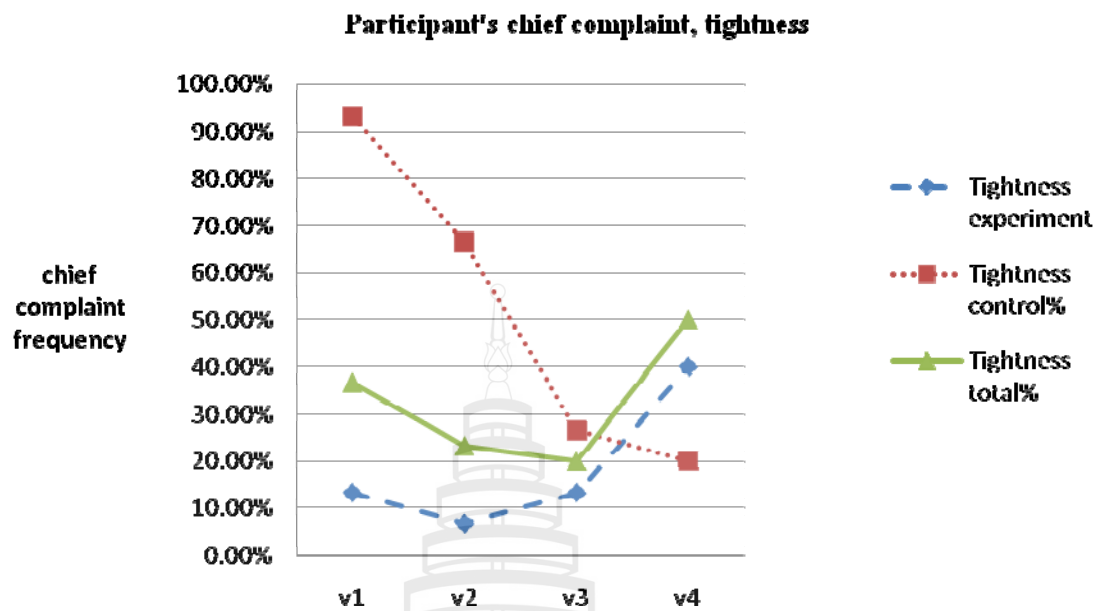


Figure 4.12 Participant's Chief Complained Characteristic in Four Times Visits, Tightness

Tightness, participant's chief complained characteristic was decreasing in every visit in control group but in experiment group, increasing was show in last week. (See figure 4.12)

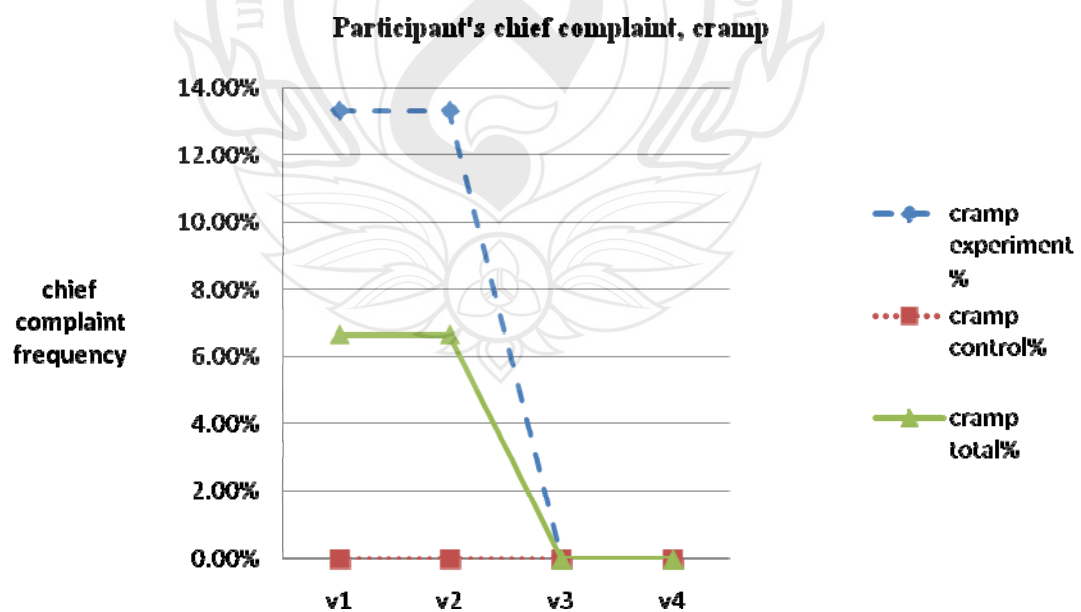


Figure 4.13 Participant's Chief Complained Characteristic in Four Times Visits, Cramp

There was no number of frequencies of complained characteristic, cramp in control group. But in experiment group there was only 13.33% in first and second visit after that the complaint was no found. (See figure 4.13)

4.3 Modified Neuropathy Pain Scale Results

Modified Neuropathy Pain Scale (MNPS) was modified from Neuropathy Pain Scale (NPS) (Fishbain et al., 2008) in order to measure patients with neuropathic pain. This measurement questionnaire can measure over all unpleasantness of neuropathic patients: pain sharpness, heat/cold, dullness, tightness, fatigue, itchy and triggering intensity, and how deep it is, consist of 10 questions. All of the questions were full field by researcher from interviewing. The answer would be 1 to 10. By 1 was no pain or feeling perfectly normal and 10 was the most sensitive sensation imaginable. Participants choose the number that best describes the intensity of their unpleasantness.

After finished this study, there was not any participant had sign of ALA side effect. The results were analyzed by SPSS program. The Kolmogorov–Smirnov statistic test was used (K–S test) for distribution testing. All of variables have normal distribution. Independent t-test was used for significant mean difference testing between experiment and control groups. And paired t-test was used for significant mean difference testing between each visit in group.

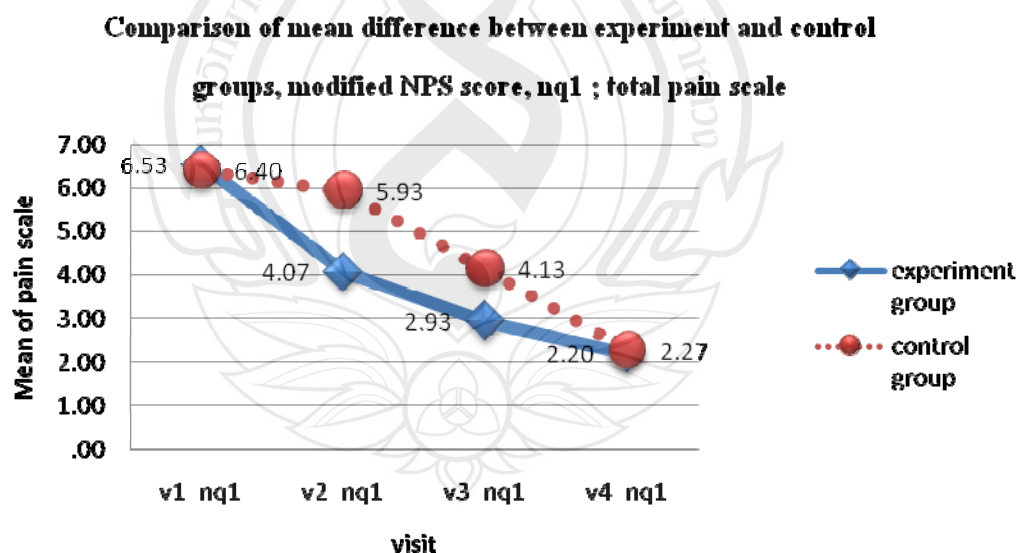


Figure 4.14 Comparison of Mean Difference between 2 Groups, Experiment and Control. nq1

From figure 4.15 shows the overall pain. It's result shows significant improvement of the experiment group in the second week (4.06 ± 1.9 , $p\text{-value} \leq 0.001$), which is approximately one week earlier than the control group who experienced the improvement in the third week (4.13 ± 2.29 , $p\text{-value} \leq 0.05$). For longer treatment the experiment and control group are nearly equal in the last week. (See table 4.10 and 4.11)

Table 4.10 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experimental Group, Question1

MNPS; pain scale, experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean $\pm$ SD	visit	mean $\pm$ SD	t	df	
1	v1_nq1	6.53 ± 1.81	v2_nq1	4.06 ± 1.98	4.79	14	<0.001
2	v1_nq1	6.53 ± 1.81	v3_nq1	2.93 ± 1.83	8.51	14	<0.001
3	v1_nq1	6.53 ± 1.81	v4_nq1	2.20 ± 1.42	9.13	14	<0.001
4	v2_nq1	4.07 ± 1.98	v3_nq1	2.93 ± 1.83	3.01	14	0.009**
5	v2_nq1	4.07 ± 1.98	v4_nq1	2.20 ± 1.42	3.11	14	0.008**
6	v3_nq1	2.93 ± 1.83	v4_nq1	2.20 ± 1.42	1.34	14	0.202

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

From table 4.10 there are significant differences of pain symptoms after treatment program in each visit. Especially the difference between first visit and second, first and third visit, first and last visit, $p\text{-value}$ were less than 0.05.

Table 4.11 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group, Question1

MNPS; pain scale, control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean $\pm$ SD	visit	mean $\pm$ SD	t	df	
1	v1_nq1	6.40 ± 2.32	v2_nq1	5.93 ± 2.37	0.608	14	0.553
2	v1_nq1	6.40 ± 2.32	v3_nq1	4.13 ± 2.29	2.69	14	0.018*
3	v1_nq1	6.40 ± 2.32	v4_nq1	2.27 ± 2.02	4.74	14	<0.001
4	v2_nq1	5.93 ± 2.37	v3_nq1	4.13 ± 2.29	4.10	14	0.001***
5	v2_nq1	5.93 ± 2.37	v4_nq1	2.27 ± 2.02	5.44	14	<0.001
6	v3_nq1	4.13 ± 2.29	v4_nq1	2.27 ± 2.02	3.44	14	0.004**

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

Table 4.11 shows that there are significant differences of pain symptom after treatment program in each visit, p-value were less than 0.05. Except there is no significant difference between first and second visit.

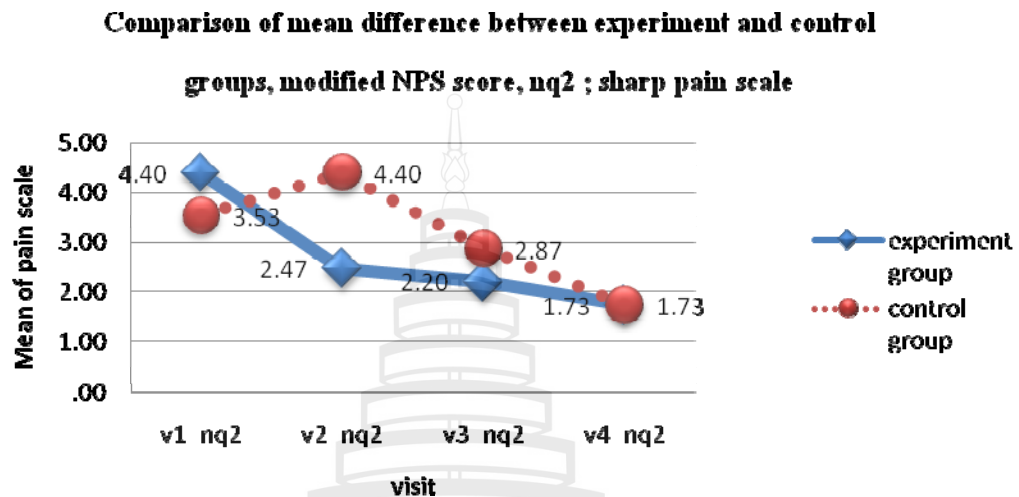


Figure 4.15 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq2

This graph shows sharp pain. It's result shows significant improvement of the experiment group in the second week (2.47 ± 2.10 , $p\text{-value} \leq 0.05$), which is approximately two weeks earlier than the control group who experienced the improvement in the fourth week (1.73 ± 1.98 , $p\text{-value} \leq 0.05$). (See table 4.12 and 4.13).

Table 4.12 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experimental Group, Question 2

MNPS; sharp pain, experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean $\pm$ SD	visit	mean $\pm$ SD	T	df	
1	v1_nq2	4.40 $\pm$ 2.87	v2_nq2	2.47 $\pm$ 2.10	2.31	14	0.037*
2	v1_nq2	4.40 $\pm$ 2.87	v3_nq2	2.20 $\pm$ 1.78	2.55	14	0.023*
3	v1_nq2	4.40 $\pm$ 2.87	v4_nq2	1.73 $\pm$ 1.62	2.81	14	0.014*
4	v2_nq2	2.47 $\pm$ 2.10	v3_nq2	2.20 $\pm$ 1.78	0.81	14	0.433
5	v2_nq2	2.47 $\pm$ 2.10	v4_nq2	1.73 $\pm$ 1.62	1.10	14	0.289
6	v3_nq2	2.20 $\pm$ 1.78	v4_nq2	1.73 $\pm$ 1.62	0.88	14	0.396

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

From table 4.12 there are significant differences of sharp pain after treatment program between each pair visit, the first, second, third and fourth visit, p-value were less than 0.05.

Table 4.13 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visit. Control Group, Question 2

MNPS; sharp pain, control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	T	df	
1	v1_nq2	3.53±3.34	v2_nq2	4.40±3.46	-0.96	14	0.354
2	v1_nq2	3.53±3.34	v3_nq2	2.87±2.88	0.69	14	0.503
3	v1_nq2	3.53±3.34	v4_nq2	1.73±1.98	2.13	14	0.052*
4	v2_nq2	4.40±3.46	v3_nq2	2.87±2.88	2.27	14	0.039*
5	v2_nq2	4.40±3.46	v4_nq2	1.73±1.98	3.66	14	0.003*
6	v3_nq2	2.87±2.88	v4_nq2	1.73±1.98	2.83	14	0.013*

Note. *p-value ≤ 0.05, **p-value ≤ 0.01, ***p-value ≤ 0.001

Table 4.13 shows that there are significant differences of sharp pain after treatment program between each pair visit, the second, third and fourth visit. The third and fourth visit pair also is significant mean difference. All p-value are less than 0.05.

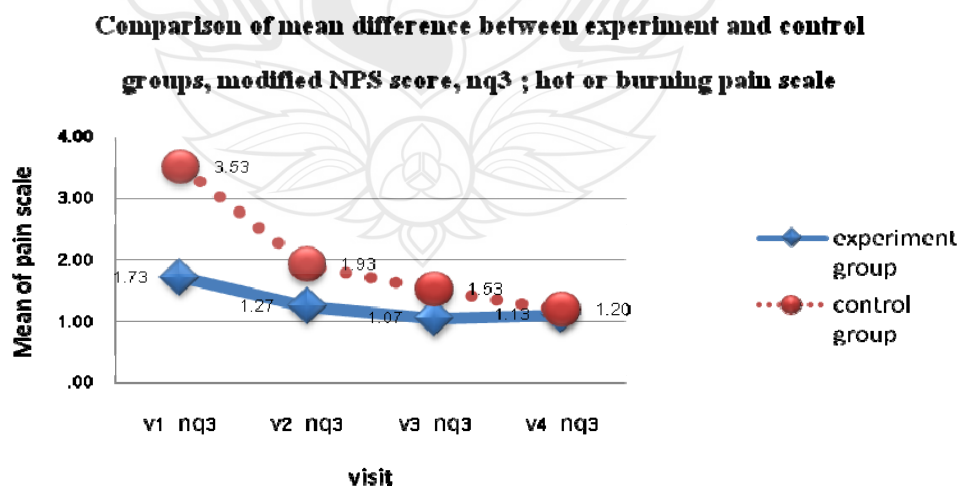


Figure 4.16 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq3

Figure 4.16 shows there are no significant difference between mean of hot or burning sensation in both experiment and control groups after treatment. Whether or not mean of hot or burning sensation in experiment group decreases more than control group.

Table 4.14 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group, Question 3

MNPS question3; experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	T	df	
1	v1_nq3	1.73±1.62	v2_nq3	1.27±1.03	1.33	14	0.204
2	v1_nq3	1.73±1.62	v3_nq3	1.07±.26	1.73	14	0.106
3	v1_nq3	1.73±1.62	v4_nq3	1.13±.35	1.5	14	0.156
4	v2_nq3	1.27±1.03	v3_nq3	1.07±.26	1	14	0.334
5	v2_nq3	1.27±1.03	v4_nq3	1.13±.35	0.62	14	0.546
6	v3_nq3	1.07±.26	v4_nq3	1.13±.35	1	14	0.334

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

From table 4.13 there are no significant differences of hot or burning sensation after treatment program.

Table 4.15 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group, Question 3

MNPS question 3; control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	T	df	
1	v1_nq3	3.53±3.38	v2_nq3	1.93±1.79	2.7	14	0.017*
2	v1_nq3	3.53±3.38	v3_nq3	1.53±1.13	2.79	14	0.014*
3	v1_nq3	3.53±3.38	v4_nq3	1.20±.86	3.1	14	0.008**
4	v2_nq3	1.93±1.79	v3_nq3	1.53±1.13	1.7	14	0.111
5	v2_nq3	1.93±1.79	v4_nq3	1.20±.86	2.44	14	0.028*
6	v3_nq3	1.53±1.13	v4_nq3	1.20±.86	2.65	14	0.019*

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

Table 4.15 shows significant differences of hot or burning sensation after treatment program, p-value is less than 0.05.

