การเปรียบเทียบผลทันทีของการรักษาด้วยวิธีการขยับข้อต่อในทิศทางการหมุนศีรษะไปทางตรงข้ามกับด้านที่มีอาการปวด และการกดจากทางด้านหลังไปด้านหน้าบริเวณข้อต่อด้านข้างของกระดูกสันหลังส่วนคอด้านที่มีอาการปวดในผู้ป่วยที่มีอาการปวดคอข้างเดียวเนื่องจากสาเหตุเชิงกล

นางสาวฐานุตรี บัวมณี

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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COMPARISON OF THE IMMEDIATE EFFECTS OF THE CONTRALATERAL CERVICAL ROTATION TECHNIQUE TO THE IPSILATERAL POSTEROANTERIOR TECHNIQUE IN THE TREATMENT OF UNILATERAL MECHANICAL NECK PAIN

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Physical Therapy
Department of Physical Therapy
Faculty of Allied Health Sciences
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Thesis Title	COMPARISON OF THE IMMEDIATE EFFECTS OF THE CONTRALATERAL CERVICAL ROTATION TECHNIQUE TO THE IPSILATERAL POSTEROANTERIOR TECHNIQUE IN THE TREATMENT OF UNILATERAL MECHANICAL NECK PAIN
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ฐานุตรี บัวมณี : การเปรียบเทียบผลทันทีของการรักษาด้วยวิธีการขยับข้อต่อในทิศทางการหมุนศีรษะไปทางตรงข้ามกับด้านที่มีอาการปวด และการกดจากทางด้านหลังไปด้านหน้าบริเวณข้อต่อด้านข้างของกระดูกสันหลังส่วนคอด้านที่มีอาการปวด ในผู้ป่วยที่มีอาการปวดคอข้างเดียวเนื่องจากสาเหตุเชิงกล. (COMPARISON OF THE IMMEDIATE EFFECTS OF THE CONTRALATERAL CERVICAL ROTATION TECHNIQUE TO THE IPSILATERAL POSTEROANTERIOR TECHNIQUE IN THE TREATMENT OF UNILATERAL MECHANICAL NECK PAIN) อ. ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร. อดิษฐ์ จิรเดชนันท์, อ. ที่ปรึกษาวิทยานิพนธ์ร่วม: ผศ. ดร. จิตอนงค์ ก้าวกสิกรรม, 130 หน้า.

งานวิจัยนี้มีวัตถุประสงค์เพื่อเปรียบเทียบผลทันทีของการรักษาด้วยการขยับข้อต่อในทิศทางการหมุนศีรษะไปทางตรงข้ามกับด้านที่มีอาการปวด และการกดจากทางด้านหลังไปด้านหน้าบริเวณข้อต่อด้านข้างของกระดูกสันหลังส่วนคอด้านที่มีอาการปวด ที่มีผลต่ออาการปวดคอและช่วงการเคลื่อนไหวของคอในผู้ป่วยที่มีอาการปวดคอข้างเดียวเนื่องจากสาเหตุเชิงกล ผู้ป่วยที่มีอาการปวดคอข้างเดียวเนื่องจากสาเหตุเชิงกล จำนวน 66 คน อายุเฉลี่ย 43.6 (12.2) ปี ได้รับการคัดเลือกให้เข้าร่วมงานวิจัย ผู้เข้าร่วมงานวิจัยได้รับการสุ่มด้วยซองปิดผนึกออกเป็น 3 กลุ่ม คือ กลุ่มที่ได้รับการขยับข้อต่อในทิศทางการหมุนศีรษะ กลุ่มที่ได้รับการขยับข้อต่อในทิศทางการกดจากทางด้านหลังไปด้านหน้าบริเวณข้อต่อด้านข้างของกระดูกสันหลังส่วนคอ และกลุ่มควบคุม ผู้วัดที่ไม่ทราบว่าผู้เข้าร่วมงานวิจัยอยู่กลุ่มใด จะเป็นผู้บันทึกข้อมูลระดับความเจ็บปวดคอ ช่วงการเคลื่อนไหวของคอ และอาการโดยรวมภายหลังการรักษา การวิเคราะห์ข้อมูลทางสถิติ ใช้ Paired t-test เพื่อวิเคราะห์ผลภายในกลุ่ม และใช้ One-way ANOVA: Multiple comparisons เพื่อวิเคราะห์ผลระหว่าง 3 กลุ่ม ด้วยโปรแกรม SPSS รุ่น 17.0 โดยกำหนดระดับความเชื่อมั่นที่ 0.05

ผลการวิเคราะห์ข้อมูลทางสถิติ พบว่า ไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติของการลดอาการปวดคอ และการเพิ่มช่วงการเคลื่อนไหวของคอ ($p>0.05$) ระหว่างวิธีการขยับข้อต่อในทิศทางการหมุนศีรษะไปทางตรงข้ามกับด้านที่มีอาการปวด และการกดจากทางด้านหลังไปด้านหน้าบริเวณข้อต่อด้านข้างของกระดูกสันหลังส่วนคอด้านที่มีอาการปวด อย่างไรก็ตาม พบความแตกต่างอย่างมีนัยสำคัญทางสถิติของการลดอาการปวดคอ และการเพิ่มช่วงการเคลื่อนไหวของคอเกือบทุกทิศทาง เมื่อเปรียบเทียบระหว่างการขยับข้อต่อทั้งสองวิธี กับกลุ่มควบคุม ($p<0.05$)

ภาควิชา กายภาพบำบัด ลายมือชื่อนิสิต.....ฐานุตรี บัวมณี.....

สาขาวิชา กายภาพบำบัด ลายมือชื่ออาจารย์ที่ปรึกษาวิทยานิพนธ์หลัก.....

ปีการศึกษา 2552 ลายมือชื่ออาจารย์ที่ปรึกษาวิทยานิพนธ์ร่วม.....

5177207937 : MAJOR PHYSICAL THERAPY

KEY WORDS : NECK PAIN / CERVICAL SPINE / MOBILIZATION / MANUAL TECHNIQUE / REHABILITATION

TANUTREE BUAMANEE: COMPARISON OF THE IMMEDIATE EFFECTS OF THE CONTRALATERAL CERVICAL ROTATION TECHNIQUE TO THE IPSILATERAL POSTEROANTERIOR TECHNIQUE IN THE TREATMENT OF UNILATERAL MECHANICAL NECK PAIN. THESIS ADVISOR: ASST. PROF. ADIT CHIRADEJNANT, Ph.D., THESIS CO-ADVISOR: ASST. PROF. CHITANONGK GAOGASIGAM, Ph.D, 130 pp.

The objective of this study was to compare the immediate effects of the use of the contralateral cervical rotation technique to the ipsilateral posteroanterior (IPA) technique on neck pain and active cervical range of motion (ROM) in the treatment of unilateral mechanical neck pain (UMNP). Sixty-six patients with UMNP with mean aged (SD) 43.6 (12.2) years were recruited. The subjects were randomly allocated into 3 groups; the rotation, IPA, and control groups by sealed envelops with assigned group. The blinded assessor established the outcome measurements including pain intensity, active cervical ROM and global perceived effect (GPE). Paired *t*-test was used to analyze within group effect and One-way ANOVA: Multiple comparisons was used to analyze the different effects among the 3 groups. All data were analyzed using the SPSS program version 17.0 for Windows with a significant level set at 0.05.

There was no statistically significant difference in pain reduction and improving active cervical ROM between the rotation and the IPA group ($p>0.05$). However, statistically significant differences in pain reduction and improving in almost all active cervical ROMs were noted when the rotation and IPA groups were compared to the control group ($p<0.05$).

Department: Physical Therapy Student's Signature Tanutree Buamanee

Field of Study: Physical Therapy Advisor's Signature Adit Chiradejnant

Academic Year: 2009 Co-advisor's Signature Chitanongk Gaogasigam

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LIST OF ABBREVIATIONS

ANOVA	=	Analysis of variance
BMNP	=	Bilateral mechanical neck pain
cm	=	Centimeters
CROM	=	Cervical range of motion device
dPAG	=	Dorsal/lateral periaqueductal gray
DPIS	=	Descending pain inhibitory system
GPE	=	Global perceived effect
Hz	=	Hertz
ICC	=	Intraclass correlation coefficient
IPA	=	Ipsilateral posteroanterior
K	=	Kappa statistic
kg	=	Kilogram
MDC	=	Minimal detectable change
m	=	Meter
mm	=	Millimeter
MNP	=	Mechanical neck pain
N	=	Newtons
NSAID	=	Non-steroidal anti-inflammatories drug
PA	=	Posteroanterior
PAG	=	Periaqueductal gray
ROM	=	Range of motion
SD	=	Standard deviation
SEM	=	Standard error of measurement
SMT	=	Spinal manipulative therapy
SWD	=	Short wave Diathermy
UMNP	=	Unilateral mechanical neck pain
VAS	=	Visual analogue scale
vPAG	=	Ventrolateral PAG