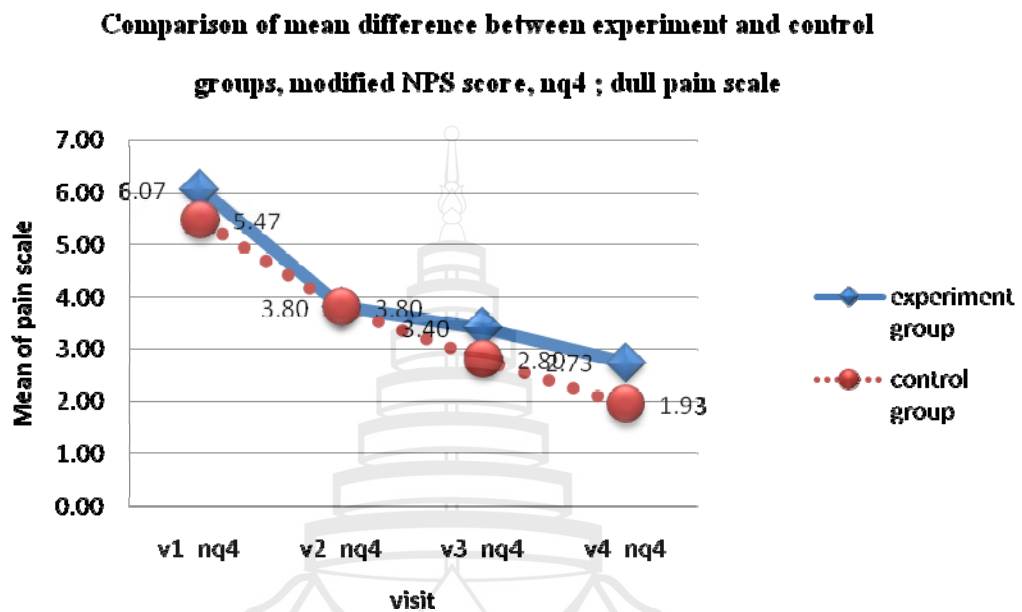


Figure 4.17 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq4

Figure 4.17 shows dull pain mean difference improvement after treatment in both experiment and control group, p-value ≤ 0.01 .

Table 4.16 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experimental Group; Question 4

MNPS question 4; experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	T	df	
1	v1_nq4	6.07±2.63	v2_nq4	3.80±1.97	3.407	14	0.004**
2	v1_nq4	6.07±2.63	v3_nq4	3.40±2.10	3.765	14	0.002**
3	v1_nq4	6.07±2.63	v4_nq4	2.73±1.75	4.498	14	0.001**
4	v2_nq4	3.80±1.97	v3_nq4	3.40±2.10	0.685	14	0.505
5	v2_nq4	3.80±1.97	v4_nq4	2.73±1.75	2.014	14	0.064
6	v3_nq4	3.40±2.10	v4_nq4	2.73±1.75	0.933	14	0.367

Note. *p-value ≤ 0.05 , **p-value ≤ 0.01 , ***p-value ≤ 0.001

Table 4.16 shows significant differences of dull pain after treatment program between first visit and another visit, p-value is less than 0.05.

Table 4.17 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group; Question 4

MNPS question 4; control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	T	df	
1	v1_nq4	5.47±2.75	v2_nq4	3.80±2.21	3.85	14	0.002**
2	v1_nq4	5.47±2.75	v3_nq4	2.80±1.86	4.64	14	<0.001
3	v1_nq4	5.47±2.75	v4_nq4	1.93±1.83	5.53	14	<0.001
4	v2_nq4	3.80±2.21	v3_nq4	2.80±1.86	2.18	14	0.046*
5	v2_nq4	3.80±2.21	v4_nq4	1.93±1.83	3.69	14	0.002**
6	v3_nq4	2.80±1.86	v4_nq4	1.93±1.83	1.31	14	0.211

Note. *p-value ≤ 0.05, **p-value ≤ 0.01, ***p-value ≤ 0.001

From table 4.17 there are significant differences of dull pain after treatment program between each visit; p-value is less than 0.05.

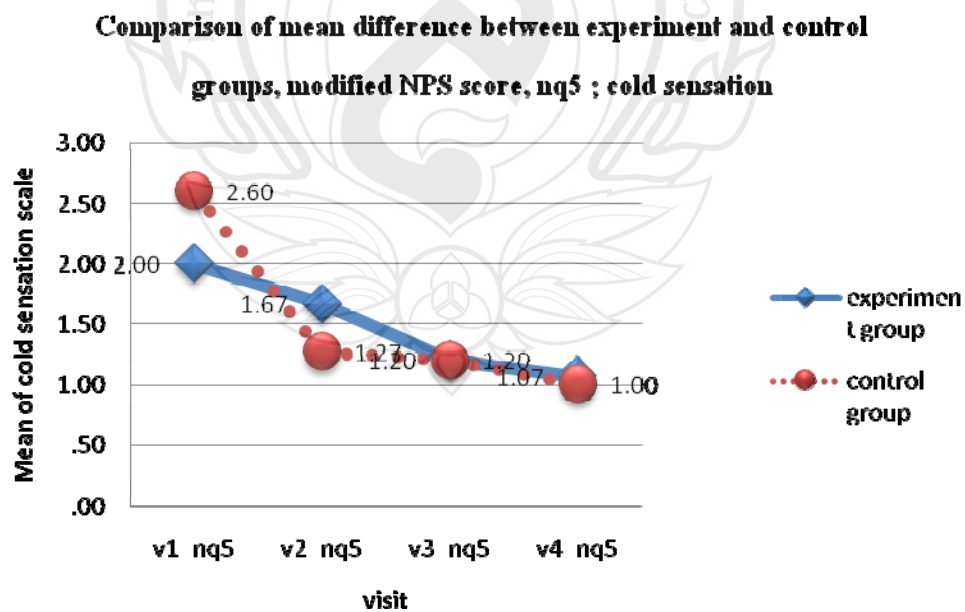


Figure 4.18 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq5

Figure 4.18 shows that there are mean significant improvement of cold sensation in both experiment and control groups, $p\text{-value} \leq 0.05$

Table 4.18 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experimental Group, Question 5

MNPS question 5; experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq5	2.00±1.81	v2_nq5	1.67±1.29	1.435	14	0.173
2	v1_nq5	2.00±1.81	v3_nq5	1.20±.77	1.922	14	0.075
3	v1_nq5	2.00±1.81	v4_nq5	1.07±.26	2.168	14	0.048*
4	v2_nq5	1.67±1.29	v3_nq5	1.20±.77	1.974	14	0.068
5	v2_nq5	1.67±1.29	v4_nq5	1.07±.26	1.964	14	0.07
6	v3_nq5	1.20±.77	v4_nq5	1.07±.26	0.619	14	0.546

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

Table 4.18 shows that there is significant difference of cold sensation after treatment program in the fourth visit, $p\text{-value}$ is less than 0.05.

Table 4.19 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group, Question 5

MNPS question 5; control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq5	2.60±2.35	v2_nq5	1.27±.80	2.51	14	0.025*
2	v1_nq5	2.60±2.35	v3_nq5	1.20±.56	2.58	14	0.022*
3	v1_nq5	2.60±2.35	v4_nq5	1.00±.38	2.78	14	0.015*
4	v2_nq5	1.27±.80	v3_nq5	1.20±.56	0.43	14	0.67
5	v2_nq5	1.27±.80	v4_nq5	1.00±.38	1.74	14	0.104
6	v3_nq5	1.20±.56	v4_nq5	1.00±.38	1.38	14	0.189

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

Table 4.16 shows that there are significant improvements of cold sensation after treatment program, p-value were less than 0.05.

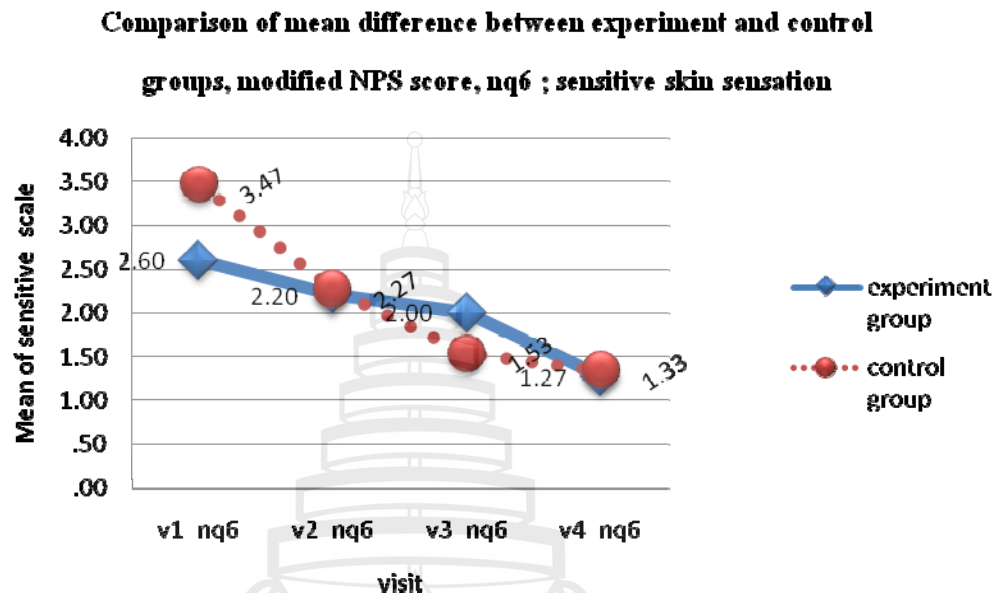


Figure 4.19 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq6

From figure 4.19 there are mean significant improvement of sensitive skin sensation in both experiment and control groups in the fourth visit, p-value ≤ 0.05 .

Table 4.20 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experimental Group, Question 6

MNPS question 6; experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq6	2.60±2.80	v2_nq6	2.20±2.21	2.103	14	0.054
2	v1_nq6	2.60±2.80	v3_nq6	2.00±1.51	1.042	14	0.315
3	v1_nq6	2.60±2.80	v4_nq6	1.27±.80	2.197	14	0.045*
4	v2_nq6	2.20±2.21	v3_nq6	2.00±1.51	0.4	14	0.695
5	v2_nq6	2.20±2.21	v4_nq6	1.27±.80	1.974	14	0.068
6	v3_nq6	2.00±1.51	v4_nq6	1.27±.80	2.582	14	0.022*

Note. *p-value ≤ 0.05 , **p-value ≤ 0.01 , ***p-value ≤ 0.001

From table 4.20 there are significant differences of sensitive sensation in fourth visit after treatment program, p-value were less than 0.05.

Table 4.21 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group, Question 6

MNPS question 6; control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq6	3.47±3.54	v2_nq6	2.27±2.19	2.74	14	0.016*
2	v1_nq6	3.47±3.54	v3_nq6	1.53±1.81	1.73	14	0.105
3	v1_nq6	3.47±3.54	v4_nq6	1.33±1.18	2.48	14	0.027*
4	v2_nq6	2.27±2.19	v3_nq6	1.53±1.81	0.92	14	0.372
5	v2_nq6	2.27±2.19	v4_nq6	1.33±1.18	1.76	14	0.1
6	v3_nq6	1.53±1.81	v4_nq6	1.33±1.18	0.45	14	0.663

Note. *p-value ≤ 0.05, **p-value ≤ 0.01, ***p-value ≤ 0.001

From table 4.21 there is significant difference of sensitive sensation after treatment program in fourth visit, p-value is less than 0.05.

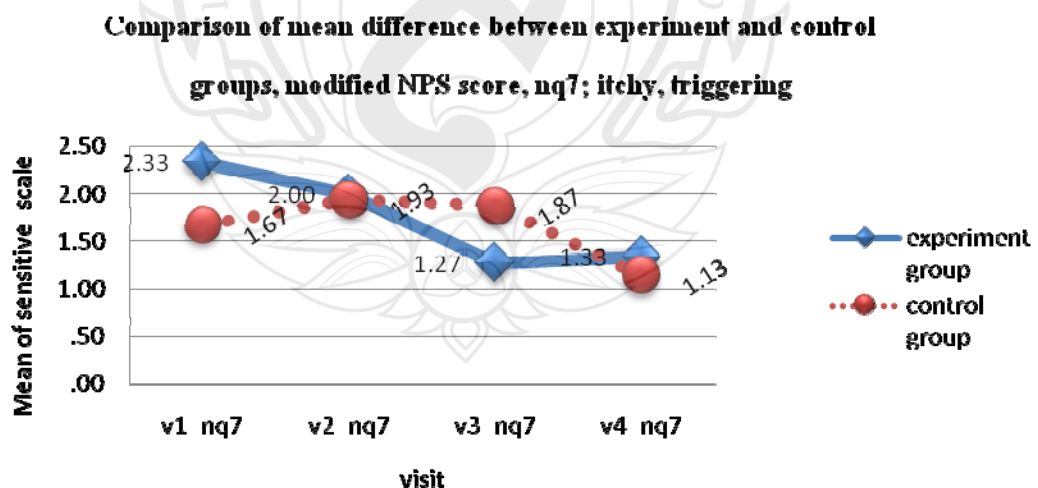


Figure 4.20 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq7

Figure 4.20 shows that itchy or triggering symptom in experiment group has significant mean improvement after treatment program in the last visit, $\text{mean}_E \text{ v1_nq7} = 1.27 \pm 1.03$, $p\text{-value} \leq 0.05$ but there is no significant mean improvement after program treatment in control group. (See table 4.19 and 4.20)

Table 4.22 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experimental Group, Question 7

MNPS question 7; experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq7	2.33±2.32	v2_nq7	2.00±1.41	0.54	14	0.601
2	v1_nq7	2.33±2.32	v3_nq7	1.27±1.03	1.86	14	0.084
3	v1_nq7	2.33±2.32	v4_nq7	1.33±1.05	1.42	14	0.177
4	v2_nq7	2.00±1.41	v3_nq7	1.27±1.03	2.44	14	0.028*
5	v2_nq7	2.00±1.41	v4_nq7	1.33±1.05	1.32	14	0.207
6	v3_nq7	1.27±1.03	v4_nq7	1.33±1.05	-0.17	14	0.869

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

Table 4.22 shows that there is significant improvement of itchy or triggering after treatment program in third visit compared with second visit, $p\text{-value}$ is less than 0.05.

Table 4.23 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group, Question 7

MNPS question 7; control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq7	1.67±1.40	v2_nq7	1.93±1.94	-0.39	14	0.703
2	v1_nq7	1.67±1.40	v3_nq7	1.87±2.03	-0.29	14	0.779
3	v1_nq7	1.67±1.40	v4_nq7	1.13±0.83	1.23	14	0.24
4	v2_nq7	1.93±1.94	v3_nq7	1.87±2.03	0.19	14	0.849
5	v2_nq7	1.93±1.94	v4_nq7	1.13±0.83	1.92	14	0.075
6	v3_nq7	1.87±2.03	v4_nq7	1.13±0.83	1.55	14	0.143

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

Table 4.23 there is no significant differences of itchy or triggering after treatment program, p-value is less than 0.05.

Comparison of mean difference between experiment and control groups, modified NPS score, nq9 ; patient's unpleasant feeling

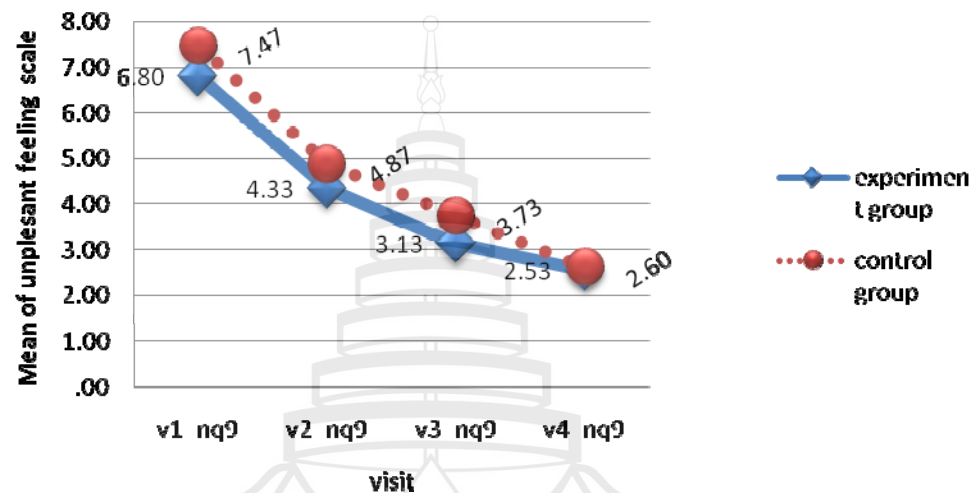


Figure 4.21 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq9

Figure 4.21 shows that there are significant mean improvement of unpleasant patients, pain was to them between each visit in both experiment and control groups, p-value ≤ 0.05 .