CHAPTER I

INTRODUCTION

1.1 Background and rationale

Mobilization is one of the most common approaches for treating patients with mechanical neck pain (MNP). This approach is defined as the use of a single movement or a set of passive oscillatory movement which can be performed as both passive physiological movement (i.e. flexion, extension, lateral flexion and rotation) and passive accessory movement (i.e. anteroposterior or AP, posteroanterior or PA and transverse movement). There are a number of differences in the use of these two movements, for example, the availability of the range of movement of the joint being moved, the articulation movement occurred in the treated joint and the effect on the soft tissue around the treated area. The sequence of the use of the passive movement selection is based on patient's clinical presentations or symptom distribution. With regard to the symptom distribution, patients with MNP can be categorized into 2 groups; unilateral MNP (UMNP) and

bilateral MNP (BMNP) (Ahn et al., 2007). It has been recommended to use the central PA technique for treating BMNP while it has been recommended to use either the ipsilateral posteroanterior (IPA) technique or the contralateral cervical rotation technique for treating UMNP (Maitland et al., 2005). Additionally, there are only few studies supporting the effectiveness of the central PA (Kanlayanaphotporn et al., 2010; Siriprapaporn et al., 2007) and the IPA technique (Kanlayanaphotporn et al., 2009; Sakuna et al., 2007) while there is no study investigating the effectiveness of the contralateral cervical rotation technique. The differences of the application of these two techniques may effect the different of treatment outcome mentioned previously. With regard to the articulation movement, the contralateral cervical rotation technique would produce movements (primarily in both PA and medial directions) more than that of the IPA technique (primarily in PA direction) during the application. Also the rotation technique would stretch both contractile tissue (ie. deep cervical muscles) and non-contractile tissues (ie. ligament and neural tissue on the ipsilateral side of UMNP) more than the IPA technique. It is questioned that the contralateral cervical rotation technique might be more effective than that of the IPA technique in reliving neck pain and

improving active cervical range of motion (ROM). Therefore, this study aimed to compare the effectiveness of the contralateral cervical rotation technique to the IPA technique in the treatment of UMNP.

1.2 Objectives

The objective of this study was to compare the effectiveness of the contralateral cervical rotation technique to the IPA technique in the treatment of UMNP.

1.3 Specific objectives

The contralateral cervical rotation technique was superior to the IPA technique in reliving neck pain and improving active cervical ROM in the treatment of UMNP patients.

1.4 Hypothesis

There would be statistically significant differences in the change in neck pain intensity and active cervical ROM between the subjects who receive the contralateral cervical rotation technique and the IPA technique.

1.5 Scope of the study

This study investigated the effectiveness of two mobilization techniques in the treatment of UMNP using a randomized controlled trial with a blinded assessor. Sixty-six patients age more than 20 years who met the inclusion criteria were recruited.

1.6 Brief method

The agreed patients gave written consent. The patients who met the inclusion criteria were recruited, hereby called subjects. The therapist then fully assessed the

subjects both subjective and objective examinations, and established the treatment dosage. Then, the assessor was asked to note pre-intervention data including pain intensity and active cervical ROM. The subjects were then randomly allocated into 3 groups; the rotation, IPA, and control groups using sealed envelops with assigned group. The sealed envelops were prepared prior to the trial using a computer generating a random number. The subjects in control group received a detuned shortwave diathermy (SWD) for 10 minutes in supine position. The subjects in the rotation group received 2 sets of 1-minute repetition of the contralateral cervical rotation mobilization technique while the subjects in the IPA group received 2 sets of 1-minute repetition of the IPA mobilization technique. Both mobilization techniques were applied to the identified spinal level obtained from the physical assessment procedure. After the subjects received the intervention for 5 minutes, the assessor was then called to note post-intervention data in the same manner as establishing pre-intervention data. Also the subjects were asked to rate their satisfaction of the intervention on the global perceived effect scale (GPE).

1.7 Advantage of the study

The results from this study were an advantage in clinical research and the selection of technique in using cervical mobilization for treating UMNP.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Neck pain is a common condition that was reported to be the high prevalence. The neck pain patients commonly suffer from pain and stiffness that affect the daily living. Physical therapy is one of the most frequently non-surgical treatments for such patients which aim to reduce neck pain and restore the cervical joint movement. This chapter describes the neck pain, management of neck pain, the effectiveness and the use of the spinal manipulative therapy (SMT) for neck pain.

2.2 Neck pain

Neck pain is one of the common symptoms reported in general populations. Approximately 50% in adult experienced neck pain once during their lifetime (Fejer et al., 2006). About 23% of neck pain patients reported an incidence of one

year recurrence (Cote et al., 2004). Due to a large number of patients with neck pain, the cost of treatment for such patients reported to be numerous (Korthals-de Bos et al., 2003).

Neck pain can be defined as any symptoms occurring in the area between the occiput and the third thoracic vertebra (Fejer et al., 2005). This symptom can also accompany with any symptoms noted in the upper extremity or head and face area (Ahn et al., 2007; Ferrari et al., 2003). However, the definite diagnosis of neck pain is still inconclusive, therefore the classification of neck pain is commonly based on either the duration or the cause of the symptoms. Regarding the duration of the symptoms, neck pain can be divided into 3 groups: acute, subacute and chronic neck pain (Fejer et al., 2005). The acute, subacute and chronic neck pain refer to the onset of symptoms less than 30 days, between 30 and 90 days and more than 90 days, respectively (Fejer et al., 2005). Regarding the cause of the symptoms, the patient can be divided into 2 groups: non-MNP and MNP (Ferrari & Russell, 2003). The non-MNP refers to neck pain causing by known causes such as tumors, spinal infection, spinal fracture, metabolic bone diseases, etc. while the

MNP refers to neck pain causing by mechanical basis such as poor posture, sport injury and occupational activities (Binder, 2007; Ferrari & Russell, 2003). Based on the cause of the symptoms, the majority of patients with neck pain are classified as MNP (Binder, 2007; Ferrari & Russell, 2003).

Additionally, it has been hypothesized that the MNP would result from any dysfunction of various anatomical structures such as ligaments, muscles, intervertebral joints, facet joints, intervertebral discs, or neural tissues (Bogduk & Aprill, 1993). Therefore, the symptom is normally aggravated with neck movements or sustained neck posture. Also, the symptom commonly distributes to the upper extremity and/or head and face area. With regards to the distribution of the symptoms, the MNP can be categorized into 2 sub-groups; unilateral MNP (UMNP) and bilateral MNP (BMNP) (Ahn et al., 2007). The UMNP refers to any symptoms occurring on one side of the neck, and the symptom can accompany with any symptoms in the ipsilateral side of the upper extremity while the BMNP refers to any symptoms noted in both the center and bilateral of the neck, and the

symptoms can accompany with any symptoms in both upper extremities (Figure 2.1).

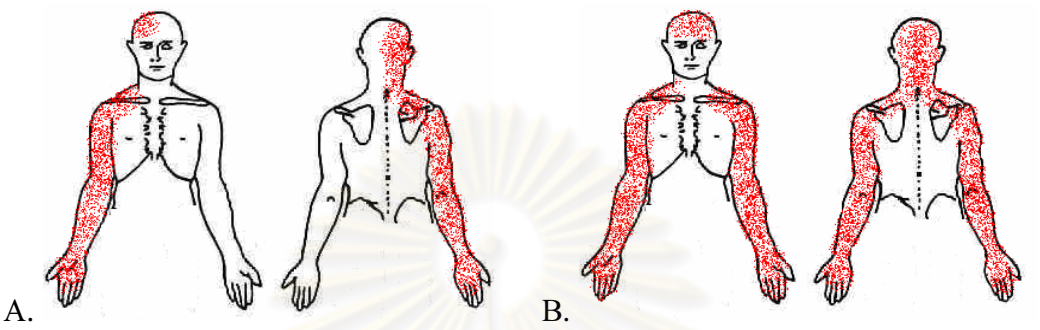


Figure 2.1 The distribution of symptoms of mechanical neck pain.
A and B represent the symptoms in UMNP and BMNP, respectively.

2.3 Management of neck pain

There are several treatments aiming to reduce neck pain and restore the cervical ROM. These include surgical treatment and non-surgical treatment. The surgical treatment is recommended for MNP patients who have positive signs of neurological deficit, cervical nerve root compression, or progressive worsening of the signs and symptoms of neck pain (Nikolaidis et al., 2010). Even though the surgical treatment is importantly recommended for these conditions, it has been reported complications such as the injury of neural structures, carotid artery or

vocal cord and infection (Denaro et al.,2010; Nikolaidis et al., 2010). In these consideration of such complications, the non-surgical treatment, is therefore, firstly recommended for treating MNP.

The non-surgical treatments include pharmacological treatment, acupuncture, massage, chiropractic and physical therapy (Jensen & Harms-Ringdahl, 2007). The use of pharmacological treatment is widely prescribed to treat MNP as medicine given by oral known as non-steroidal anti-inflammatory drugs (NSAIDs). The use of this medication appears to be effective in reducing neck pain in both acute and chronic conditions (Peloso et al., 2009). However, there are a number of patients experiencing side effects especially the gastrointestinal problems after the use of NSAIDs (Bateman & Kennedy, 1995; Moore et al., 1998; Peloso et al., 2009). Additionally, the symptoms from the side effects have been reported to be worse than the main symptoms (Bateman & Kennedy, 1995). This would be a possible reason that such patients would choose other approaches to treat their symptoms in order to avoid these side effects.