Table 4.24 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experimental Group; Question 9

MNPS question 9; experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq9	6.80±1.74	v2_nq9	4.33±1.45	5.41	14	<0.001
2	v1_nq9	6.80±1.74	v3_nq9	3.13±2.10	10.56	14	<0.001
3	v1_nq9	6.80±1.74	v4_nq9	2.53±1.46	9.91	14	<0.001
4	v2_nq9	4.33±1.45	v3_nq9	3.13±2.10	2.4	14	0.031*
5	v2_nq9	4.33±1.45	v4_nq9	2.53±1.46	3.67	14	0.003**
6	v3_nq9	3.13±2.10	v4_nq9	2.53±1.46	1.29	14	0.219

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

Table 4.24 shows that there are significant improvements of unpleasant feeling after treatment program, p-value is less than 0.05.

Table 4.25 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group, Question 9

MNPS question 9; control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq9	7.47±2.13	v2_nq9	4.87±2.70	4.96	14	<0.001
2	v1_nq9	7.47±2.13	v3_nq9	3.73±2.71	6.33	14	<0.001
3	v1_nq9	7.47±2.13	v4_nq9	2.60±1.84	7.28	14	<0.001
4	v2_nq9	4.87±2.70	v3_nq9	3.73±2.71	3.12	14	0.008**
5	v2_nq9	4.87±2.70	v4_nq9	2.60±1.84	3.65	14	0.003**
6	v3_nq9	3.73±2.71	v4_nq9	2.60±1.84	2.2	14	0.045*

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

Table 4.25 shows there are significant differences of unpleasant feeling after treatment program in control group, p-value are less than 0.05.

Comparison of mean difference between experiment and control groups, modified NPS score, nq10.1 ; how intense deep pain.

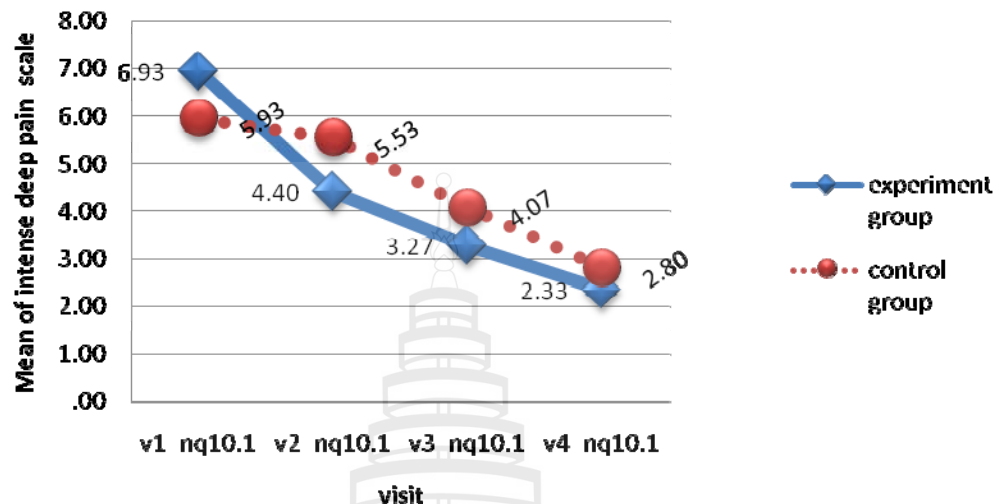


Figure 4.22 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq10.1

This graph shows how intense deep pain. It's result also shows significant improvement of the experiment group in the second week (4.40 ± 2.03 , $p\text{-value} \leq 0.001$), which is approximately two weeks earlier than the control group who experienced the improvement in the fourth week (2.8 ± 2.04 , $p\text{-value} \leq 0.01$). (See table 4.26 and 4.27)

Table 4.26 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experimental Group, Question 10.1

MNPS question 10.1; experimental group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq10_1	6.93±1.58	v2_nq10_1	4.40±2.03	4.75	14	<0.001
2	v1_nq10_1	6.93±1.58	v3_nq10_1	3.27±1.91	8.47	14	<0.001
3	v1_nq10_1	6.93±1.58	v4_nq10_1	2.33±1.45	9.47	14	<0.001
4	v2_nq10_1	4.40±2.03	v3_nq10_1	3.27±1.91	2.06	14	0.059
5	v2_nq10_1	4.40±2.03	v4_nq10_1	2.33±1.45	3.07	14	0.008*
6	v3_nq10_1	3.27±1.91	v4_nq10_1	2.33±1.45	1.9	14	0.079

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

Table 4.26 shows significant mean difference of how intense of deep pain were to them after treatment program in experiment group for every visit, all p-value are less than 0.05.

Table 4.27 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group, Question 10.1

MNPS question10.1; control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq10_1	5.93±2.76	v2_nq10_1	5.53±2.29	0.47	14	0.645
2	v1_nq10_1	5.93±2.76	v3_nq10_1	4.07±2.76	2.02	14	0.063
3	v1_nq10_1	5.93±2.76	v4_nq10_1	2.80±2.04	3.41	14	0.004**
4	v2_nq10_1	5.53±2.29	v3_nq10_1	4.07±2.76	4.04	14	0.001***
5	v2_nq10_1	5.53±2.29	v4_nq10_1	2.80±2.04	5.34	14	<0.001
6	v3_nq10_1	4.07±2.76	v4_nq10_1	2.80±2.04	2.35	14	0.034**

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

From table 4.27 there are significant mean improvement of how intense were patients deep pain were to them after treatment program, fourth visit compared with first. Also there are significant mean differences third and fourth visit compared with second visit, p-value≤ 0.01.

Comparison of mean difference between experiment and control groups, modified NPS score, nq10.12; how intense surface pain.

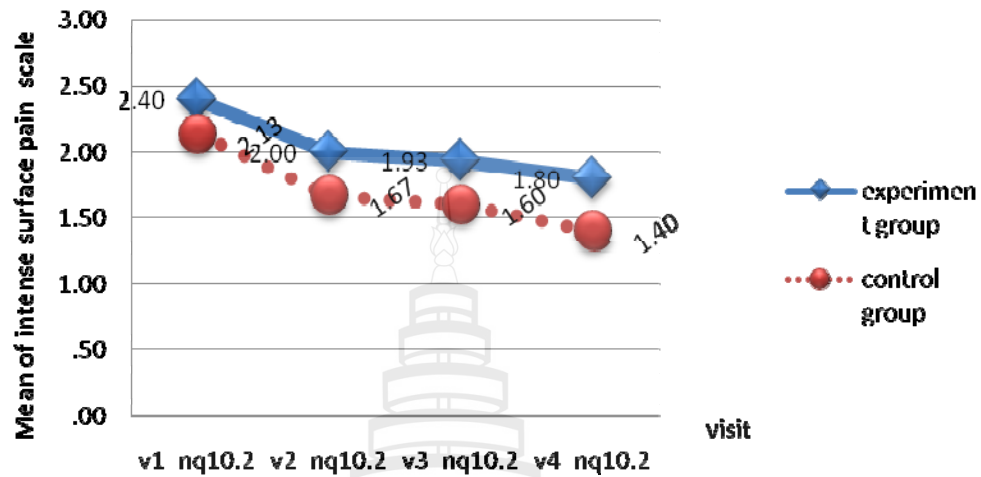


Figure 4.23 Comparison of Mean Difference between 2 Groups, Experiment and Control, nq10.2

Figure 4.23 there is no significant difference after treatment of how intense were patients surface pain were to them in both experiment and control groups. Whether or not mean of intense decrease in every each visit both groups.

Table 4.28 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group, Question 10.2

MNPS question10.2; experiment group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq10_2	2.40±2.29	v2_nq10_2	2.00±1.51	0.5	14	0.624
2	v1_nq10_2	2.40±2.29	v3_nq10_2	1.93±1.53	0.67	14	0.513
3	v1_nq10_2	2.40±2.29	v4_nq10_2	1.80±1.47	0.92	14	0.374
4	v2_nq10_2	2.00±1.51	v3_nq10_2	1.93±1.53	0.14	14	0.892
5	v2_nq10_2	2.00±1.51	v4_nq10_2	1.80±1.47	0.32	14	0.751
6	v3_nq10_2	1.93±1.53	v4_nq10_2	1.80±1.47	0.31	14	0.758

Note. *p-value ≤ 0.05, **p-value ≤ 0.01, ***p-value ≤ 0.001

Table 4.28 shows that there is no significant mean differences of how intense were patient's surface pain were to them after treatment program, p-value is less than 0.05.

Table 4.29 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group, Question 10.2

MNPS question 10.2; control group (n=15)							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_nq10_2	2.13±2.36	v2_nq10_2	1.67±1.76	0.74	14	0.472
2	v1_nq10_2	2.13±2.36	v3_nq10_2	1.60±1.24	0.91	14	0.377
3	v1_nq10_2	2.13±2.36	v4_nq10_2	1.40±1.06	1.38	14	0.188
4	v2_nq10_2	1.67±1.76	v3_nq10_2	1.60±1.24	0.37	14	0.719
5	v2_nq10_2	1.67±1.76	v4_nq10_2	1.40±1.06	0.74	14	0.469
6	v3_nq10_2	1.60±1.24	v4_nq10_2	1.40±1.06	1	14	0.334

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

Table 4.29 shows that there is no significant mean differences of how intense were patients surface pain were to them after treatment program, p-value is less than 0.05.

4.4 Modified Neuropathic Pain Impact on Quality-of-Life Questionnaire (NePIQoL)

4.4.1 Comparisons mean difference between both groups, experiment and control group

Modified NePIQoL measures how qualities of life of participants are after the treatment (program). The results were analyzed by SPSS program. The Kolmogorov–Smirnov statistic test was used (K–S test) for distribution testing. All of variables were normal distribution. Independent t-test was used for testing significant mean difference between experimental and control groups.

The results of total NePIQoL questionnaires, in 7 parts show no mean significant difference between participants' experimental group and control groups. Though participants symptoms, the effect of the symptom to the people around participants, effect of the symptom on participant's mind, social effects, effects on activities daily living, effects on health, also participant's overall health condition and quality of life. (See appendix)

Table 4.30 Comparison between Mean of NePIQoL between Experiment and Control Group, Total Score Question 1, Symptom

NePIQoL, symptoms (n=15), total score: question 1					
visit	group	mean± SD	T	df	p-value
v1_q11	experiment	8.80±5.40	-0.93	28.00	0.362
	control	10.47±4.39	-0.93	26.88	0.362
v2_q11	experiment	5.73±4.82	-0.22	28.00	0.828
	control	6.13±5.14	-0.22	27.88	0.828
v3_q11	experiment	2.67±3.33	-1.89	28.00	0.069
	control	5.40±4.50	-1.89	25.80	0.070
v4_q11	experiment	1.93±2.99	0.06	28.00	0.952
	control	1.87±3.00	0.06	28.00	0.952

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

From table 4.30 shows there is no significant means difference between experiment and control group for their symptom in every visits.

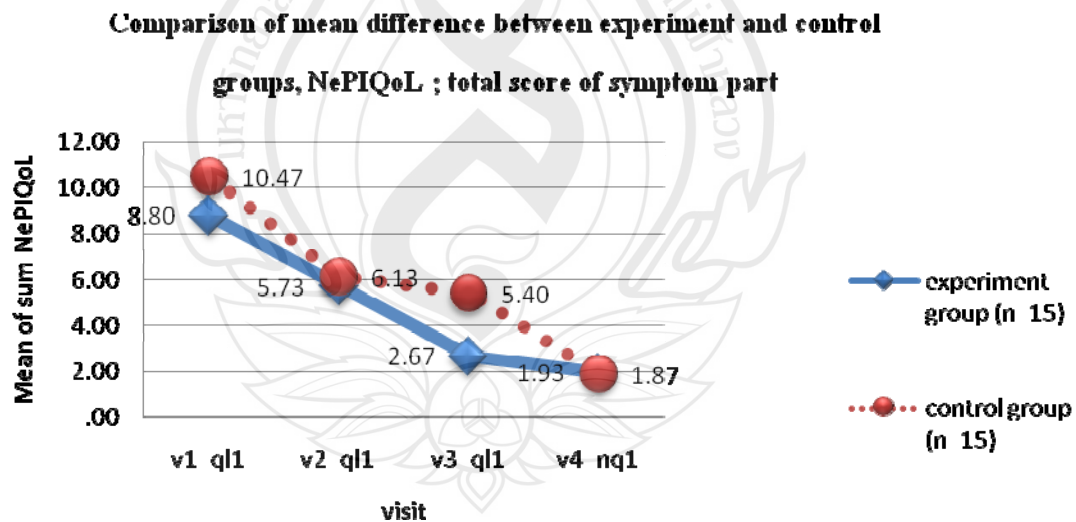


Figure 4.24 Comparison between Mean of NePIQoL between Experiment and Control Group, Total Score Question 1, Symptom

Figure 4.24 shows mean of total score NePIQoL, question 1 results. It's found that patients who receive ALA supplementation physical therapy has mean significant improvement in the third visit lower than control group ($\text{mean}_{\text{EV3_q1}} = 2.67 \pm 3.33$,

mean_Cv3_nq1=5.40±4.50, p-value≤0.001). But in fourth visit, mean significant differences of both groups are nearly equal (mean_Ev4_nq1 = 1.93±2.99, mean_C v4_nq1 = 1.87±3.00, p-value≤ 0.001). (See table 4.39-4.40)

Table 4.31 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Total Score, Question 1

NePIQoL, symptom: experimental group (n=15); total score, question 1							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q11	8.80±5.40	v2_q11	5.73±4.82	3.18	14	0.007**
2	v1_q11	8.80±5.40	v3_q11	2.67±3.33	4.37	14	0.001***
3	v1_q11	8.80±5.40	v4_q11	1.93±2.99	4.72	14	<0.001
4	v2_q11	5.73±4.82	v3_q11	2.67±3.33	2.88	14	0.012*
5	v2_q11	5.73±4.82	v4_q11	1.93±2.99	2.96	14	0.010**
6	v3_q11	2.67±3.33	v4_q11	1.93±2.99	0.75	14	0.466

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

Table 4.31 shows significant mean difference of NePIQoL, total score question 1 in experiment group. The significant improvement is found in the second visit, all p-value is less than 0.01. There are also significant improvements in the third and the fourth visits compared with first visit all p-value are less than 0.001.

Table 4.32 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group; Total Score, Question 1

NePIQoL, symptom: control group (n=15); total score, question 1							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q11	10.47±4.39	v2_q11	6.13±5.14	3.43	14	0.004**
2	v1_q11	10.47±4.39	v3_q11	5.40±4.50	4.46	14	0.001***
3	v1_q11	10.47±4.39	v4_q11	1.87±3.00	6.54	14	<0.001
4	v2_q11	6.13±5.14	v3_q11	5.40±4.50	0.74	14	0.47
5	v2_q11	6.13±5.14	v4_q11	1.87±3.00	2.94	14	0.011*
6	v3_q11	5.40±4.50	v4_q11	1.87±3.00	2.97	14	0.010**

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

Table 32 shows significant mean improvements of total question 1 in experiment group are in the second, third and fourth weeks after treatment program, p-value are less than 0.01.

Table 4.33 Comparison between Mean of NePIQol between Experiment and Control Group, Total Score Question 2, the Effect of the Symptom to the People Around Patients

NePIQoL, The effect of the symptom to the people around patients (n=15): question 2					
visit	group	mean± SD	t	df	p-value
v1_q12	experiment	7.67±4.79	0.30	28.00	0.770
	control	7.20±3.80	0.30	26.63	0.770
v2_q2	experiment	3.93±4.76	-0.81	28.00	0.424
	control	5.27±4.23	-0.81	27.63	0.424
v3_q12	experiment	3.07±3.51	-0.18	28.00	0.858
	control	3.33±4.51	-0.18	26.41	0.858
v4_q12	experiment	1.47±2.26	0.26	28.00	0.799
	control	1.27±1.98	0.26	27.52	0.799

Note. *p-value≤ 0.05.

Table 4.33 shows that there is no significant mean difference of total score NePIQoI, the effect of the symptom to the people around patients between experiment and control group, *p-value $\leq$ 0.05.