Physical therapy would be another approach that plays an important role in the treatment of MNP. This approach includes thermotherapy, electrotherapy, exercise therapy, mechanical cervical traction, massage and spinal manipulative therapy (SMT). Even though there are a number of physical therapy interventions offering for MNP, the effectiveness of thermotherapy, electrotherapy, traction is still inconclusive. Also, it has been noted that exercise therapy (Binder, 2008) and SMT (Binder, 2008; Gross et al., 2010) were more effective than other physical therapy interventions in the treatment of MNP.

2.4 Spinal manipulative therapy for neck pain

It has been noted that SMT is more effective on reliving neck pain than the conventional physical therapy and general practitioner for treating MNP (Binder, 2008; Bronfort et al., 2004). Additionally, it has been reported that SMT was superior to general practitioner and conventional physical therapy in improving functional activities for chronic MNP whereas there was inconclusive for acute MNP (Binder, 2008; Bronfort et al., 2004). However, it has been suggested that

SMT would be able to both relieve pain and improve mobility of a treated joint in the treatment of MNP (Maitland et al., 2005).

SMT includes both spinal manipulation and spinal mobilization. Briefly, spinal manipulation is a single small passive movement applied with high velocity at the end or just beyond the end of range of the treated joint. Spinal mobilization is a set of passive oscillatory movements either large or small movement applied within an available ROM of the treated joint. SMT can be performed by a chiropractor and a physical therapist. The majority of the uses of spinal manipulation are performed by a chiropractor while the majority of the uses of spinal mobilization are performed by a physical therapist.

There were a number studies investigating the effectiveness of the use of spinal manipulation (Cassidy et al., 1992; Giles & Muller, 1999; Howe et al., 1983; Hurwitz et al., 2002; Martinez-Segura et al., 2006; Muller & Giles, 2005; Pikula, 1999; Wood et al., 2001) and spinal mobilization (Kanlayanaphotporn et al., 2009; 2010; Sakuna et al., 2007; Siriprapaporn et al., 2007) for treating MNP. It was

reported that the spinal manipulation was effective on pain reduction both short term (Cassidy et al., 1992; Giles & Muller, 1999; Howe et al., 1983; Martinez-Segura et al., 2006; Pikula, 1999) and long term (Howe et al., 1983; Hurwitz et al., 2002; Muller & Giles, 2005; Wood et al., 2001). Also it was noted that spinal manipulation was effective in short term (Howe et al., 1983; Martinez-Segura et al., 2006; Pikula, 1999) and long term improvement of the cervical ROM (Howe et al., 1983). On the other hand, it was noted that spinal mobilization was effective on pain reduction both short term (Kanlayanaphotporn et al., 2009; 2010; Sakuna et al., 2007; Siriprapaporn et al., 2007) and long term pain (Sakuna et al., 2007; Siriprapaporn et al., 2007). Additionally it was noted that spinal mobilization was effective in short term improvement of the cervical ROM (Kanlayanaphotporn et al., 2009).

Even though, it seems to be a few studies on the effectiveness of the use of the spinal mobilization, it has been recommended to firstly choose the cervical mobilization before cervical manipulation (Maitland et al., 2005). This is because there would be possible incidence of adverse effects such as headache and

dizziness occurred after the application of cervical manipulation. This has been confirmed by a greater number of episodes of such effects after the application of the cervical manipulation than that of the cervical mobilization (Hurwitz et al., 2002). The cervical mobilization, therefore, seems to be a safer approach in the treatment of MNP.

2.5 Mechanisms of spinal manipulative therapy

There are several studies proposing the mechanisms of SMT (Threlkeld, 1992; Wright, 1995). These include neurophysiological (Brown, 2005; Melzack & Wall, 1965; Wright, 1995) and biomechanical mechanisms (Threlkeld, 1992). This part gives the details in these mechanisms.

2.5.1 The neurophysiological mechanisms

It has been hypothesized that SMT would activate several neural tissues via both spinal level (Melzack & Wall, 1965) and supraspinal level (Brown, 2005; Wright,

1995). Regarding the spinal level, this is well known as ‘gate control theory’ (Figure 2.2). The nociceptive afferent input or pain sensation is sent via Aδ and C fibers (small fibers) to the interneuron in the spinal cord before ascending this impulse to the brain. When the SMT is applied, this would stimulate mechanoreceptors and proprioreceptors via Aα and Aβ fibers (large fibers) to the interneuron in the spinal cord before ascending this impulse to the brain. Due to the different in the size between the nerve fiber, the impulse from the mechanoreceptors and proprioreceptors is faster than that of the nociceptive receptor. Additionally, the impulse from the mechanoreceptors and proprioreceptors would result in an inhibition of the interneuron resulting in the blockage of the nociceptive afferent input at interneuron in spinal cord, hereby called “close gate” (Melzack & Wall, 1965). When the gate is closed, this would result in the pain relief effect.

Regarding the supraspinal level, SMT would activate projection neurons in the periaqueductal gray (PAG) in midbrain resulting in an activation of the descending pain inhibitory system (DPIS). When the DPIS is activated, the interneuron in

spinal cord which is inhibited by the impulse from the mechanoreceptors and proprioreceptors in the spinal level is also suppressed. Consequently, this would result in the pain relief effect (Brown, 2005; Wright, 1995). Figure 2.2 shows the summary of the neurophysiological mechanisms of SMT. The activation on the neuron in the PAG would be able to divide in to two parts; dorsolateral PAG (dPAG) and ventrolateral PGA (vPAG) (Figure 2.3). The dPAG is stimulated, this would produce the sympathoexcitation resulting in an immediate pain relief occurred about 1 minute after the application of SMT. On the other hand, when the vPAG is stimulated, this would produce sympathoinhibition resulting in a latent pain relief occurred between 20 to 45 minutes after the application of SMT.

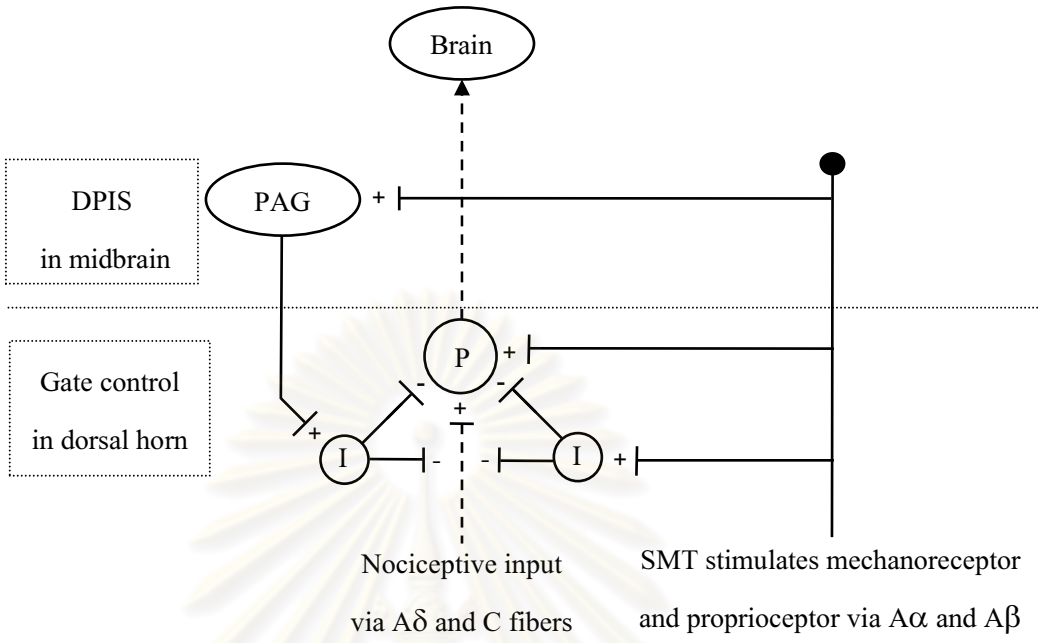


Figure 2.2 Summary of the neurophysiological mechanisms of SMT
(modified from Brown, 2005; Melzack & Wall, 1965).
I and P represent inhibitory interneuron and projection neuron, respectively.
+ and – represent activation of the impulse and inhibition of the impulse, respectively.
- - - represents the nociceptive input. — represents the modulation pathways.
…. separates the spinal level and supraspinal level.

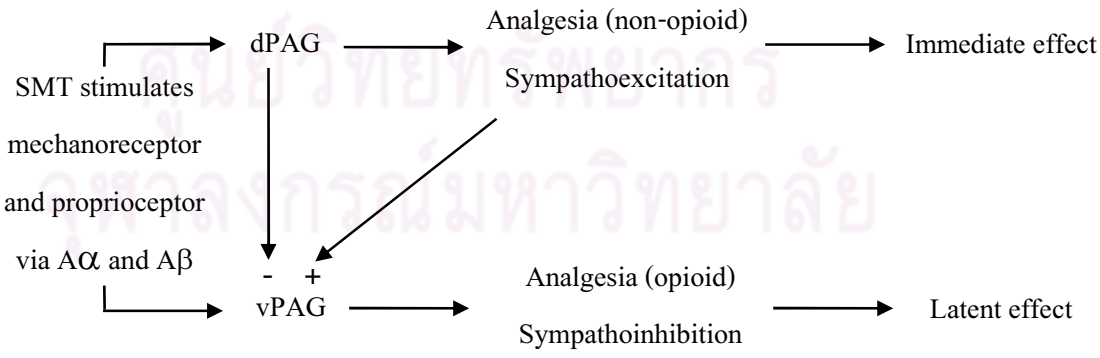


Figure 2.3 The descending pain inhibitory system (modified from Wright, 1995)
The dPAG and vPAG represent dorsolateral and ventrolateral periaqueductal gray, respectively. The + and – signs represent activation of the impulse and inhibition of the impulse, respectively.

2.5.2 The biomechanical mechanisms

With regard to the biomechanical mechanism, the improving in the mobility of the treated joint would be the result from an increase in the synovial fluid and clearance of the toxic substance via blood flow increment (Maigne & Vautravers, 2003). Additionally, it has been hypothesized that SMT would cause tissue elongation resulting in restoring the movement of the treated joint (Maitland et al., 2005). However, there is a study reporting on the amount of force applied to cadaveric specimens noting that the amount of force ranging from 224 to 1,136 N caused permanent tissue elongation (Threlkeld, 1992). On the other hand, it has been noted that the force applied to a asymptomatic subject during cervical mobilization ranged from 21.8 to 61 N (Snodgrass et al., 2007). In consideration of the amount of force applied between these two studies, it is noticed that the force applied to a human subject is relatively a lot lesser than that applied to cadaveric specimens (Threlkeld, 1992). Therefore, it is unlikely that cervical mobilization would result in the tissue elongation. However, these results should be interpreted

with care because there are a number of differences between the human subject and the cadaveric specimens.

2.6 Treatment dosage

There are three parameters that are needed to be considered for the use of SMT. These parameters include grade of movement, frequency and the number of repetitions. The grade of movement represents how far the passive movement goes with respect to the treated joint resistance. In practice, a movement diagram commonly used to portray behavior of joint resistance, pain and muscle spasm occurred during passive manual assessment (Maitland et al 2005). Figure 2.4 shows a normal movement diagram.

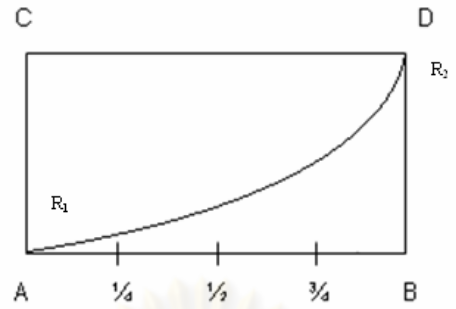


Figure 2.4 The movement diagram (Modified from Maitland et al., 2005)

The horizontal line AB represents the starting range of movement (A) to the limit of normal passive range (B). The vertical line AC and BD represent the intensity of each variable. Line R represents the resistance in the passive joint movement. R_1 represents the first point of feeling resistance while R_2 represents the maximum resistance at the end of normal joint movement.

2.6.1 Grade of movement

The grade of movement can divided in to 5 grades; *Grade I* represents a small-amplitude oscillatory movement near the beginning of the range, *Grade II* represents a large-amplitude oscillatory movement that is free from resistance, *Grade III* and *IV* represent a large-amplitude oscillatory movement and a small-amplitude oscillatory movement at 50% of joint resistance, respectively, *Grade V* represents a single small passive movement applied with high velocity at the end or

just beyond the end of range of the treated joint (Maitland et al., 2005). The grades of movement can be varied with an increase (+) or decrease (-) of 25 percentage of the joint resistance. The therapist selects the different grades of mobilization depending on the aim of treatment. The expert has recommended to use *Grade I, II and III* to relieve pain dominance factor while to use *Grade IV and V* to relieve stiffness dominance factor (Maitland et al., 2005). Figure 2.5 shows five grades of movement with respect to the resistance in the movement diagram

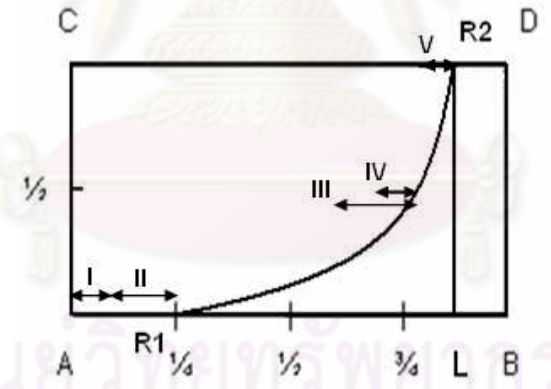


Figure 2.5 Grade of movement with respect to the resistance in the movement diagram (modified from Maitland et al., 2005, page 176).

L represents the limit of a joint movement. The different sizes of the arrow line represent the size of the amplitude of a passive oscillatory movement.

2.6.2 Oscillatory frequency of mobilization

In generally, mobilization has been recommended to apply with the oscillatory frequency ranged from 0.5-2.0 Hz in the treatment of musculoskeletal disorders (Maitland et al, 2005). Also, mobilization can be applied in different frequencies depends on a patient's problem. It has been recommended to use a low oscillatory frequency and a high frequency of the mobilization to treat a patient's pain problem or pain as a predominant factor and to treat a patient's resistance problem or resistance as a predominant factor, respectively (Maitland et al., 2005). A study investigating the frequency of the cervical mobilization to asymptomatic subjects noted that the oscillatory frequency ranged to be 0.54 – 1.74 Hz which is well in the range of the recommendation (Snodgrass et al., 2007).

2.6.3 The number of repetitions of mobilization

The judgment on how many repetitions is given to the patients depends on the response of the patient's symptoms. It has been suggested that a physical therapist

should apply mobilization for 3 to 4 repetitions of a set of 30-second (a maximum of 2 minutes) to get an optimum treatment effect (Maitland et al., 2005). If the treatment is continued, this would cause either an increased in soreness of the treated area or worsening of the symptoms (Maitland et al., 2005). This would be the case of why a number of studies investigating effectiveness of spinal mobilization using 2 sets of 1-minute repetition (Chiradejnant et al., 2002; 2003; Kanlayanaphotporn et al., 2009; 2010; Kongsawatvarakul & Chiradejnant, 2007).

2.7 The use of mobilization technique in the treatment of mechanical neck pain

The mobilization technique can be performed as passive physiological movement (i.e. flexion, extension, lateral flexion and rotation) and passive accessory movement (i.e. AP, PA and transverse movement). The use of cervical mobilization for treating MNP has been followed the recommendation of manual therapy experts (Maitland et al., 2005). Regarding the distribution of symptoms, it has been suggested that a therapist would firstly use the central PA technique to

treat a patient who has bilateral symptoms while a therapist would firstly use either the contralateral cervical rotation technique or IPA technique to treat a patient who has unilateral symptoms (Figure 2.6).

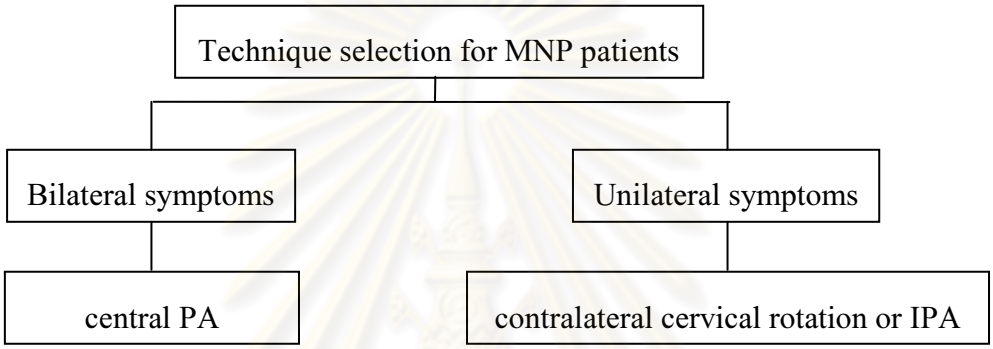


Figure 2.6 The Sequence of technique selection for treating MNP patients (modified from Maitland et al., 2005)

There are a few studies investigating the effectiveness of the use of specific cervical mobilization in the treatment of MNP (Kanlayanaphotporn et al., 2009; 2010; Sakuna et al., 2007; Siriprapaporn et al., 2007). These findings partially support this recommendation. For example, the use of the central PA in the treatment of BMNP noted to be effective in pain reduction (Kanlayanaphotporn et al., 2010; Siriprapaporn et al., 2007). On the other hand, the use of IPA technique in the treatment of UMNP noted to be effective in pain reduction

(Kanlayanaphotporn et al., 2009; Sakuna et al., 2007) and an improving only ROM on worst movement (Kanlayanaphotporn et al., 2009). Regarding the use of the cervical mobilization in the treatment of UMNP, it has been recommended to firstly choose either the IPA or the contralateral cervical rotation technique for treating UMNP patients. The effectiveness of IPA mobilization has been documented whereas there is no study investigating the effectiveness of the use of the contralateral cervical rotation technique in UMNP patients. It is possible that different findings might be noted for the use of the contralateral cervical rotation technique because the movements occurred as well as the effect on surrounded tissues during the application of the cervical rotation and the IPA are differences.