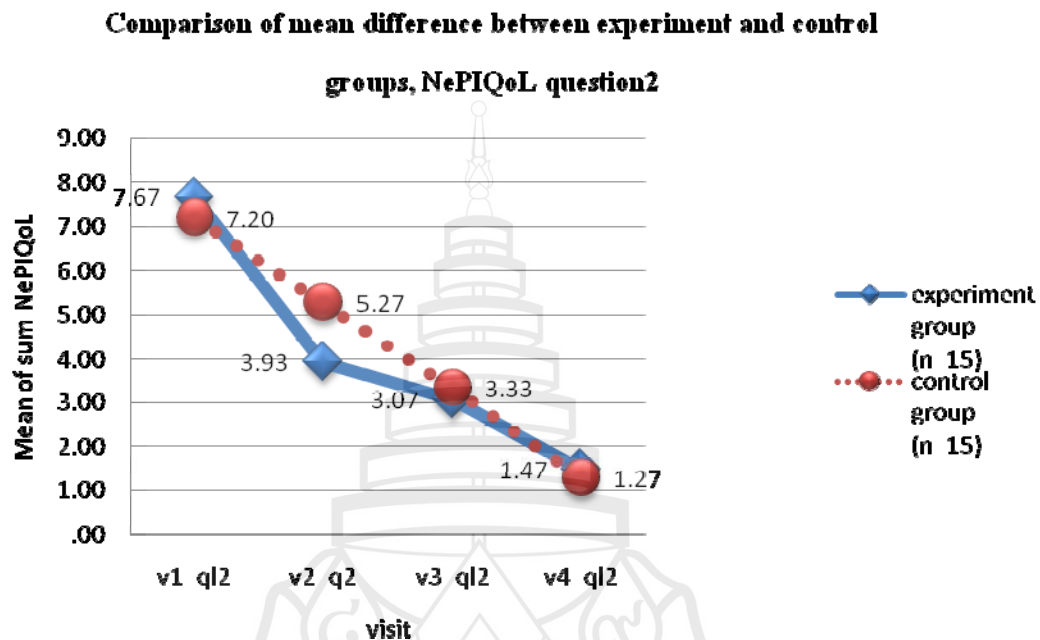


Figure 4.25 Comparisons between Mean of NePIQoI between Experiment and Control Group, Total Score Question 2

From figure 4.25 shows total mean score point. The effect of the symptom to the people around patients in experiment group has significantly better results in the second visit than control group, compared with first visit ($\text{mean}_{\text{EV2_ql1}} = 3.39 \pm 4.76$, p-value $\leq$ 0.01, $\text{mean}_{\text{C v2_ql1}} = 5.27 \pm 4.23$, p-value $\leq$ 0.05) . And being nearly equal in the third and fourth weeks, $\text{mean}_{\text{EV3_ql2}} = 3.07 \pm 3.51$, p-value $\leq$ 0.01, $\text{mean}_{\text{C v3_ql2}} = 3.33 \pm 4.51$, p-value $\leq$ 0.001, and $\text{mean}_{\text{EV4_ql2}} = 1.47 \pm 2.26$, p-value $\leq$ 0.001, $\text{mean}_{\text{C v4_ql2}} = 1.27 \pm 1.98$, p-value $\leq$ 0.001.

Table 4.34 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Total Score, Question 2

NePIQoL, The effect of the symptom to the people around patients: experimental group (n=15), question 2

pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q12	7.67±4.79	v2_q2	3.93±4.76	3.27	14	0.006**
2	v1_q12	7.67±4.79	v3_q12	3.07±3.51	3.03	14	0.009**
3	v1_q12	7.67±4.79	v4_q12	1.47±2.26	4.36	14	0.001***
4	v2_q12	3.93±4.76	v3_q12	3.07±3.51	0.7	14	0.497
5	v2_q12	3.93±4.76	v4_q12	1.47±2.26	1.86	14	0.083
6	v3_q12	3.07±3.51	v4_q12	1.47±2.26	2.51	14	0.025*

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

Table 4.34 shows that after 1 week of the experiment, the significant difference of the symptoms can be seen in the mean value, p-value≤ 0.01.

Table 4.35 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group; Total Score, Question 2

NePIQoL, The effect of the symptom to the people around patients: control group (n=15), question 2

pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q12	7.20±3.80	v2_q2	5.27±0.23	2.49	14	0.026*
2	v1_q12	7.20±3.80	v3_q12	1.27±1.98	4.85	14	0.000***
3	v1_q12	7.20±3.80	v4_q12	1.27±1.98	6.13	14	<0.001
4	v2_q12	5.27±0.23	v3_q12	1.27±1.98	3.33	14	0.005
5	v2_q12	5.27±0.23	v4_q12	1.27±1.98	3.43	14	0.004
6	v3_q12	3.33±4.51	v4_q12	1.27±1.98	1.78	14	0.097

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

Table 4.35 shows that there are mean significant differences effect of the symptom to the people around patients in control group after one week treatment program, compared with first visit, $p\text{-value} \leq 0.05$.

Table 4.36 Comparison between Mean of NePIQol between Experiment and Control Group, Total Score Question 3, the Effect of the Symptom on Patients' Mind

NePIQoL, effect of the symptom on patients' mind (n=15):question 3					
visit	group	Mean SD	t	df	p-value
v1_ql3	Experiment	14.87±6.77	-1.18	28.00	0.249
	Control	18.00±7.78	-1.18	27.47	0.250
v2_ql3	Experiment	12.47±5.42	-0.54	28.00	0.592
	control	13.93±8.97	-0.54	23.03	0.593
v3_ql3	experiment	8.60±5.88	-0.51	28.00	0.617
	control	10.00±8.95	-0.51	24.18	0.617
v4_ql3	experiment	5.27±6.81	-0.18	28.00	0.861
	control	5.73±7.63	-0.18	27.64	0.861

Note. * $p\text{-value} \leq 0.05$

From table 4.36, there is no significant mean difference of total score point question 3, NePIQol; the effect of the symptom on patients' mind between experiment and control group, $p\text{-value} \leq 0.05$.

Comparison of mean difference between experiment and control groups, NePIQoL question3

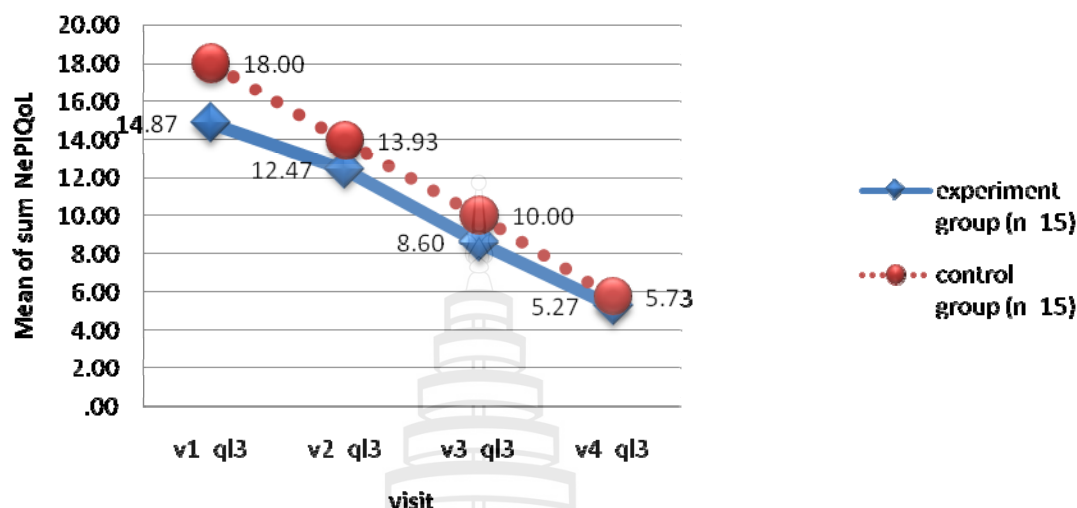


Figure 4.26 Comparisons between Mean of NePIQoL between Experiment and Control Group, Total Score Question 3 Shows that Both Groups had Mean Significant Decrease of Total Score Point Question 3, NePIQoL; the Effect of the Symptom on Patients' Mind in Experiment and Control Group Every Visit

Table 4.37 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Total Score, Question 3

**NePIQoL, effect of the symptom on patients' mind:
experimental group (n=15), question 3**

pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_ql3	14.87±6.77	v2_ql3	12.47±5.42	1.83	14	0.088
2	v1_ql3	14.87±6.77	v3_ql3	8.60±5.88	4.92	14	<0.001
3	v1_ql3	14.87±6.77	v4_ql3	5.27±6.81	4.7	14	<0.001
4	v2_ql3	12.47±5.42	v3_ql3	8.60±5.88	2.45	14	0.028*
5	v2_ql3	12.47±5.42	v4_ql3	5.27±6.81	3.78	14	0.002**
6	v3_ql3	8.60±5.88	v4_ql3	5.27±6.81	1.96	14	0.07

Note. *p-value ≤ 0.05, **p-value ≤ 0.01, ***p-value ≤ 0.001

From table 4.37, there are mean significant differences of the symptom on patients' mind in experiment group in the third visit after treatment program, compared with first visit, $p\text{-value} \leq 0.001$. The third and fourth Also are mean significant difference visit compared with the second visit, $p\text{-value} \leq 0.05$.

Table 4.38 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group; Total Score, Question 3

NePIQoL, effect of the symptom on patients' mind: control group (n=15), question 3

pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q13	18.00±7.78	v2_q13	13.93±8.98	2.51	14	0.025*
2	v1_q13	18.00±7.79	v3_q13	10.00±8.95	5.64	14	<0.001
3	v1_q13	18.00±7.80	v4_q13	5.73±7.63	5.31	14	<0.001
4	v2_q13	13.93±8.97	v3_q13	10.00±8.95	4.55	14	<0.001
5	v2_q13	13.93±8.98	v4_q13	5.73±7.63	4.19	14	0.001***
6	v3_q13	10.00±8.95	v4_q13	5.73±7.64	2.28	14	0.039*

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

From table 4.38 there were mean significant difference of the symptom on patients' mind in control group after one week treatment program, compared with first visit, $p\text{-value} \leq 0.05$.

Table 4.39 Comparisons between Mean of NePIQol between Experiment and Control Group, Total Score Question 4, Social Effect

NePIQoL, social effect (n=15): question 4					
visit	group	mean $\pm$ SD	t	df	p-value
v1_q4	experiment	14.73 $\pm$ 7.41	0.05	28.00	0.964
	control	14.60 $\pm$ 8.48	0.05	27.51	0.964
v2_q4	experiment	12.27 $\pm$ 5.06	0.45	28.00	0.657
	control	11.20 $\pm$ 7.70	0.45	24.20	0.658
v3_q4	experiment	8.27 $\pm$ 6.13	-0.24	28.00	0.815
	control	8.93 $\pm$ 9.05	-0.24	24.62	0.815
v4_q4	experiment	5.93 $\pm$ 6.11	0.59	28.00	0.561
	control	4.60 $\pm$ 6.31	0.59	27.97	0.561

Note. *p-value $\leq$ 0.05

From table 4.39, there was no significant mean difference of total score question 4, NePIQol; social effect between experiment and control group, *p-value $\leq$ 0.05.

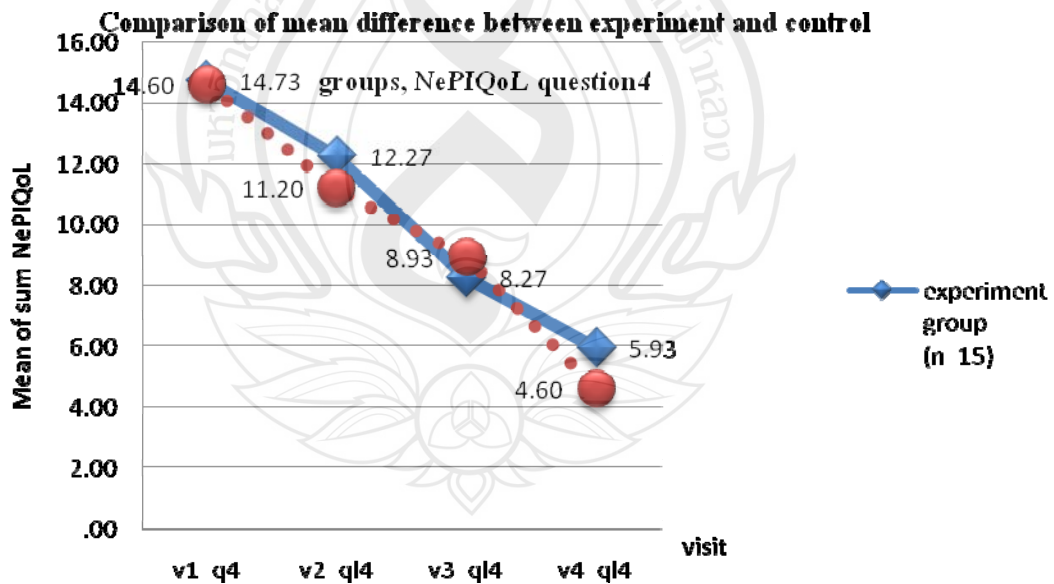


Figure 4.27 Comparisons between Mean of NePIQol between Experiment and Control Group, Total Score Question 4

From figure 4.27 shows total mean score of patient's social in control group has significant better than control group in the last week, $\text{mean}_{\text{Ev4_ql4}} = 5.93 \pm 6.11$, $\text{mean}_{\text{Cv4_ql4}} = 4.60 \pm 6.31$, $p\text{-value} \leq 0.001$.

Table 4.40 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Total Score, Question 4

NePIQoL, social effect: experimental group (n=15), question 4							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q4	14.73 $\pm$ 7.41	v2_q4	12.27 $\pm$ 5.06	2.03	14	0.062
2	v1_q4	14.73 $\pm$ 7.41	v3_q4	8.27 $\pm$ 6.13	4.49	14	0.001***
3	v1_q4	14.73 $\pm$ 7.41	v4_q4	5.93 $\pm$ 6.11	3.98	14	0.001***
4	v2_q4	12.27 $\pm$ 5.06	v3_q4	8.27 $\pm$ 6.13	3.13	14	0.007**
5	v2_q4	12.27 $\pm$ 5.06	v4_q4	5.93 $\pm$ 6.11	3.4	14	0.004**
6	v3_q4	8.27 $\pm$ 6.13	v4_q4	5.93 $\pm$ 6.11	1.7	14	0.111

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

From table 4.40 there are mean significant differences of social effects in experiment group after two weeks treatment program, compared with first visit, $p\text{-value} \leq 0.001$. The second visit also there is mean significant difference compared with third and fourth visit, $p\text{-value} \leq 0.01$.

Table 4.41 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group; Total Score, Question 4

NePIQoL, social effect: control group (n=15), question 4							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_ql4	14.60±8.48	v2_ql4	11.20±7.70	1.89	14	0.079
2	v1_ql4	14.60±8.48	v3_ql4	8.93±9.05	3.03	14	0.009**
3	v1_ql4	14.60±8.48	v4_ql4	4.60±6.31	4.67	14	<0.001
4	v2_ql4	11.20±7.70	v3_ql4	8.93±9.05	3.27	14	0.006***
5	v2_ql4	11.20±7.70	v4_ql4	4.60±6.31	5	14	<0.001
6	v3_ql4	8.93±9.05	v4_ql4	4.60±6.31	2.57	14	0.022**

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

From table 4.41 there is a mean significant difference of social effects in control group after two weeks treatment program, compared every visit pairs, p-value≤ 0.001.

Table 4.42 Comparisons between Mean of NePIQoL between Experiment and Control Group, Total Score Question 5, Effects on Activities Daily Living

NePIQoL, effects on activities daily living (n=15): question 5					
visit	group	mean ±SD	t	df	p-value
v1_ql5	Experiment	14.80±6.85	-1.20	28.00	0.242
	Control	17.87±7.20	-1.20	27.93	0.242
v2_ql5	Experiment	10.40±3.78	-0.82	28.00	0.418
	Control	12.20±7.60	-0.82	20.52	0.421
v3_ql5	Experiment	8.80±6.62	0.17	28.00	0.869
	Control	8.40±6.57	0.17	28.00	0.869
v4_ql5	Experiment	5.80±6.44	-0.24	28.00	0.809
	Control	6.40±7.03	-0.24	27.79	0.809

Note. *p-value≤ 0.05

From table 4.42, there is no significant mean difference of total score question 5, NePIQol; effects on activities daily living between experiment and control group, *p-value ≤ 0.05 .

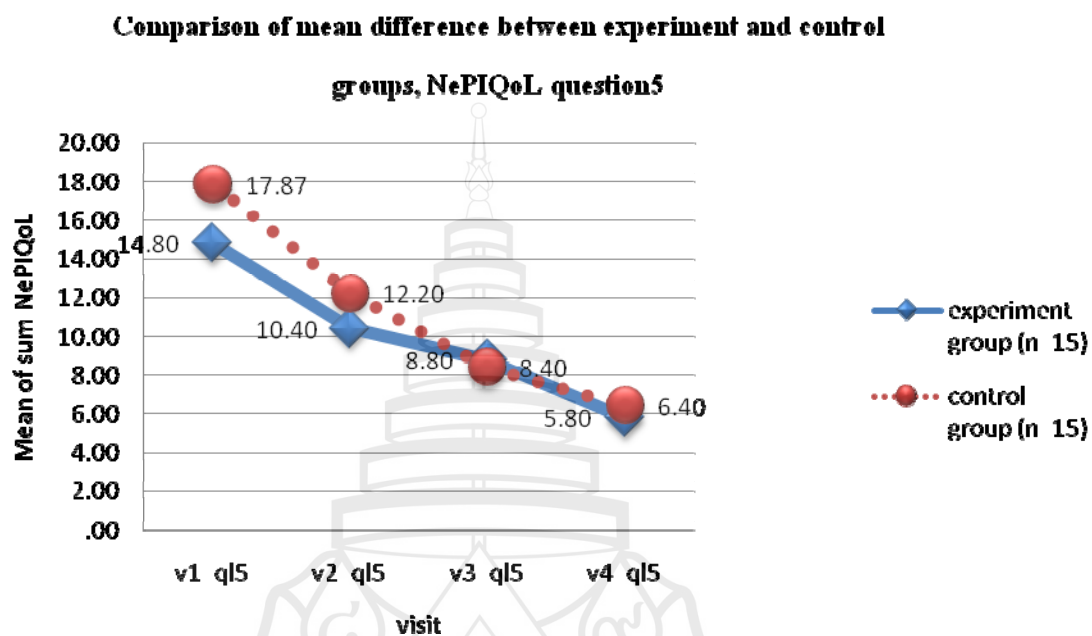


Figure 4.28 Comparisons between Mean of NePIQol between Experiment and Control Group, Total Score Question 5

From figure 4.28 show total score of effects on activities daily living in both groups also decrease in every visit. It is found that significant in second visits, p-value ≤ 0.01 .