2.7.1 Arthrokinematic movements during the rotation and the IPA technique

During the application of the mobilization to a vertebrae, this would induce the intervertebral movement occurred with regard to the direction of the force applied. The contralateral cervical rotation technique is applied while a patient is in supine

lying (Maitland et al., 2005). Prior to the application of this technique, the therapist has to localize the force by wiring up the position of the target cervical spine. After the starting position is set, the therapist has to apply the pressure via his thrusting knuckle to produce a set of oscillatory rotation movements. Regarding to the IPA technique, a therapist applies a set of PA oscillatory movements to superior articular facet of a targeted cervical spine while a patient is in prone position (Maitland et al., 2005). Figure 2.7 shows the maneuvers of the application of these two techniques which are explained in details elsewhere (Maitland et al., 2005).

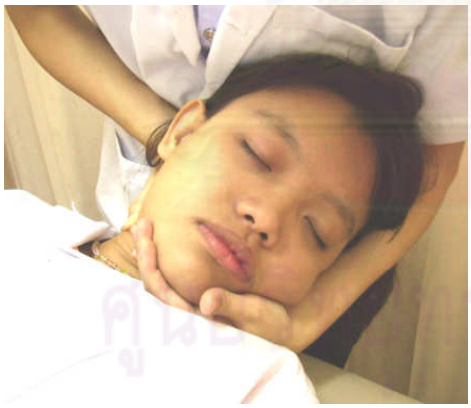
A.  B. 

Figure 2.7 The maneuvers of the application of contralateral cervical rotation technique (A) and IPA techniques (B) to right facet joint according to Maitland (2005. page 283, 277, respectively)

In consideration of arthrokinematic movements occurred between these two techniques, it is noted that the application of the rotation technique would produce primarily both PA translation of the superior articulation on the inferior articulation as well as medial gliding of the superior articulation on the inferior articulation while the application of the IPA technique would primarily produce only the PA translation of the superior articulation on the inferior articulation (Bogduk & Mercer, 2000). Figure 2.8 shows the movement occurred during the cervical rotation technique and the IPA technique. Based on the arthrokinematic movements occurred during these two techniques, the cervical rotation technique would produce articulation movements more than that of the IPA technique. Aditionally, the contralateral cervical rotation technique would stretch a number of structures on the ipsilateral side of the cervical spine (ipsilateral side of UMPN) including both contractile tissues and non-contractile tissues (i.e. ligament, joint capsule and neural tissue) more than that of the IPA technique. Consequently, the tone of the muscle and the neural tension on the ipsilateral side of the UMNP would be reduced resulting in pain relief effect and improving in cervical ROM. Therefore, it is questioned that the cervical rotation technique would be more

effective than that of the IPA technique in reliving neck pain and improving active cervical ROM in the treatment of UMNP patients.

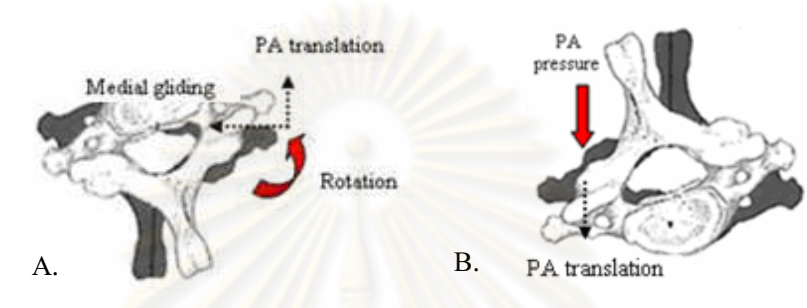


Figure 2.8 Movement occurred during the contralateral cervical rotation technique (A) and the IPA technique (B) applied to right facet joint (modified from Takasaki et al., 2009)

2.8 Summary

The selection of the use of cervical mobilization technique for MNP has followed the recommendation of manual therapy experts regarding to the distribution of symptoms. It has been suggested that a therapist would firstly use either the contralateral cervical rotation technique or IPA technique to treat a patient who has unilateral symptoms. Based on the articulation movement occurred during these two techniques, the contralateral cervical rotation technique would produce

articulation movements more than that of the IPA technique. Also the contralateral cervical rotation technique would affect a number of structures more than that of the IPA technique. Therefore, it is questioned that the contralateral cervical rotation technique might be more effective than that of the IPA technique in reliving neck pain and improving active cervical ROM in the treatment of UMNP patients.

CHAPTER III

METHODOLOGY

3.1 Introduction

This chapter describes the study design, characteristics of all participants, materials, outcome measures, procedure, data processing and data analysis.

3.2 Study design

Multiple comparisons of the effectiveness of the use of the contralateral rotation technique, the IPA technique and a placebo treatment in the treatment of UMNP patients were investigated using a randomized controlled trial with a blinded assessor. The random group allocations used a computer generating number with a random function of Microsoft Excel 2003. An assessor who was blinded to the intervention responded to take pre-and post-intervention data. The outcome measures including pain intensity both at rest and on most painful movement, 6

active cervical ROM and ROM on most painful movement, and GPE. All verbal instructions and standardized position were conducted in the same manner using a script. This study was approved by the Ethical Review Committee for Research Involving Human Subjecting and/or Use of Animal in Research, Health Science Group of Faculties, Colleges and Institutes, Chulalongkorn University, Thailand (Appendix A).

3.3 Participants

This section describes the participants in this study including subjects, a physical therapist and an assessor.

3.3.1 Subjects

UMNP patients attending the Health Sciences Service Center, Faculty of Allied Health Sciences, Chulalongkorn University were asked if they wished to participate. To be eligible, the patients needed to have these conditions: (1) their

age over 20 years old, (2) neck pain intensity at rest more than 20-mm on a visual analogue scale (VAS), (3) did not take any medications including non-steroid anti-inflammation drugs, muscle relaxant and pain relief on the treatment day (4) never received the cervical mobilization or SWD treatment. The patients were asked to fill out a questionnaire including the demographic data, the duration of symptoms, the area of pain and screening questions for any contraindications for the use of mobilization (Maitland et al., 2005). The potential patients were excluded if they have any of these conditions: (1) the contraindications of mobilization such as spine infection and recent spinal fracture, (2) positive neurological problems, (3) positive vertebrobasilar insufficient syndrome sign, (4) history of cervical spine surgery (Maitland et al., 2005). The patients who met the inclusion criteria were recruited, hereby called subjects.

3.3.2 Physical therapist

A physical therapist (Buamanee T.) who has been a graduate student in Musculoskeletal Physical Therapy Program, Faculty of Allied Health Sciences,

Chulalongkorn University involved in this study hereby called therapist. The therapist was responsible to assess the subject, establish the treatment dosage (grade of mobilization and spinal level treated) and treat all subjects. Additionally, the therapist had to train the manual assessment of the cervical spinal in order to identify a spinal treated level and the application of the cervical rotation and IPA techniques from a manual therapy expert who had had both clinical experience and a Master Degree in Manipulative Physiotherapy. The training aimed to validate the assessment procedure (Appendix B) and the application of manipulative therapy techniques. The application of these two techniques has been explained elsewhere (Maitland et al., 2005).

3.3.3 Assessor

An assessor (Kaewket M.) who has been a graduate student in Musculoskeletal Physical Therapy Program, Faculty of Allied Health Sciences, Chulalongkorn University was asked to involve in this study. The assessor who was blinded to the intervention was responsible to note all outcome measures before and 5-minute

after intervention (Kanlayanaphotporn et al., 2009; Martinez-Segura et al., 2006). The intra-tester reliability of the assessor was also determined (Appendix C).

3.4 Materials

This section describes the materials in this study including cervical range of motion device (CROM), a wooden chair, a pillow, a mirror, foam, a couch and SWD.

3.4.1 Cervical range of motion device

The CROM (Performance Attainment Associates, Roseville, Minnesota, The United States of America) consisted of a magnetic neck brace and 3 inclinometers mounted to the frame (Figure 3.1). The inclinometer in sagittal plane responded to measure the flexion and extension of the active cervical ROM. The inclinometer in frontal plane responded to measure the lateral flexion of the active cervical ROM. The inclinometer in horizontal plane responded to measure the rotation of the

active cervical ROM. The inclinometers in both sagittal and frontal planes worked with a gravity-dependent while the horizontal plane worked with a magnetic needle associated with magnetic neck brace to measure active cervical ROM.