Table 4.43 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Total Score, Question 5

NePIQoL, effects on activities daily living: experimental group (n=15), question 5							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q15	14.80±6.85	v2_q15	10.40±3.78	3.49	14	0.004**
2	v1_q15	14.80±6.85	v3_q15	8.80±6.62	3.74	14	0.002**
3	v1_q15	14.80±6.85	v4_q15	5.80±6.44	4.45	14	0.001***
4	v2_q15	10.40±3.78	v3_q15	5.80±6.44	1.18	14	0.256
5	v2_q15	10.40±3.78	v4_q15	8.80±6.62	2.93	14	0.011*
6	v3_q15	8.80±6.62	v4_q15	5.80±6.44	1.55	14	0.143

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

From table 4.43 there were mean significant difference question 5, effects on activities daily living in experimental group after one week treatment program, compared with first visit, p-value≤ 0.01.

Table 4.44 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group; Total Score, Question 5

NePIQoL, effects on activities daily living: control group (n=15), question 5							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q15	17.87±7.20	v2_q15	12.20±7.60	3.26	14	0.006**
2	v1_q15	17.87±7.20	v3_q15	8.40±6.57	6.15	14	<0.001
3	v1_q15	17.87±7.20	v4_q15	6.40±7.03	5.98	14	<0.001
4	v2_q15	12.20±7.60	v3_q15	8.40±6.57	4.4	14	0.001***
5	v2_q15	12.20±7.60	v4_q15	6.40±7.03	4.46	14	0.001***
6	v3_q15	8.40±6.57	v4_q15	6.40±7.03	1.78	14	0.096

Note. *p-value≤ 0.05, **p-value≤ 0.01, ***p-value≤ 0.001

From table 4.44 there are mean significant difference effects on activities daily living in control group after one week treatment program, compared with first and second visit, p-value≤ 0.01.

Table 4.45 Comparisons between Mean of NePIQol between Experiment and Control Group, Total Score Question 6, Effects on Health

NePIQoL, effects on health (n=15): question 6					
visit	group	mean $\pm$ SD	t	df	p-value
v1_ql6	Experiment	3.33 $\pm$ 3.52	-0.29	28.00	0.772
	Control	3.73 $\pm$ 3.97	-0.29	27.60	0.773
v2_ql6	Experiment	2.40 $\pm$ 2.32	-1.17	28.00	0.251
	Control	3.87 $\pm$ 4.26	-1.17	21.66	0.254
v3_ql6	Experiment	1.47 $\pm$ 1.77	-1.06	28.00	0.296
	Control	2.47 $\pm$ 3.18	-1.06	21.89	0.299
v4_ql6	Experiment	0.93 $\pm$ 1.91	-1.11	28.00	0.278
	Control	2.00 $\pm$ 3.21	-1.11	22.80	0.280

Note. *p-value $\leq$ 0.05

From table 4.45, there is no significant mean difference of total score question 6, NePIQol; effects on health between experiment and control group, *p-value $\leq$ 0.05.

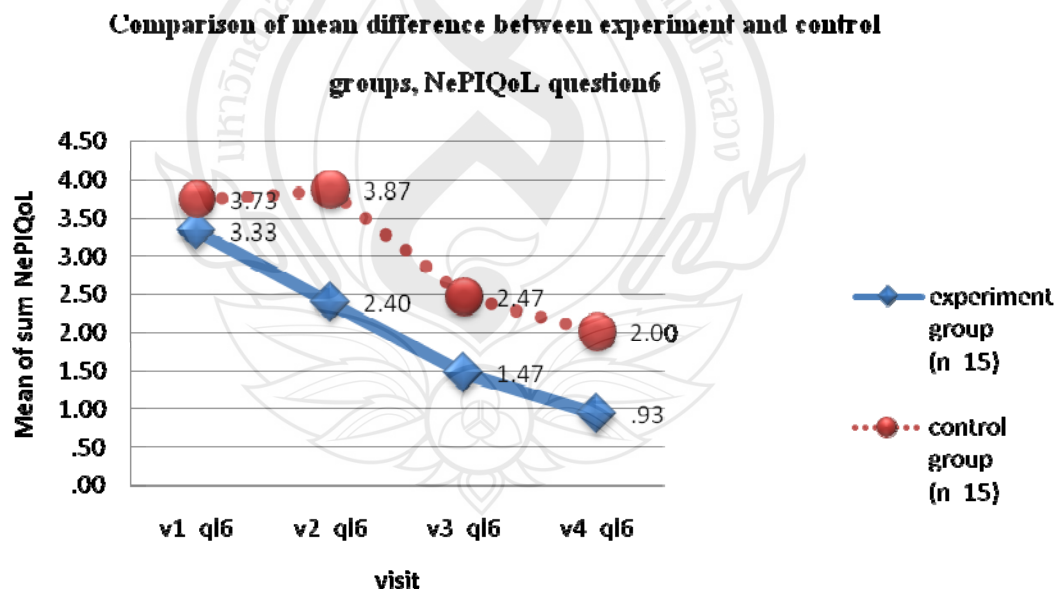


Figure 4.29 Comparisons between Mean of NePIQol between Experiment and Control Group, Total Score Question 6

This graph shows quality of life in part of effect on their health. Its result also shows significant improvement of the experiment group in the last week (0.93 ± 1.91 , $p\text{-value} \leq 0.05$). But the significant improvement has not seen in control group.

Table 4.46 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Total Score, Question 6

NePIQoL, effects on health: experimental group (n=15), question 6							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_ql6	3.33 $\pm$ 3.52	v2_ql6	2.40 $\pm$ 2.32	1.05	14	0.31
2	v1_ql6	3.33 $\pm$ 3.52	v3_ql6	1.47 $\pm$ 1.77	1.87	14	0.083
3	v1_ql6	3.33 $\pm$ 3.52	v4_ql6	0.93 $\pm$ 1.91	2.69	14	0.018*
4	v2_ql6	2.40 $\pm$ 2.32	v3_ql6	1.47 $\pm$ 1.77	1.61	14	0.131
5	v2_ql6	2.40 $\pm$ 2.32	v4_ql6	0.93 $\pm$ 1.91	2.3	14	0.038*
6	v3_ql6	1.47 $\pm$ 1.77	v4_ql6	0.93 $\pm$ 1.91	0.72	14	0.481

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

From table 4.46 there is mean significant difference of effect on patient's health in experiment group in the last week of treatment program compared with first and second visit, $p\text{-value} \leq 0.05$.

Table 4.47 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group; Total Score, Question 6

NePIQoL, effects on health: control group (n=15), question 6							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_ql6	3.73 $\pm$ 3.97	v2_ql6	3.87 $\pm$ 4.26	-0.29	14	0.774
2	v1_ql6	3.73 $\pm$ 3.97	v3_ql6	2.47 $\pm$ 3.18	1.97	14	0.069
3	v1_ql6	3.73 $\pm$ 3.97	v4_ql6	2.00 $\pm$ 3.21	1.68	14	0.115
4	v2_ql6	3.87 $\pm$ 4.26	v3_ql6	2.47 $\pm$ 3.18	2.47	14	0.027*
5	v2_ql6	3.87 $\pm$ 4.26	v4_ql6	2.00 $\pm$ 3.21	2.08	14	0.057
6	v3_ql6	2.47 $\pm$ 3.18	v4_ql6	2.00 $\pm$ 3.21	0.72	14	0.482

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

From table 4.47 there is no mean significant difference of effect on patient's health in control group after treatment program compared with first visit, $p\text{-value} \leq 0.05$. But there was mean significant difference of second visit compared with third visit, $p\text{-value} \leq 0.05$

Table 4.48 Comparisons between Mean of NePIQoL between Experiment and Control Group, Question 7.1, Overall Health

NePIQoL, overall health (n=15): question 7.1					
visit	group	mean $\pm$ SD	t	df	p-value
v1_q17.1	Experiment	5.33 $\pm$ 1.59	2.03	28.00	0.052
	Control	3.93 $\pm$ 2.15	2.03	25.76	0.053
v2_q17.1	Experiment	6.87 $\pm$ 1.06	0.38	28.00	0.704
	Control	6.67 $\pm$ 1.72	0.38	23.31	0.705
v3_q17.1	experiment	7.33 $\pm$ 1.76	-0.20	28.00	0.839
	Control	7.47 $\pm$ 1.81	-0.20	27.98	0.839
v4_q17.1	experiment	8.13 $\pm$ 1.60	0.00	28.00	1.000
	Control	8.13 $\pm$ 1.41	0.00	27.56	1.000

Note. * $p\text{-value} \leq 0.05$

From table 4.48, there is no significant mean difference of NePIQoL, question 7.1; overall health between experiment and control group, * $p\text{-value} \leq 0.05$.

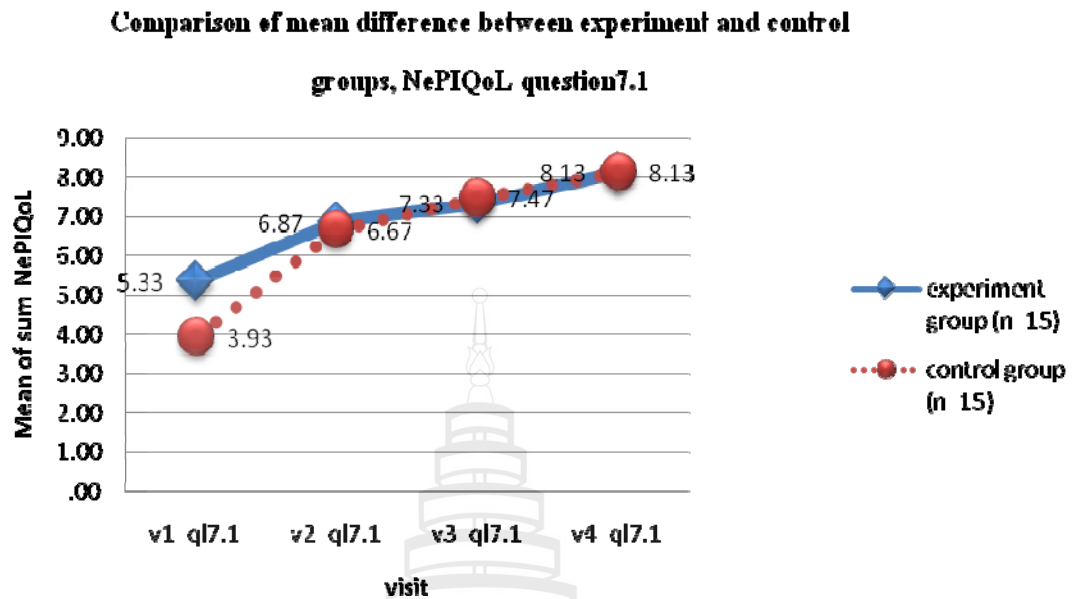


Figure 4.30 Comparisons between Mean of NePIQoL between Experiment and Control Group, Question 7.1

Figure 4.30 shows the overall patient's health there are significant mean better in every weeks in both experiment and control groups, $p\text{-value} \leq 0.001$. (See table 4.47 and 4.48)

Table 4.49 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Question 7.1

NePIQoL, overall health: experimental group (n=15), question 7.1							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_ql7.1	5.33±1.59	v2_ql7.1	6.87±1.06	-5.6	14	<0.001
2	v1_ql7.1	5.33±1.59	v3_ql7.1	7.33±1.76	-4.27	14	0.001***
3	v1_ql7.1	5.33±1.59	v4_ql7.1	8.13±1.60	-4.09	14	0.001***
4	v2_ql7.1	6.87±1.06	v3_ql7.1	7.33±1.76	-1.24	14	0.235
5	v2_ql7.1	6.87±1.06	v4_ql7.1	8.13±1.60	-2.18	14	0.047
6	v3_ql7.1	7.33±1.76	v4_ql7.1	8.13±1.60	-1.26	14	0.228

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

From table 4.49, there is mean significant difference of effects of the symptom to the people around patients in experimental group after one week treatment program, $p\text{-value} \leq 0.01$. And there was mean significant difference of total score, third visit compared with fourth visit, $p\text{-value} \leq 0.05$

Table 4.50 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Question 7.1

NePIQoL, overall health: control group (n=15), question 7.1							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean	visit	mean	t	df	
1	v1_q17.1	3.93±2.15	v2_q17.1	6.67±1.72	-4.7	14	<0.001
2	v1_q17.1	3.93±2.15	v3_q17.1	7.47±1.81	-6.05	14	<0.001
3	v1_q17.1	3.93±2.15	v4_q17.1	8.13±1.41	-8.57	14	<0.001
4	v2_q17.1	6.67±1.72	v3_q17.1	7.47±1.81	-2.04	14	0.061
5	v2_q17.1	6.67±1.72	v4_q17.1	8.13±1.41	-4.56	14	<0.001
6	v3_q17.1	7.47±1.81	v4_q17.1	8.13±1.41	-2.87	14	0.012**

Note. * $p\text{-value} \leq 0.05$, ** $p\text{-value} \leq 0.01$, *** $p\text{-value} \leq 0.001$

From table 4.50 there is mean significant difference improved of overall patients health after treatment program, $p\text{-value} \leq 0.001$.

Table 4.51 Comparisons between Mean of NePIQol between Experiment and Control Group, Question 7.2, Quality of Life

NePIQoL, quality of life (n=15):question 7.2					
visit	group	mean± SD	t	df	p-value
v1_q17.2	experiment	6.33±1.29	0.33	28.00	0.747
	Control	6.13±2.00	0.33	23.97	0.747
v2_q17.2	experiment	7.53±1.25	0.00	28.00	1.000
	Control	7.53±1.25	0.00	28.00	1.000
v3_q17.2	experiment	8.27±1.10	0.00	28.00	1.000
	Control	8.27±1.03	0.00	27.89	1.000
v4_q17.2	experiment	9.00±0.85	0.22	28.00	0.826
	Control	8.93±0.80	0.22	27.91	0.826

Note. *p-value≤ 0.05

From table 4.51, there was is significant mean difference of total score NePIQol, question 7.2; quality of life between experiment and control group.

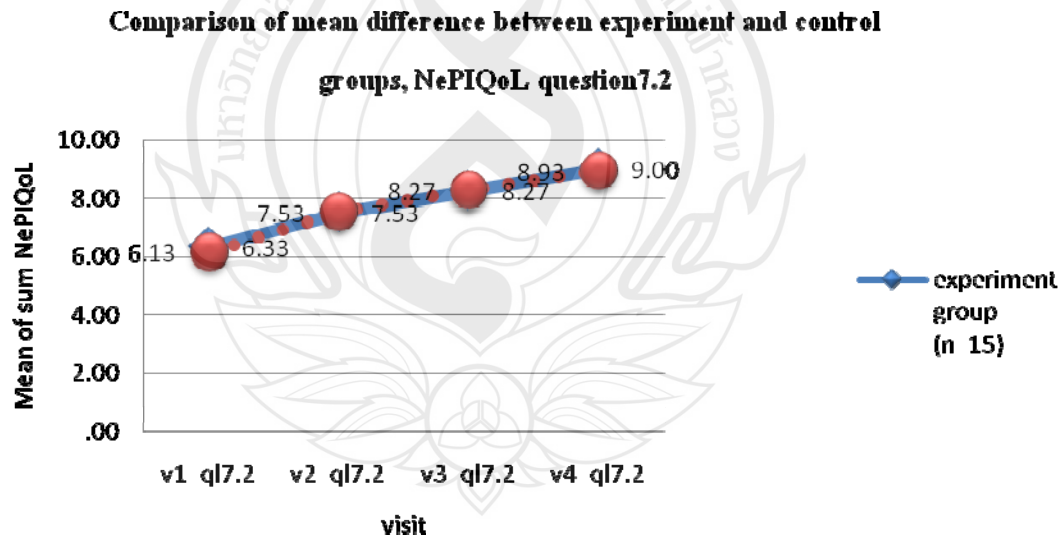


Figure 4.31 Comparisons between Mean of NePIQol between Experiment and Control Group Question 7.2

From figure 4.31 show overall quality of life there are significant mean better in every weeks in both experiment and control groups, p-value≤ 0.01(see table 4.50 and 4.51)

Table 4.52 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Experiment Group; Total Score, Question 7.2

NePIQoL, quality of life: experimental group (n=15), question 7.2							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean $\pm$ SD	visit	mean $\pm$ SD	t	df	
1	v1_ql7.2	6.33 $\pm$ 1.29	v2_ql7.2	7.53 $\pm$ 1.25	-3.85	14	0.002**
2	v1_ql7.2	6.33 $\pm$ 1.29	v3_ql7.2	8.27 $\pm$ 1.10	-5.61	14	<0.001
3	v1_ql7.2	6.33 $\pm$ 1.29	v4_ql7.2	9.00 $\pm$ 0.85	-6.69	14	<0.001
4	v2_ql7.2	7.53 $\pm$ 1.25	v3_ql7.2	8.27 $\pm$ 1.10	-2.75	14	0.016*
5	v2_ql7.2	7.53 $\pm$ 1.25	v4_ql7.2	9.00 $\pm$ 0.85	-5.74	14	<0.001
6	v3_ql7.2	8.27 $\pm$ 1.10	v4_ql7.2	9.00 $\pm$ 0.85	-3.21	14	0.006**

Note. *p-value $\leq$ 0.05, **p-value $\leq$ 0.01, ***p-value $\leq$ 0.001

From table 4.52, there is mean significant differences improved of overall patient's quality of life after treatment program, p-value $\leq$ 0.01.