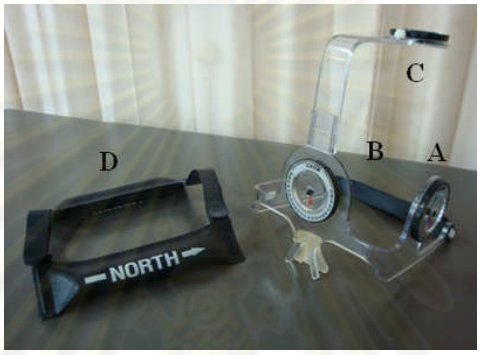


Figure 3.1 The cervical range of motion device (CROM). The A, B and C represent the inclinometer in sagittal plane, frontal plane and horizontal plane, respectively. The D represents the magnetic neck brace.

The CROM was shown to be valid for measuring of all cervical movements against the radiograph and the optoelectronic system with the Pearson's r correlation ranging from 0.82 to 0.98 (Tousignant et al., 2000; 2002; 2006). The inter- and intra-tester reliability was reported to be high with intraclass correlation coefficients (ICCs) ranging from 0.73 to 0.86 (Youdas et al., 1991) and 0.84 to 0.98 (Kanlayanaphotporn et al., 2009; Sakuna et al., 2007; Youdas et al., 1991),

respectively. The intra-tester reliability and the standard errors of measurements (SEM) of the recruited assessor were investigated prior to the data collection (Appendix C). It was noted that the assessor was reliable to measure active cervical ROM with the ICCs values ranging from 0.85 to 0.98 which was consistent to that of the previous studies (Kanlayanaphotporn et al., 2009; Sakuna et al., 2007; Youdas et al., 1991). Additionally, the SEMs of the recruited assessor using the CROM were less than 3 degrees

3.4.2 Wooden chair

A wooden chair was used during cervical ROM measurement. The height from the floor to the seat and the seat to the top of backrest were 45 centimeters. The seat dimension was 40x45 centimeters (cm). This wooden chair has the backrest for supporting the back to prevent the compensatory from thoracic while subjects move the neck. The subjects were asked to sit with the buttocks closed the back of chair.

3.4.3 Pillow

A pillow was used during cervical ROM measurement. The pillow dimension was 40x50 cm. The pillow was laid on the subject's lap for supporting the forearm to relax their shoulder while the subject was sitting on the wooden chair.

3.4.4 Mirror

A mirror was used during cervical ROM measurement. The mirror dimension was 100x150 cm. While the subjects sit on the wooden chair, this mirror was put in front of the subjects. This method is the self-feed back for the subject to recognize the neutral head position before initiating head movement.

3.4.5 Foam

The foam was used during cervical ROM measurement. The foam dimension was 30x40x10 cm. While the subjects were sitting on the wooden chair, the foam was

laid underneath their feet to support the hip and knee at 90 degrees. The foam was not necessary if the subject's feet could lay flat on the floor.

3.4.6 Couch

A high-adjustable couch (Gymna Uniphy, Belgium) was used in this study. The couch was able to adjust the hight in order to allow the therapist to use their body mechanic during the assessment and treatment procedures. Additionally, the couch had the face hole allowing the subject to breathe comfortably in prone position.

3.4.7 Short wave Diathermy

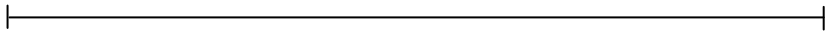
The SWD (ENRAF-NONIUS: model CURAPULS 970, 240V/50-60Hz) with 2 rubber pads was used in this study. The detuned SWD technique was used for all subjects in the control group.

3.5 Outcome measures

This section describes the outcome measures in this study including pain intensity, active cervical ROM and GPE.

3.5.1 Pain intensity

A visual analogue scale (VAS) was used to record the pain intensity both at rest and on most painful movement (Figure 3.2). The reliability and validity of the VAS has been reported to be high in order to measure the pain intensity (Ostelo & de Vet, 2005). This scale was shown to all subjects as a 100-millimeter (mm) line, the left end and right ended is labeled “no pain” and “pain as bad as it could be”, respectively. All subjects were asked to mark both before and 5-minute after the intervention on the same VAS to represent their pain intensity. A metal ruler was used to measure the distance from no pain to the marker to quantify the pain intensity. Also, the clinical important change for pain on VAS has been noted to be more than 14 mm (Kelly, 2001).



No pain Pain as bad as it could be

Figure 3.2 The visual analogue scale (VAS) (Ostelo & de Vet, 2005)

3.5.2 Active cervical range of motion

Active cervical ROMs were investigated including flexion, extension, lateral flexion and rotation to both sides using the CROM. In order to measure active cervical ROM, the subject was instructed to practice all cervical movements prior to the measurement in a standard sitting position (Figure 3.3). The position included the buttocks closed against the back of chair, elbow flexion about 90 degrees with a pillow support, hips and knees positioned about 90 degrees and both feet flat on the floor. If the feet were higher from the floor, the foam was laid underneath their feet. After the position was set, the frame of the CROM was then positioned to the subject's head using a Velcro strap and the magnetic neck brace was positioned on the subject's shoulder. The subject received the consistent verbal instruction (Appendix D) and was asked to stay the neutral head position

while the assessor read the inclinometer on 0 degree. Then, the subject was asked to perform maximal active cervical movement in each direction twice and the measurement was recorded on the second trial.

Figure 3.3 A standard sitting position in lateral view

3.5.3 Global Perceived Effect

GPE reflected the subject's satisfaction. The subjects were asked to score their symptom changes at 5-minute after the treatment. GPE will be noted using a numerical 7-point scale. The scale ranges from 1 to 7 where 1 represents completely recovered, 4 represents no change and 7 represents worse than ever

(Table 3.1). The clinical important change should define in term of any changes at least 2 on the 7-point scale (Ostelo & de Vet, 2005)

Score	Definition
1	completely recovered
2	much improved
3	slightly improved
4	no change
5	slightly worsened
6	much worsened
7	worse than ever

Table 3.1 The global perceived effect (GPE) scale (Ostelo & de Vet, 2005)

3.5.4 Neck disability index (NDI)

Thai NDI is a questionnaire (Appendix E) which was used to assess the neck pain related to the patient's disability (Luckumnueporn, 2007). The reliability and validity of NDI has been reported to be high in order to measure the neck disability in Thai MNP patients (Luckumnueporn, 2007). It consists of 10 items. Each item is about the level of activities which was disturbed by neck pain. The score of each item rated form 0 to 5 so the total score of this questionnaire varied from 0 to 50. When the subject finished the NDI questionnaire, the total NDI score would be calculated to percentage.

3.6 Procedure

The procedure of this study was conducted at the laboratory room number 3201, Health Sciences Service Center, Faculty of Allied Health Sciences, Chulalongkorn University. The UMNP patients were asked if they wish to participate in this study. The details of the study (Appendix F) were then fully explained to the patients. The agreed patients gave written consent (Appendix G) and filled out a questionnaire (Appendix H) including the demographic data, the duration of symptoms, the area of pain and NDI. The recruited patients hereby called subjects. The therapist then fully assessed the subject both subjective and objective examinations, and determined the treatment dosage including spinal level treated and grade of treatment. Then, the assessor was asked to establish pre-intervention data (Appendix I) including pain intensity and active cervical ROM.

The subjects were then randomly allocated into 3 groups; the rotation, IPA, and control groups by sealed envelops with assigned group. The sealed envelops were prepared prior to the trial using a computer generating a random number by a

Microsoft Excel program. The subjects in control group received a detuned SWD technique for 10 minutes in supine position. The subjects were asked to lie on the back comfortably with the shoulders on the 2 rubber pads. The subjects in the rotation group received 2 sets of 1-minute repetition of the contralateral rotation mobilization technique while the subjects in the IPA group received 2 sets of 1-minute repetition of the IPA mobilization technique. Both mobilization techniques were applied to the identified spinal level obtained from the physical assessment procedure. After the subjects received the intervention for 5 minutes, the assessor was then called to obtain post-intervention data (Appendix I) in the same manner as establishing pre-intervention data, and GPE (Appendix J). Flow of subjects through the trial was shown in Figure 3.4.