Table 4.53 Comparisons of MNPS's Mean Difference Before and After the Treatment, 1st, 2nd, 3rd, 4th Visits. Control Group; Total Score, Question 7.2

NePIQoL, quality of life: control group (n=15), question 7.2							
pair	first parameter		second parameter		mean sig. difference		p-value
	visit	mean $\pm$ SD	visit	mean $\pm$ SD	t	df	
1	v1_q17.2	6.13 $\pm$ 2.00	v2_q17.2	7.53 $\pm$ 1.25	-3.61	14	0.003**
2	v1_q17.2	6.13 $\pm$ 2.00	v3_q17.2	8.27 $\pm$ 1.03	-4.14	14	0.001***
3	v1_q17.2	6.13 $\pm$ 2.00	v4_q17.2	8.93 $\pm$ 0.80	-5.06	14	<0.001
4	v2_q17.2	7.53 $\pm$ 1.25	v3_q17.2	8.27 $\pm$ 1.03	-2.58	14	0.022*
5	v2_q17.2	7.53 $\pm$ 1.25	v4_q17.2	8.93 $\pm$ 0.80	-4.84	14	<0.001
6	v3_q17.2	8.27 $\pm$ 1.03	v4_q17.2	8.93 $\pm$ 0.80	-3.57	14	0.003**

Note. *p-value $\leq$ 0.05, **p-value $\leq$ 0.01, ***p-value $\leq$ 0.001

From table 4.53 there are mean significant differences improved of overall patient's quality of life after treatment program, p-value $\leq$ 0.01.

CHAPTER 5

CONCLUSION, DISCUSSION AND COMMENT

5.1 Discussion

Even though the results show no significant difference of the mean values of the modified NPS and modified NePIQol score between patients with sciatic neuropathic pain caused by back problems who received 600 mg oral ALA supplementation physical therapy and patients who received physical therapy alone. There are significant improvements of the mean value of modified NPS and modified NePIQol score after treatment in many parts.

The modified NPS score in part of total pain scale, sharp pain and intense deep pain characteristic of patients who received 600 mg oral ALA supplementation physical therapy has significantly improved mean from the first week earlier than patients who received physical therapy alone (Pain scale mean 4.06 ± 1.9 , $p\text{-value} \leq 0.001$, Sharp pain mean 2.47 ± 2.10 , $p\text{-value} \leq 0.05$, intense deep pain 4.40 ± 2.03 , $p\text{-value} \leq 0.001$). Same as previous studied (Ziegler et al., 2006), oral ALA treatment in diabetic peripheral neuropathy (DNP), their results found a significant reduction of Neuropathy Symptoms and Change score (NSC) and Total Symptom score (TSS) and its sub scores for stabbing/lancinating was observed in all active arms compared with the placebo arm (all $P \leq 0.05$) but no significant differences among the three ALA groups, 600, 1200 and 1800 mg and the placebo group were noted for paresthesia and numbness. In part of burning pain, intense surface pain from this study, the significant different is not found that is contrast from the previous studied.

Previous review, ALA treatment for neuropathic pain in DNP (Mijnhout et al., 2010), they found 4 RCTs had a significant improve, an oral or intra venous ALA dose at list 600 mg per day resulted in 50% reduction in TSS but in most group was less than 30%. In their discussion, the improvements of oral ALA were much less clearly described. So they did not recommend the use of oral ALA for the treatment of diabetic neuropathy. Dissimilarly, from this study more than 60% reduction in the last week are found such as pain scale reduction is 55.30% in the 3rd and 66.36 % in the last week, sharp pain reduction is 50% in the 3rd and 60.61% in the last week, intense deep pain reduction is 52.81% and 66.38%.

Anyway in this study, all of parameters of the modified NPS score and NePIQol score have significant improved from the first visit, except NPS; burning sensation, intense surface pain.

Noticeably, oral ALA 600 mg supplementation in the treatment of physical therapy can earlier decrease neuropathic pain symptom; sharp pain, and intense deep pain and also improve quality of life in sciatic neuropathic pain which is approximately two or three weeks earlier than the control group who experienced the improvement in the last

week. The mechanism may because its antioxidant effect (Catherine, 2010; Packer et al., 1995; Packer et al., 2001). After peripheral nerve damage, inflammatory responded occur (Bouhassira et al., 2005; Helms & Barone, 2008; Dworkin et al., 2003). That lead to oxidative stress. ALA may help in that part so the patient's pain will decrease faster in the second or third week compared with placebo control.

DNP patients, an oxidative stress is an important damage mechanism (Stevens, Obrosova, Cao, Van Huysen & Greene, 2000). So ALA, its antioxidant effect, may help DPN more clearly than neuropathy comes from back problems in the long period of treatment, like studied of Ziegler et al. (2006).

However ALA supplementation on physical therapy treatment is much value to the patients who suffer from neuropathic pain. Its earlier reduction pain effect can help them happier from problem that they face. Future studied should be continuing.

5.2 Conclusions

From the study the results are found that there are significant mean difference of NPS score in part of total pain, sharp pain and intense deep pain after ALA supplementation in the treatment of physiotherapy treatment approximately one earlier than control group which experience physiotherapy alone. Also NePIQol score in part of their pain effect on health. Confirm ALA and its antioxidant effect on peripheral neuropathic pain.

5.3 Comment

This study is the first study of peripheral neuropathy come from back problems, sciatic nerve neuropathy. More studies shall be conducted in order to prove and strengthen the results and findings from this study.

Future studies, should take more period of treatment program than 4 weeks and more populations. In long time period of using ALA and more populations, the study may find some more interesting and clear results. But for oral ALA dosing, more dose should be careful from previous study (Ziegler et al., 2006). Overdosing can make participants have nausea and vomiting.



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APPENDICES

APPENDIX A

CONSENT FORM



Consent from

Date.....

I (Mr./Mrs./Ms.).....years old, from
(address).....

(Contact number.....e-mail.....)

I would like to complete this form as an evidence of research participation and the following conditions;

1. By signing this document, I consent to the process of this research (The Efficacy of Oral Alpha-Lipoic Acid for Physiotherapy Supplementation in the Treatment of Sciatic Neuropathic Pain) which is to be performed on myself, the used of medication for the purpose of this research.

2. I fully understand this research, its methods and process, its safety, symptoms and dangers that results from this research and its use of medications and the benefits from participating it.

3. I am aware that my information provided in this document is to be kept confidential. The information can only be presented as statistic for the purpose of this research and study to third party.

4. Should I have doubts about the process of this research or irregular symptoms which are likely to be caused by this research, I must contact Miss Aree Jaroenchaichana, Master of sciences program in anti-aging and regenerative science, Mae Fah Luang Hospital, Bangkok. Tel.089-665-0893.

5. I am fully aware that I have rights to terminate my participation in this research at any stage in this research, without any effect to physical therapy that I should be.

6. I have read this document and fully understand all details and conditions contained in every part of this document before signing this document.

Name..... Participant Date.....
(.....)

Name..... Researcher Date.....
(.....)

Name..... Witness Date.....
(.....)

Name..... Witness Date.....
(.....)





หนังสือยินยอมในการเป็นผู้เข้าร่วมงานวิจัย (Consent from)

วันที่.....เดือน.....พ.ศ.....

ข้าพเจ้า (นาย/นาง/นางสาว).....อายุ.....ปี

อยู่บ้านเลขที่ หมู่ที่.....ซอย.....ถนน.....

แขวง/ตำบล.....เขต/อำเภอ.....

จังหวัด.....

เบอร์โทรศัพท์.....E-mail.....

ขอทำหนังสือแสดงความยินยอมเข้าร่วมโครงการวิจัยเพื่อเป็นหลักฐานแสดงว่า

1. ข้าพเจ้ายินยอมเข้าร่วมโครงการวิจัยของ นางสาวอารีย์ เจริญชัยชนะ (ผู้วิจัย) เรื่อง ศึกษาประสิทธิภาพของ อัลฟาไลโปอิกแอซิด สำหรับการเสริมกับการรักษาทางกายภาพบำบัดในผู้ที่อาการทางเส้นประสาทไขอาติก (The Efficacy of Oral Alpha-Lipoic Acid for Physiotherapy Supplementation in the Treatment of Sciatic Neuropathic Pain) ด้วยความสมัครใจและพร้อมให้ความร่วมมือในการวิจัยนี้

2. ข้าพเจ้าได้รับการอธิบายและตอบข้อสงสัยจากผู้วิจัยเกี่ยวกับวัตถุประสงค์การวิจัย วิธีการวิจัย ความปลอดภัย อาการหรืออันตรายที่อาจเกิดขึ้นจากงานวิจัย รวมทั้งประโยชน์ที่จะได้รับจากการวิจัยโดยละเอียดแล้ว ตามเอกสารชี้แจงผู้เข้าร่วมงานวิจัยแนบท้าย

3. ข้าพเจ้าได้รับการรับรองจากผู้วิจัยว่าจะเก็บข้อมูลส่วนตัวของข้าพเจ้าเป็นความลับ จะเปิดเผยได้เฉพาะในรูปแบบของการสรุปผลการวิจัยเท่านั้น

4. หากข้าพเจ้ามีข้อข้องใจเกี่ยวกับขั้นตอนของการวิจัย หรือหากเกิดผลข้างเคียงที่ไม่พึงประสงค์จากการวิจัยกับข้าพเจ้า ข้าพเจ้าจะสามารถติดต่อกับ นางสาวอารีย์ เจริญชัยชนะ สำนักวิชาเวชศาสตร์ชะลอวัยและฟื้นฟูสุขภาพ โรงพยาบาลแม่ฟ้าหลวง กรุงเทพมหานคร โทรศัพท์ 089-665-0893

5. ข้าพเจ้าได้รับทราบว่าข้าพเจ้ามีสิทธิ์ที่จะถอนตัวออกจากการวิจัยครั้งนี้เมื่อไรก็ได้โดยไม่มีผลกระทบใดๆ ต่อการรักษาทางกายภาพบำบัดตามสิทธิ์ที่ข้าพเจ้าควรได้รับ

ข้าพเจ้าได้อ่านและเข้าใจข้อความตามหนังสือนี้แล้ว จึงได้ลงลายมือชื่อไว้เป็นสำคัญ พร้อม
กับผู้วิจัยและพยาน

ลงชื่อ.....ผู้ยินยอม/ ผู้เข้าร่วมงานวิจัย วันที่.....

(.....)

ลงชื่อ.....ผู้วิจัย วันที่.....

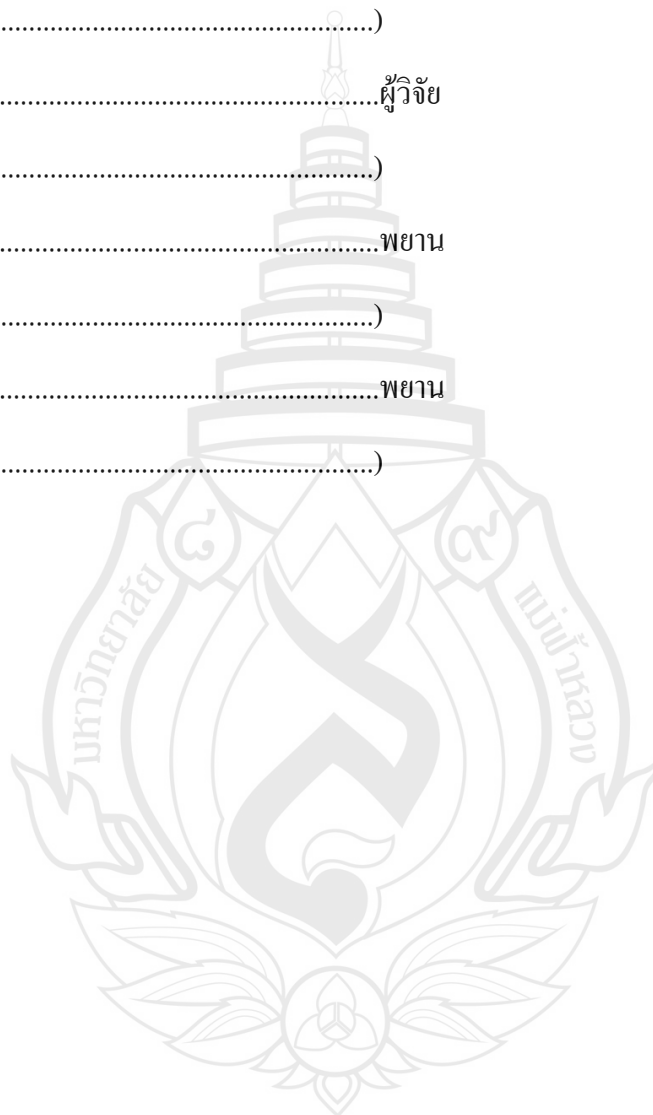
(.....)

ลงชื่อ.....พยาน วันที่.....

(.....)

ลงชื่อ.....พยาน วันที่.....

(.....)



Participant Information Sheet

Should you have any questions in any part of this document, please notify the researcher to ensure your understanding of the details and conditions in this document. You may be provided with a copy of this document to bring it home to discuss with your friends and family, should you require.

Research name The Efficacy of Oral Alpha-Lipoic Acid for Physiotherapy Supplementation in the Treatment of Sciatic Neuropathic Pain.
Researcher Aree Jaroenchaichana
Location PK physical therapy clinic and Mae Fah Luang Hospital
Office 78, 80, PK physical therapy clinic, Boromrachchachonnane 53, Boromrachchachonnane road, Taling chan, Bangkok. Tel. 028809445, 0896650893
Research duration 4 weeks
Objective and history of the research

Aree Jaroenchaichana and Mae Fah Luang University Bangkok are going to study neuropathic pain syndrome. It is the result of nervous system from chronic noxious stimuli and comes from central or peripheral nerve or both. After primary problems such as back pain, and another musculoskeletal problems, it could lead to neuropathic pain

One of the major health problems among workers is musculoskeletal disorders such as lower back pain (LBP), joint and muscle problems. This problem affects quality of life, physical and psychosocial activities, performance at work and everyday-life activities. Although, neuropathic pain is the most common symptom found in patient with nervous system. Sciatic nerve is responsible for sensory impulse of lower extremity, back to spinal cord and perceived to brain. It is the mainly affected nerve in neuropathic pain.

Pain is the first symptom that brings patients to seek help from doctor or therapist or even Thai masseurs. An analgesic, anti-inflammatory drug, NSAIDs, COX-2 inhibiting are main choices for pain management. On the other hand, physiotherapy or alternative treatments are less popular because the use of drugs produces good results in acute pain in patients, but for chronic pain, patients have to consider carefully between benefit versus the side effects such as irritating stomach, hepatitis and heart problems. Estimation of the prevalence in neuropathic pain patients are not precise enough, however chronic neuropathic pain may be much more common than has generally been expected

Alpha-lipoic acid (ALA) has become a common ingredient in multivitamin formulas, anti-aging supplements. There are only little side effects such as nausea and vomiting if highly does used. Alpha-lipoic acid improve peripheral neurological problems in diabetic patients is well known. There are studies of the neuropathic pain related to musculoskeletal problems, sciatic neuropathic pain. Neuropathic pain mechanism is still a mystery to us though there have been several attempts to clarify it. Is it anti-oxidant mechanism role that protect peripheral nerve cell from secondary damage that intern helps relive neuropathic pain?

This aim of study is the efficacy of alpha-lipoic acid and physiotherapy in the treatment of sciatic neuropathic pain in musculoskeletal problems. Does alpha-lipoic improve neuropathic pain and quality of life regarding musculoskeletal problems?

The participant who get in this study will be treat for free in PK physical therapy clinic and Mae Fah Luang Hospital

If I agree to participate in the research, the following will happen;

1. I will go through selection process and will continue to further process should I am eligible to participate.
2. I will provide my information in participant information form and will undertake a check up by the researcher.
3. I will be given medication set A or B according to the result of random selection process.
4. I will be provided with the information on the medication intake which is twice a day, one after breakfast and another after supper for 4 weeks.
5. I am not to take any other supplements which have effect on nerve such as vitamin B for 4 weeks while I am participating in the research.
6. I must participate in physiotherapist session, checkups and fill out questionnaires once per week for 4 weeks.
7. During the participation in this research, I will be discussing my symptoms of neuropathic pain which had effect on whether or not the next session of the research will take place.

Risks and symptoms

Should there be any side effect from the use of drug set A or B such as vomiting, the researcher shall be notified immediately by contacting Aree Jaroenchaichana 089-6650893

Benefit

I will receive the results from the appointed checkups.

Alternative

I was given the right to reject any checkups and drop out. I can also consult the doctor in orthopedics field should I require, which will have no effect in the future physiotherapy.

Should I fail to follow the requirement of the research as a participant such as failing to take Alpha-lipoic acid, the researcher have right to deny my part in this research without providing me any explanation of the termination.

Question

I was given the explanation, scopes and purpose of the research. I have clarified my doubts with the researchers about the topic of the research and am now fully understand all aspects of the participation in the research. Should I have questions regarding this research, I am to contact Aree Jaroenchaichana 089-6650893, E-mail: pu__aree@yahoo.com

Confidentiality

My personal details and information provided to this study shall be kept confidential. They shall be used only for the purpose of this research. The information shall not to be published in any form of media. My information provided shall be protected by law. The direct access to the information is permitted to the people listed in the previous paragraph of this document.

Should any terms and conditions given in this document is bridged by any party, I shall contact the ethic committee, anti-aging and regenerative science, Mae Fah Luang University. Telephone 02-6642295-6

Consent

The decision to participate in this research is made by me. I am willing to be part of the research for the benefit of the study and myself. Should I decide to end my part in this research, I am eligible to do so regardless of time or day. The termination of my participation shall not affect my treatment in the present day or in the future. My signature below represents my decision to participate as subject in this research

Name..... (Participant) Date.....

(.....)

Name..... Researcher Date.....

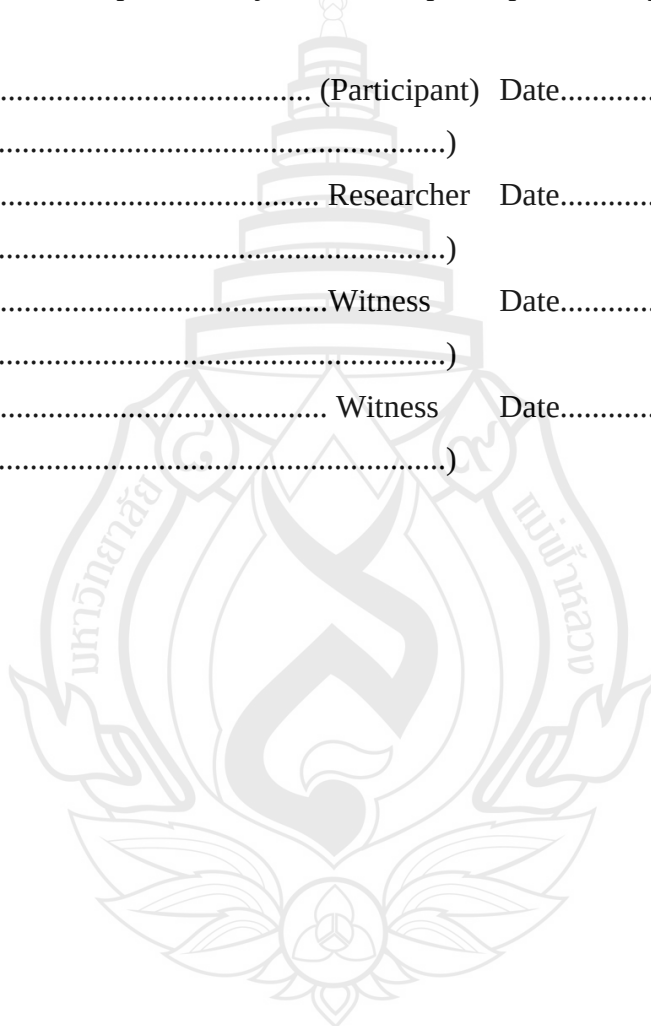
(.....)

Name..... Witness Date.....

(.....)

Name..... Witness Date.....

(.....)



เอกสารแจ้งผู้เข้าร่วมวิจัย
(Participant Information Sheet)

ในเอกสารนี้อาจมีข้อความที่ท่านอ่านแล้วไม่เข้าใจ โปรดสอบถามผู้วิจัยให้ช่วยอธิบาย จนกว่าจะเข้าใจดี ท่านอาจจะขอเอกสารนี้กลับไปอ่านที่บ้านเพื่อปรึกษาหารือกับญาติพี่น้อง เพื่อนสนิท แพทย์ประจำตัวของท่านหรือแพทย์ท่านอื่น เพื่อช่วยในการตัดสินใจเข้าร่วมการวิจัย

ชื่อโครงการ ศึกษาประสิทธิภาพของอัลฟาไลโปอิกแอซิดสำหรับการเสริมกับการรักษาทางกายภาพบำบัดในผู้ที่อาการทางเส้นประสาทไขอาติก (The Efficacy of Oral Alpha-Lipoic Acid for Physiotherapy Supplementation in the Treatment of Sciatic Neuropathic Pain.)

ชื่อผู้วิจัย นางสาวอารีย์ เจริญชัยชนะ

สถานที่วิจัย พิเศษคลินิกกายภาพบำบัด

สถานที่ทำงาน 78, 80 พิเศษคลินิกกายภาพบำบัด, ซ.บรมราชชนนี 53, ถ.บรมราชชนนี, ดลิ่งชัน
กทม. โทรศัพท์ 028809445, 0896650893

ระยะเวลาในการวิจัย 4 สัปดาห์

จุดประสงค์และภูมิหลัง

นางสาวอารีย์ เจริญชัยชนะและโรงพยาบาลมหาวิทยาลัยแม่ฟ้าหลวง กรุงเทพมหานคร กำลังศึกษาประสิทธิภาพของอัลฟาไลโปอิกแอซิดสำหรับการเสริมกับการรักษาทางกายภาพบำบัดในผู้ที่มีอาการทางเส้นประสาทไขอาติก เปรียบเทียบกับกลุ่มที่ใช้การรักษาทางกายภาพบำบัดเพียงอย่างเดียว โดยจุดประสงค์ของการศึกษาเพื่อพิจารณาว่า ประสิทธิภาพของ อัลฟาไลโปอิกแอซิดสำหรับการเสริมการรักษาทางกายภาพบำบัด จะช่วยลดอาการจากอาการปลายประสาทไขอาติกอีกเสบได้รวดเร็วกว่าการรักษาด้วยกายภาพบำบัดเพียงอย่างเดียว และผลการวิจัยจะใช้เป็นแนวทางในการเสริมการรักษาอาการในผู้ที่มีปลายประสาทอีกเสบ โดยให้อัลฟาไลโปอิกแอซิดร่วมกับการรักษาปกติ เนื่องจากในปัจจุบัน ประสิทธิภาพของ อัลฟาไลโปอิกแอซิด ถูกนำมาใช้ในการรักษาในกลุ่มผู้ป่วยเบาหวานที่มีอาการปวดเส้นประสาท และได้ผลเป็นที่น่าพอใจ แต่สำหรับผู้ที่มีอาการปวดเส้นประสาทที่เกิดจากอาการทางระบบกระดูกและกล้ามเนื้อยังมีข้อมูลน้อย

ในการทดสอบครั้งนี้ ผู้ที่ได้รับการคัดเลือกจะถูกสุ่มมาประชากรในประเทศไทย และจะได้รับการรักษาที่ พิเศษคลินิกกายภาพบำบัด กรุงเทพมหานคร โดยไม่เสียค่าใช้จ่ายใดๆ ทั้งสิ้น หากข้าพเจ้าตกลงเข้าร่วมการศึกษานี้ สิ่งดังต่อไปนี้จะเกิดขึ้น

1. ข้าพเจ้าจะได้รับคัดเลือกเพื่อดูว่าข้าพเจ้ามีคุณสมบัติเหมาะสมสำหรับการศึกษานี้หรือไม่
2. ข้าพเจ้าจะได้รับการสอบถามข้อมูลเบื้องต้น กรอกแบบสอบถาม ตรวจร่างกาย ชักประวัติจากผู้วิจัย (นักกายภาพบำบัด)
3. ข้าพเจ้าจะได้รับการสุ่มว่าจะได้รับยา A หรือ ยา B
4. ข้าพเจ้าได้รับคำอธิบายวิธีการรับประทานยา A หรือยา B วันละ 2 เม็ด หลังอาหารเช้าและเย็น เป็นเวลา 4 สัปดาห์
5. ข้าพเจ้าจะไม่รับประทานวิตามินอื่น ๆ ที่มีผลต่อลายประสาท เช่น วิตามินบี เป็นเวลา 4 สัปดาห์ ขณะเข้าร่วมการวิจัย
6. ข้าพเจ้าจะเข้ามารับการรักษาทางกายภาพบำบัดจากนักกายภาพบำบัด พร้อมทั้ง ตอบแบบฟอร์มและรับการตรวจร่างกายโดยผู้วิจัย อาทิตย์ละ 1 ครั้ง เป็นเวลา 4 สัปดาห์
7. ข้าพเจ้าจะได้รับการสอบถามถึงลักษณะของอาการปลายประสาทอักเสบของข้าพเจ้าในระหว่างการศึกษาวิจัยนี้ ที่มีผลเกี่ยวข้องกับความสัมพันธ์ในการร่วมการศึกษาวิจัยต่อไป

ความเสี่ยงและอาการไม่สบาย

ข้าพเจ้าจะแจ้งให้ผู้วิจัยทราบทันที ถ้ามีผลข้างเคียงจากการรับประทาน อัลฟาไลโปอิก ได้แก่ คลื่นไส้ อาเจียน ข้าพเจ้าสามารถหยุดยา A หรือยา B ได้ทันทีและสามารถแจ้งให้กับผู้วิจัยทราบ ได้ที่นางสาวอารีย์ เจริญชัยชนะ 089-6650893

ผลประโยชน์

ข้าพเจ้าจะได้ทราบผลการตรวจอาการปลายประสาทอักเสบทุกครั้งที่น่าจดหมาย

ทางเลือก

ข้าพเจ้าอาจเลือกปฏิเสธการตรวจและออกจากการศึกษาได้ หรือปรึกษาแพทย์เฉพาะทางกระดูกและกล้ามเนื้อได้ โดยจะไม่มีผลกระทบต่อการรักษาทางการแพทย์หรือกายภาพบำบัดใดๆ ภายหลัง

หากข้าพเจ้าไม่ปฏิบัติตามข้อตกลง เช่น ไม่ให้ความร่วมมือในการรับประทาน อัลฟาไลโปอิกแอซิด เสริมการรักษาทางกายภาพบำบัด ข้าพเจ้าอาจถูกเพิกถอนจากการศึกษาวิจัยได้ ผู้วิจัยสามารถร้องขอให้ข้าพเจ้าออกจากการศึกษาได้ โดยไม่ต้องแจ้งเหตุผลแก่ข้าพเจ้า

คำถาม

ผู้วิจัยที่ได้ลงนามทำนี้ได้พูดคุยกับข้าพเจ้าเกี่ยวกับการศึกษานี้ และข้าพเจ้าได้รับโอกาสในการถามคำถาม ข้าพเจ้าเข้าใจถึงความเกี่ยวข้องที่จะเข้าร่วมในการศึกษาวิจัยนี้ หากข้าพเจ้ามีคำถาม

อื่นเพิ่มเติมเกี่ยวกับการวิจัยนี้ ข้าพเจ้าจะติดต่อ นางสาวอารีย์ เจริญชัยชนะ ที่หมายเลขโทรศัพท์ 089-6650893 หรือ E-mail : pu__aree@yahoo.com

การปกปิดความลับ

ข้อมูลการเข้าร่วมการวิจัยของข้าพเจ้าจะถูกปกปิดเป็นความลับ ความเป็นส่วนบุคคลจะไม่ถูกเปิดเผยในรายงานใดหรืองานตีพิมพ์ใดที่เกี่ยวกับผลงานนี้ ผู้วิจัยอาจทบทวนข้อมูลเกี่ยวกับข้าพเจ้าเพื่อตรวจสอบการศึกษาความถูกต้องของวิธีการดำเนินวิจัยทางคลินิก และ/หรือข้อมูลอื่นๆ โดยไม่ละเมิดสิทธิของข้าพเจ้าในการรักษาความลับเกินขอบเขตที่กฎหมายอนุญาตไว้ โดยข้าพเจ้าได้ลงนามในเอกสารใบยินยอมอนุญาตให้บุคคลต่างๆ ข้างต้นมีสิทธิตรวจสอบเวชระเบียนของข้าพเจ้าโดยตรง

หากข้าพเจ้าได้รับการปฏิบัติไม่ตรงตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าสามารถติดต่อกับประธานคณะกรรมการจริยธรรมสำหรับการพิจารณาโครงการวิจัยที่ทำในมนุษย์ หรือผู้แทนได้ที่ ฝ่ายวิจัยสำนักวิชาเวชศาสตร์ชะลอวัยและฟื้นฟูสุขภาพ มหาวิทยาลัยแม่ฟ้าหลวง โทร 02-6642295-6

การยินยอม

การเข้าร่วมในงานวิจัยเป็นไปตามความสมัครใจของข้าพเจ้า ข้าพเจ้ามีสิทธิ์ที่จะถอนตัวจากการศึกษา ณ เวลาใด และการเพิกถอนดังกล่าวจะไม่มีผลต่อการดูแลรักษาทางการแพทย์หรือกายภาพบำบัดของข้าพเจ้าในอนาคต การเข้าร่วมงานวิจัยของข้าพเจ้าอาจสิ้นสุดเวลาใดก็ได้ ด้วยหรือไม่ด้วยความสมัครใจของข้าพเจ้า หากต้องการเข้าร่วมข้าพเจ้าจะลงชื่อข้างล่างนี้ ข้าพเจ้าจะได้รับสำเนาที่ลงชื่อเอกสารนี้เพื่อเก็บรักษาไว้

ลงชื่อ.....ผู้ยินยอม/ ผู้เข้าร่วมงานวิจัย วันที่.....

(.....)

ลงชื่อ.....ผู้วิจัย วันที่.....

(.....)

ลงชื่อ.....พยาน วันที่.....

(.....)

ลงชื่อ.....พยาน วันที่.....

(.....)

APPENDIX B

DATA COLLECTION FORM

Patient demographic information

**Title: The Efficacy of Oral Alpha-Lipoic Acid for Physiotherapy
Supplementation in the Treatment of Sciatic Neuropathic Pain.**

ID number.....

Date.....

1. Personal details of participant

Name.....Client ID number.....

Address.....
.....

Telephone number Mobile phone number.....

Email address.....

Sex () 1. Male () 2. Female

Weight.....kg. Hight.....cm. Body mass index.....kg./cm²

Age

() 1. Under 26 () 2. 26-35 years old () 3. 36-45 Years old () 4. 46-55 years old
() 5. Over 55

Occupation

() 1. Government official () 2. Work for private firm () 3. House wife
() 4. Student () 5. Self employed () 6. Free lance
() 7. Unemployed () 8. Others,

Marital status

- () 1. Single () 2. Married () 3. Divorced () 4. Widowed

Environment at work

- () 1. Office work () 2. Spend a lot of time standing () 3. Uncertain

Do you have any disease that requires ongoing check up and medication?