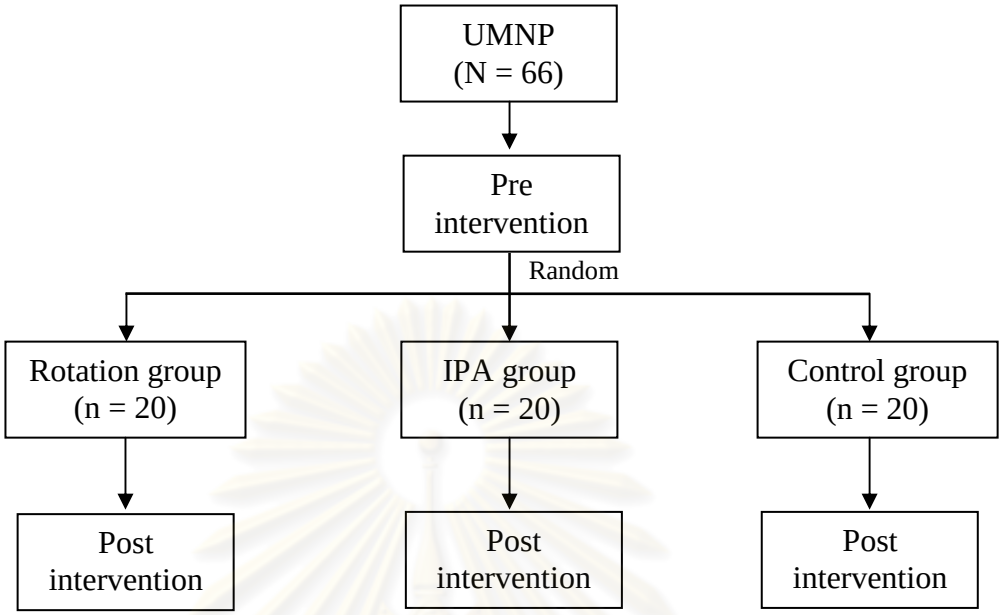


Figure 3.4 Flow of subjects through the trial

3.7 Data analysis

Mean and standard deviations (SDs) of the demographic data were calculated. Mean of change scores of each variable were calculated by subtracting the pre-intervention from post-intervention scores. The variable included pain at rest, pain on most painful movement, 7 cervical ROM including flexion, extension, ipsilateral flexion, contralateral flexion, ipsilateral rotation, contralateral rotation and ROM on most painful movement. Paired *t*-test was used to analyze within group effect and One-way ANOVA (multiple comparisons) was used to analyze

the different effects among 3 groups. All data were analyzed using the SPSS program version 17.0 for Windows with a significant level set at 0.05.

The clinical important change for pain on VAS was set to be more than 14 mm (Kelly, 2001), and the minimal detectable change (MDC) for active cervical ROM from the intra-tester reliability of the recruited assessor was set to be more than 6 degrees (Appendix C). The GPE was classified into 3 groups; (1-2) improved, (3-5) unchanged and (6-7) worsened. The percentages of subjects in each classified group were calculated and compared between groups.

CHAPTER IV

RESULTS

4.1 Introduction

The result of this study is shown in this chapter. The demographic data of subjects and the data of all outcome measures are presented as follows.

4.2 Demographic data of subjects

Eighty five of UMNP patients wished to participate in this study. Nineteen of the patients (6 males and 13 females) were excluded because their pains at rest were less than 20-mm on VAS. A total of sixty-six of UMNP subjects (8 males and 58 females) who met the inclusion criteria were recruited. Figure 4.1 shows the flow chart of the recruited subjects. The demographic data of subjects were indicated in Appendix K. The mean and SDs of the demographic data and pre-intervention data of all subjects are presented in Table 4.1. All variables were investigated using

One-way ANOVA: Multiple comparisons in order to ensure whether the subjects in each group were not different prior to the intervention. It was noted that there was no statistically significant difference of all variables among groups with *p* values > 0.05. The majority of subjects had their neck pain more than 90 days as characterized as chronic (P_{25-75}= 365-1825 days). Only 5 subjects had their neck pain between 30 and 90 days as characterized as subacute stage (2 in the contralateral cervical rotation group, 2 in the IPA group and 1 in the placebo group).

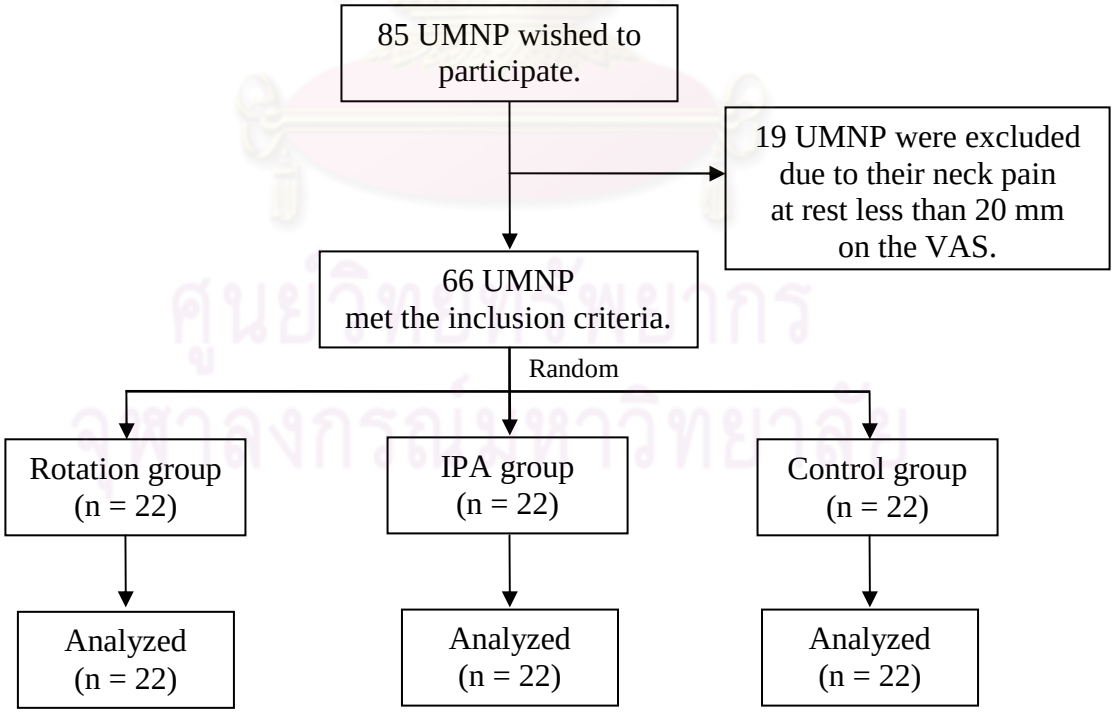


Figure 4.1 Flow chart of the recruited subjects through the trial

Table 4.1 The demographic data of the recruited subjects in each group (N=66)

Variables	Mean (SDs) of each group (n=22)		
	Rotation	**IPA**	**Control**
Sex (male/female)	2/20	3/19	3/19
Symptomatic side (left/right)	8/14	10/12	9/13
Age (years)	44.7 (12.0)	42.3 (12.6)	43.0 (12.5)
Height (m)	1.6 (0.1)	1.6 (0.1)	1.6 (0.1)
Body weight (kg)	58.5 (13)	58.2 (8.0)	61.1 (11.2)
Duration of neck pain (days)	1665.0 (1744.7)	1256.6 (1389.9)	1520.7 (1373.6)
Neck disability index (%)	29.5 (11.9)	25.2 (12.7)	24.3 (10.9)
Neck pain intensity (mm)			
At rest	44.0 (16.0)	47.3 (17.1)	45.2 (15.5)
On most painful movement	61.1 (18.6)	63.1 (20.9)	55.2 (18.0)
Active cervical ROM (degrees)			
Flexion	46.3 (10.9)	44.6 (9.9)	43.6 (10.7)
Extension	59.0 (10.1)	55.6 (13.8)	56.6 (10.1)
Ipsilateral lateral flexion	35.6 (5.6)	34.6 (6.6)	35.6 (6.6)
Contralateral lateral flexion	35.6 (6.3)	34.7 (7.4)	33.7 (6.6)
Ipsilateral rotation	59.5 (7.9)	56.3 (9.4)	58.4 (9.6)
Contralateral rotation	59.8 (9.1)	56.3 (10.4)	58.7 (10.7)
On most painful movement	48.3 (15.4)	45.6 (14.2)	43.0 (11.8)

4.3 Pain intensity, active cervical ROM and GPE

The majority of the subjects in both rotation and IPA groups received the grade of mobilization as grade 4 (Table 4.2). The pre- and post-intervention data, mean

(SDs) of the change score of each variable and Paired t-test result are shown in Table 4.3. With regards to the pain intensity, statistically significant differences of neck pain intensity both at rest and on most painful movement within rotation and IPA groups are noted with the $p<0.001$. With regards to the active cervical ROM, statistically significant differences of all active cervical ROM within rotation and IPA groups are noted with the $p<0.05$ except for the cervical flexion in the IPA group. It is noted that there is no statistically significant difference of all variables in control group.

Multiple comparisons using the One-way ANOVA were conducted to compare between group effects (Table 4.4). There was no statistically significant difference between the rotation and the IPA group. Statistically significant differences in pain at rest and pain on most painful movement are noted when the rotation and IPA groups were compared to the control group ($p<0.001$). Statistically significant differences in cervical extension, contralateral rotation and ROM on most painful movement are noted when compared both the rotation and IPA groups to the control group. Additionally, statistically significant difference in ipsilateral and

contralateral lateral flexion; and ipsilateral rotation are noted when compared the rotation group to the control group (p<0.05). The raw data of subjects were indicated in Appendix K.

Additionally, the number of subjects who rated each score on the GPE scale is presented in Table 4.5. The GPE was classified into 3 groups; (1-2) improved, (3-5) unchanged and (6-7) worsened. Approximately 30 percents of the subjects in both rotation and IPA groups rated their scale as improved while all of the subjects in control groups rated their scale as unchanged.