- () 1 None () 2. Yes,

Are you on any medication? () 1.No () 2. Yes,

Vitamin and supliments you are taking () 1. None () 2. Yes,

Cigarette () 1. Yes.....cigarette(s) daily () 2. No

Alcohol () 1. Regularly () 2. Occasional () 3. Never

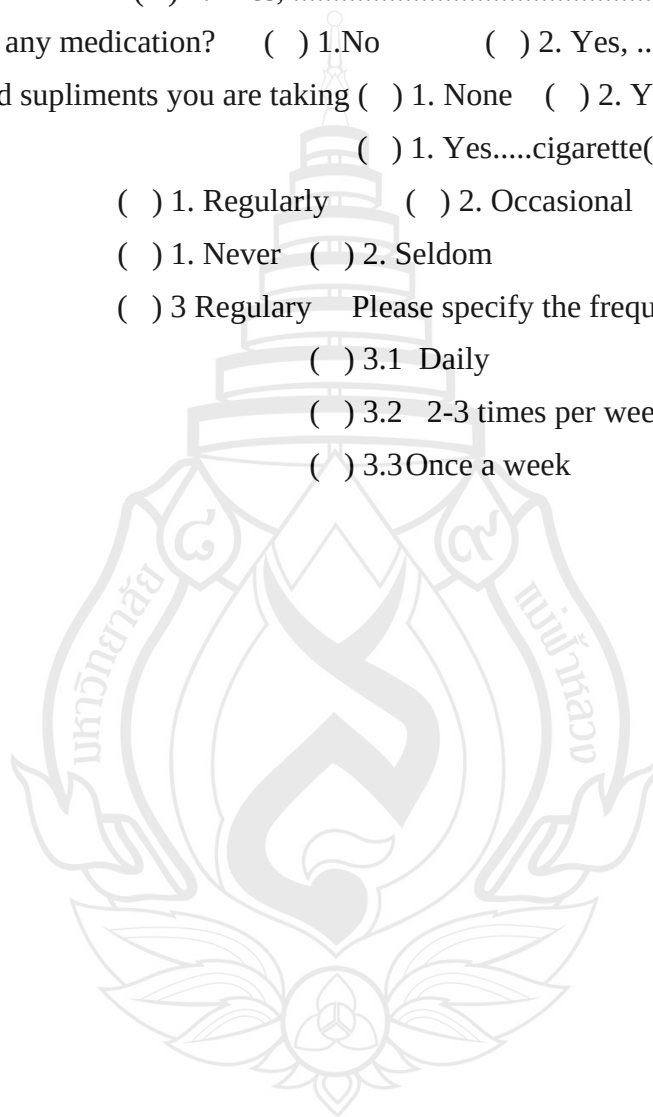
Exercise () 1. Never () 2. Seldom

() 3 Regulary Please specify the frequency

() 3.1 Daily

() 3.2 2-3 times per week

() 3.3Once a week



Data participant record (by therapist)

Date.....PN.....

1 Patient History

CC1:.....

Agg:.....

East:.....

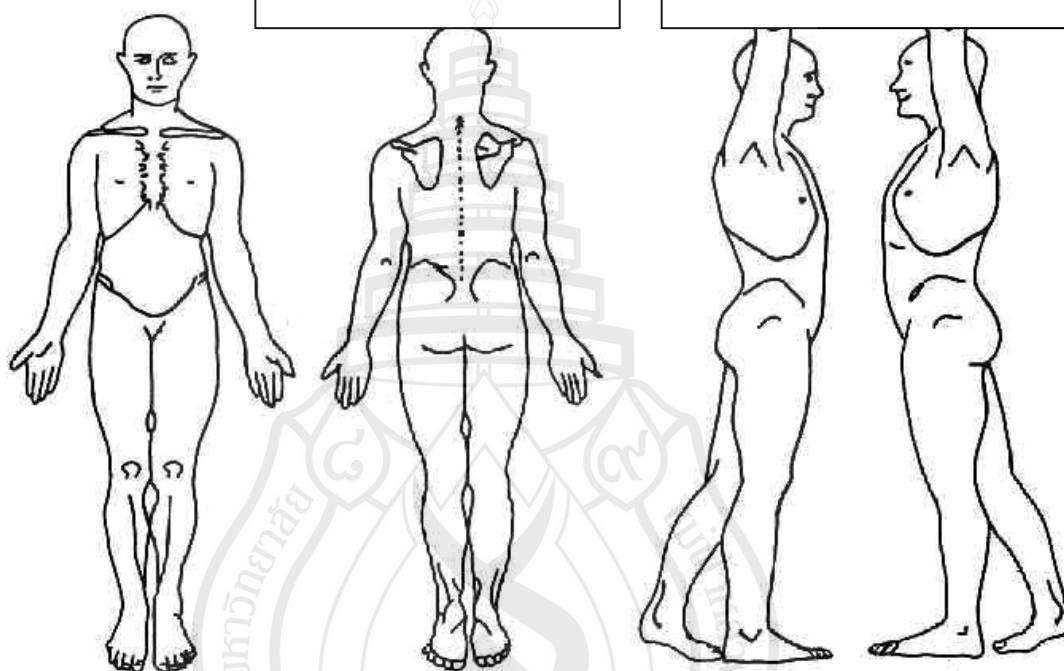
AM:.....

CC2:.....

Agg:.....

East:.....

AM:.....



CC3:.....

Agg:.....

East:.....

AM:.....

Dx.

Impairment

.....

.....

(Their pain has several different qualities e.g., burning, throbbing, shooting)

2. Physical examination

2.1 Observations

Pelvis level: ASIS..... PSIS.....Iliac crest.....

Others.....

2.2. Objective examinations

2.2.1 Functional examination:

Sitting.....

Standing.....

Lying.....

Changing position.....

Walking.....

2.2.2 Lumbar Active Range of Motion (AROM):

Flex.....Ext.....

Rt. Lat. flexLt. Lat. flex.....

Rt. Rot.....Lt. Rot.....

2.2.3 Passive Physiological Intervertebral Movement (PPIVM):

.....

2.2.3 Passive Accessory Intervertebral Movement (PAIVM):

.....

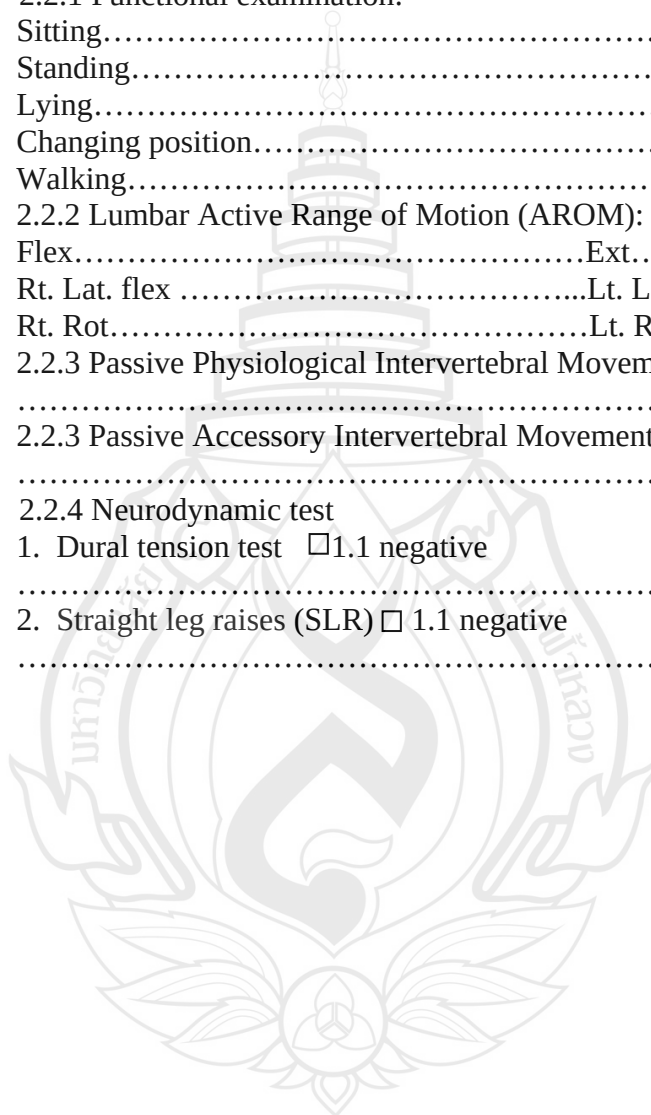
2.2.4 Neurodynamic test

1. Dural tension test ☐ 1.1 negative ☐ 1.2 positive

.....

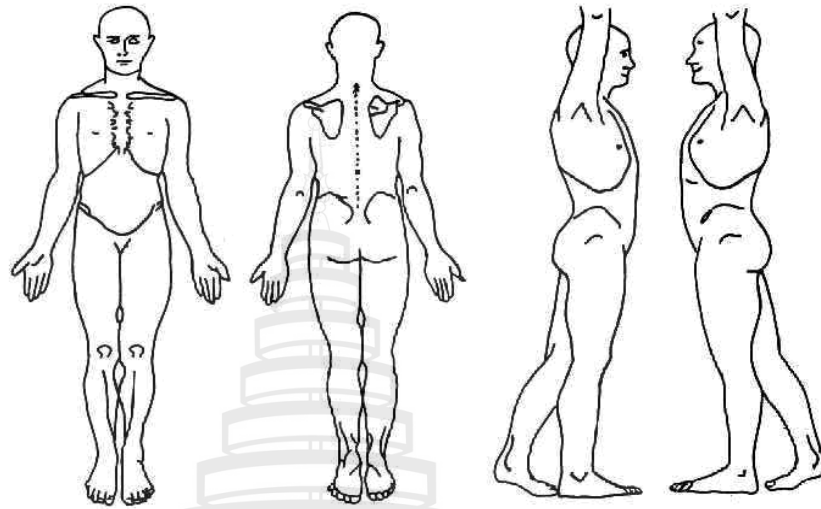
2. Straight leg raises (SLR) ☐ 1.1 negative ☐ 1.2 positive

.....



2.2.5 Neurological examination

☐ 1. Pinprick/ ☐ 2. Light touch



3. Deep Tendon Reflex (DTR)

2.2.4 Muscle Power Testing (MPT)

L1
 L3.....
 L5.....
 S2.....



L2.....
 L4.....
 S1.....

NEUROPATHY PAIN SCALE

Researcher record

() 1. 1st time () 2. 2nd time () 3. 3rd time () 4. 4th time

1. Please use the scale below to tell us how intense your pain is. Place an "X" through the number that best describes the intensity of your pain												The most intense pain sensation imaginable
No pain at all	1	2	3	4	5	6	7	8	9	10		
2. Please use the scale below to tell us how sharp your pain feels. Words used to describe "sharp" feelings include "like a knife," "like a spike," jabbing" or "like jolts."												The most sharp sensation imaginable
Not sharp at all	1	2	3	4	5	6	7	8	9	10		
3. Please use the scale below to tell us how hot your pain feels. Words used to describe very hot pain include "burning" and "on fire"												The most hot sensation imaginable
Not hot at all	1	2	3	4	5	6	7	8	9	10		
4. Please use the scale below to tell us how dull your pain feels. Words used to describe very dull pain include "like a dull toothache" and "dull pain", "aching." "like bruise"												The most dull sensation imaginable
Not dull at all	1	2	3	4	5	6	7	8	9	10		

5. Please use the scale below to tell us how cold your pain feels. Words used to describe very cold pain include “ice” and “freezing.”																	
Not cold at all	1	2	3	4	5	6	7	8	9	10	The most cold sensation imaginable						
6. Please use the scale below to tell us how sensitive your skin is to light touch or clothing. Words used to describe sensitive skin include “like sunburned skin” and “raw skin.”																	
Not sensitive at all	1	2	3	4	5	6	7	8	9	10	The most sensitive sensation imaginable						
7. Please use the scale below to tell us how itchy your pain feels. Words used to describe itchy pain include “like poison oak” and “like a mosquito bite.”																	
Not itchy at all	1	2	3	4	5	6	7	8	9	10	The most itchy sensation imaginable						
8.1 Which of the following best describes the time quality of your pain? Please check only one answer.																	
1. () I feel a background pain all of the time and occasional flare-ups (break through pain) some of the time.																	
2. () I feel many types of pain some times.																	
3. () I feel a single type of pain all the times.																	
4. () I feel a single type of pain some times. Other times, I am pain free.																	
8.2 Describe pain that occur to you.																	
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1.....</td> <td style="width: 50%;">4.....</td> </tr> <tr> <td>2.....</td> <td>5.....</td> </tr> <tr> <td>3.....</td> <td></td> </tr> </table>												1.....	4.....	2.....	5.....	3.....	
1.....	4.....																
2.....	5.....																
3.....																	

9. Now that you have told us the different physical aspects of your pain, the different types of sensation, we want you to tell us overall how unpleasant your pain is to you. Words used to describe very unpleasant pain include “miserable” and “intolerable.” Remember, pain can have a low intensity, but still feel extremely unpleasant, and some kind of pain can have a high intensity but be very tolerable. With this scale, please tell us how unpleasant your pain feels.

Not
unpleasant

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

The most
unpleasant
sensation
imaginable

10 Lastly, we want you to give us an estimate of the severity of your deep vs surface pain. We want you to rate each location of pain separately. We realize that it can be difficult to make these estimates, and most likely it will be a “best guess.” But please give us your best estimate.

No deep
pain

HOW INTENSE IS YOUR DEEP PAIN?

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

The most
deep pain
sensation
imaginable

No deep
pain

HOW INTENSE IS YOUR SURFACE PAIN?

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

The most
intense
surface pain
sensation
imaginable

Impact of Neuropathic Pain on Quality-of-Life Questionnaire

1. Symptoms	None	Least	Little	Moderate	High	Severe
1.1 Cold weather results in more pain.	0	1	2	3	4	5
1.2 Pain can be caused by just lightly touching the area.	0	1	2	3	4	5
1.3 More pain is caused by pressing the area with a little more force.	0	1	2	3	4	5
1.4 I also feel itchy in the area of pain.	0	1	2	3	4	5
1.5 I also feel itchy in other areas but not in the area of pain.	0	1	2	3	4	5
1.6 Numbness co-occurs with the pain in the same area.	0	1	2	3	4	5
1.7 Numbness occurs in other areas but not in the area of pain.	0	1	2	3	4	5
1.8 I feel shill in the area of pain.	0	1	2	3	4	5
1.9 I feel shill in other areas but not in the area of pain.	0	1	2	3	4	5
1.10 I feel burning sensation in the area of pain.	0	1	2	3	4	5
1.11 I feel burning sensation in other areas but not in the area of pain.	0	1	2	3	4	5
1.12 More pain can be caused but washing the area or when taking a shower.	0	1	2	3	4	5

2. The effect of the symptom to the people around you	None	Least	Little	Moderate	High	Severe
2.1 The symptom affects people around me.	0	1	2	3	4	5
2.2 I participate in activities with people around me normally though the occurrence of the symptom.	0	1	2	3	4	5
2.3 People get irritated by the symptom I have	0	1	2	3	4	5
2.4 The pain effects my relationship with my partner	0	1	2	3	4	5
2.5 I have to rely on others when I feel the pain.	0	1	2	3	4	5
3. Effect of the symptom on your mind	None	Least	Little	Moderate	High	Severe
3.1 I get anxious of when I will feel the pain.	0	1	2	3	4	5
3.2 I am disappointed because I cannot do things I used to be able to.	0	1	2	3	4	5
3.3 I am angry of myself because of the pain.	0	1	2	3	4	5
3.4 I prefer to be left alone when I have the symptom.	0	1	2	3	4	5
3.5 I can hardly concentrate when I have the symptom.	0	1	2	3	4	5
3.6 I can ignore the symptom and continue working.	0	1	2	3	4	5
3.7 I can manage the pain myself.	0	1	2	3	4	5
3.8 I am concerned about the future treatments I may need.	0	1	2	3	4	5

4. Social effects	None	Least	Little	Moderate	High	Severe
4.1 The symptom affects my daily life.	0	1	2	3	4	5
4.2 I am content with my hobbies though I have the pain from time to time.	0	1	2	3	4	5
4.3 The symptom affects my driving skills and/or the use of public transportations.	0	1	2	3	4	5
4.4 I stopped traveling because of the pain.	0	1	2	3	4	5
4.5 I get exhausted because of the pain.	0	1	2	3	4	5
4.6 The time I spend on each task is shortened because of the pain.	0	1	2	3	4	5
4.7 I prefer to be left alone when the pain gets worse.	0	1	2	3	4	5
4.8 It gets more and more difficult for me to move around or travel from one place to another.	0	1	2	3	4	5
5. Effects on activities daily living	None	Least	Little	Moderate	High	Severe
5.1 My work results in more pain.	0	1	2	3	4	5
5.2 I cannot walk as far as what I used to.	0	1	2	3	4	5
5.3 I cannot stand as long as what I used to.	0	1	2	3	4	5
5.4 The pain affects my balance.	0	1	2	3	4	5
5.5 I have pain when I am sitting down.	0	1	2	3	4	5
5.6 The pain makes sleeping more difficult.	0	1	2	3	4	5
5.7 I toss and turn at night when I have the pain	0	1	2	3	4	5

6. Effects on health	None	Least	Little	Moderate	High	Severe
6.1 Numbness makes shaving, taking shower more difficult.	0	1	2	3	4	5
6.2 Pain makes shaving, taking shower more difficult.	0	1	2	3	4	5
6.3 The symptom makes toilet use difficult.	0	1	2	3	4	5
6.4 Tight or loose clothes worsen the pain.	0	1	2	3	4	5
6.5 It is more difficult to put on or take off my clothes because of the pain.	0	1	2	3	4	5

7. Please circle the number best describe your symptom after one week of treatment where number 1 being the worst and number 10 being the best (least painful).

7.1 **Your overall health condition** which is the pain in nervous system such as sharp pain, burning sensation and cold pain which affect your daily life.

Worst

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

Best

7.2 **Your quality of life** which is your well being of your body, mind and the ability to maintain normal social life.

Worst

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

Best



CURRICULUM VITAE

CURRICULUM VITAE

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2003-2010	Physiotherapist at physical therapy clinic, Mahidol University
2005-2010	Clinical instructors, orthopedics field Faculty of physical therapy, Mahidol University
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