Table 4.2 The number of subjects in each grade of movement in rotation and IPA groups

Grade of movement	Number of subjects	
	Rotation	IPA
1	-	-
2	1	1
3	4	3
4	17	18

Table 4.3 Pre- and post-intervention data, mean (SDs) of the change score and Paired *t*-test result of all variables of each group

Variables	Rotation				IPA				Control			
	Mean (SDs)			*p*	Mean (SDs)			*p*	Mean (SDs)			*p*
	Pre	Post	Change		Pre	Post	Change		Pre	Post	Change	
Neck pain intensity (mm)												
At rest	44.0 (16.0)	29.2 (17.3)	14.8 (9.0)	0.000*	47.3 (17.1)	34.5(19.1)	12.9 (12.6)	0.000*	45.2(15.5)	45.1 (16.3)	-0.1 (8.3)	0.940
On most painful movement	61.1 (18.6)	44.8 (22.7)	16.3 (12.5)	0.000*	63.1 (20.9)	47.1 (28.6)	16.0 (15.1)	0.000*	55.2(18.0)	55.2 (20.8)	0.0 (7.0)	1.000
Active cervical ROM (°)												
Flexion	46.3 (10.9)	49.2 (9.4)	2.9 (6.0)	0.033*	44.6 (9.9)	44.9 (9.1)	0.36 (5.5)	0.758	43.6 (10.7)	42.8 (11.0)	-0.7 (5.8)	0.561
Extension	59.0 (10.1)	62.1 (9.9)	3.9 (5.3)	0.038*	55.6 (13.8)	60.7 (12.7)	5.2 (6.8)	0.002*	56.6 (10.1)	55.0 (11.1)	-1.6 (5.4)	0.195
Ipsilateral lateral flexion	35.6 (5.6)	37.5 (6.1)	1.8 (4.0)	0.047*	34.6 (6.6)	37.3 (6.2)	2.7 (5.5)	0.029*	35.6 (6.6)	34.7 (4.8)	-0.5 (3.3)	0.219
Contralateral lateral flexion	35.6 (5.8)	38.7 (5.8)	3.0 (4.0)	0.001*	34.7 (7.4)	37.9 (7.5)	3.3 (3.3)	0.000*	33.7 (6.6)	34.1 (5.7)	0.4 (3.7)	0.648
Ipsilateral rotation	59.5 (7.9)	62.5 (7.0)	3.0 (4.9)	0.009*	56.3 (9.4)	59.5 (9.2)	3.2 (5.6)	0.015*	58.4 (9.6)	57.3 (9.3)	-0.6 (4.8)	0.296
Contralateral rotation	59.8 (9.1)	65.2 (9.0)	5.6 (4.0)	0.000*	56.3 (10.4)	60.6 (11.4)	4.3 (4.3)	0.000*	58.7 (10.7)	59.1 (10.9)	0.4 (3.2)	0.605
On most painful movement	48.3 (15.4)	52.6 (15.1)	3.9 (5.8)	0.003*	45.6 (14.2)	49.5 (15.2)	3.8 (5.6)	0.004*	43.0 (11.8)	42.9 (12.0)	-0.3 (5.2)	0.936

Pre, post and change represent pre-intervention data, post-intervention data and change score, respectively.

°, *p* and * represent degrees, *p*-value and statistically significant difference ($p<0.05$), respectively.

Table 4.4 The *p*-values of the multiple comparisons

Variables	I versus II	I versus III	II versus III
Neck pain intensity (mm)			
At rest	0.800	0.000*	0.000*
On most painful movement	0.996	0.000*	0.000*
Active cervical ROM (degrees)			
Flexion	0.312	0.098	0.804
Extension	0.755	0.009*	0.001*
Ipsilateral lateral flexion	0.770	0.204	0.048*
Contralateral lateral flexion	0.985	0.052	0.035*
Ipsilateral rotation	0.992	0.055	0.042*
Contralateral rotation	0.526	0.000*	0.004*
On most painful movement	0.998	0.038*	0.043*

I, II and III represent rotation group, IPA group and control group, respectively.

* represents the statistically significant difference (p<0.05).

Table 4.5 The number of subjects who rated each score on the GPE scales after intervention

GPE	Rotation		IPA		Control	
	Number of subjects	%	Number of subjects	%	Number of subjects	%
1 = completely recovered	-	27.3	-	31.8	-	0
2 = much improved	6		7		-	
3 = slightly improved	13		13		7	
4 = no change	3	72.2	2	68.2	13	100
5 = slightly worsened	-		-		2	
6 = much worsened	-	0	-	0	-	0
7 = worse than ever	-		-		-	

CHAPTER V

DISCUSSION

5.1 Introduction

The purpose of this study was to compare the effectiveness of the contralateral cervical rotation technique to the IPA technique in reliving pain and improving cervical ROM in the treatment of UMNP patients. The subjects were randomly allocated into three groups. The subjects in rotation group and IPA group received 2 sets of 1-minute repetition contralateral cervical rotation and IPA technique, respectively. The subjects in control group received a placebo treatment for 10 minutes using a detuned SWD technique. One-way ANOVA with multiple comparisons was used to investigate the effectiveness of these three interventions. A total of 10 variables were investigated. These included pain at rest, pain on most painful movement, 7 cervical ROM including flexion, extension, ipsilateral flexion, contralateral flexion, ipsilateral rotation, contralateral rotation and ROM on most painful movement, and GPE. The results suggest that the rotation

technique and the IPA were superior to the placebo treatment whereas the rotation technique was not superior to the IPA technique. Also, the within group comparison shows that rotation and the IPA techniques were effective in reliving neck pain (p=0.000), and improving active cervical ROM almost all directions (p<0.05).

5.2 Effectiveness of the cervical rotation technique and the IPA technique on neck pain intensity

Comparing the effectiveness of the cervical rotation technique to that of the IPA technique, there was no statistically significant difference on the change score of pain intensity between these two techniques. This would imply that the effectiveness of the cervical rotation technique was not superior to that of the IPA technique on pain relief. However, the within group analysis after the use of these two techniques revealed a significant difference on pain relief (p<0.001) with the mean change of 14.8 and 12.9 mm on the VAS for the rotation and IPA groups, respectively. It would be possible that both techniques are effective in pain relief;

therefore the statistical analysis would not detect the significant difference in the decrease in pain intensity between groups.

Comparing the mean change of pain intensity at rest between the rotation group to that of the IPA group, it was noted that the pain relief effect after the application of the rotation technique was greater than that of the IPA technique (Table 4.3). This is also consistent when compared to the previous studies (Kanlayanaphotporn et al., 2009; Sakuna et al., 2007). This may imply that the rotation technique is superior to the IPA technique in relieving pain intensity at rest. There are a number of explanations accounting for this finding. First, grip type, comparing the size of the contact areas between the thumb grip used during the IPA mobilization and the thrusting knuckle grip used during the rotation mobilization, it can be seen that the contact area of the thumb grip is relatively smaller than that of the knuckle grip. A small contact area would produce more pain or soreness around the treated area after the treatment (Snodgrass et al., 2006). Consequently, the patient who was treated with the IPA mobilization may rate their pain intensity at rest after the treatment more than the patient who was treated with the rotation mobilization.

Second, the available range of movement during the rotation mobilization is commonly larger than that of the PA mobilization. This would therefore allow the therapist to apply the rotation oscillatory movements in a greater range which is more controllable than that of the PA technique. This is matched to the recommendation to apply a set of passive movement in a larger range in order to relief pain (Maitland et al., 2005). Therefore, the more hypoalgesic effect at rest after the application of rotation mobilization than that of the IPA mobilization would be explained by this evidence.

Last, the rotation mobilization would have an effect on ipsilateral side of the UMNP such as muscles, ligament and neural tissues resulting in a decrease in the pain intensity. Unfortunately, this study was designed to collect all data which were mainly concerned in clinical practice. Therefore, interpreting these results with this regards is limited. In order to understand this mechanism, additional data of cervical muscle activity using electromyographic study or nerve conduction velocity are required.

However, the decrease in pain intensity after the use of both techniques is consistent to previous studies (Kanlayanaphotporn et al., 2009; Sakuna et al., 2007). In consideration to the effectiveness of the IPA mobilization, the current study noted the greater immediate pain reduction at rest (12.8 mm.) than that of the previous studies (ranged 8.1- 10.8 mm.). This would be because of the different design between the current study to the previous studies (Sakuna et al., 2007, Kanlayanaphotporn et al., 2009). The previous studies allowed the therapist to applied the IPA mobilization more than 1 levels whereas the current study allowed the therapist to apply the IPA mobilization to only 1 level. The former study did not state the exact number of the spinal levels treated in their study (Sakuna et al., 2007) while the later study allowed the therapist to apply the IPA technique to 2-4 spinal levels in each subject (Kanlayanaphotporn et al., 2009). It would be possible that applying the mobilization more than 1 level would cause the soft tissue soreness around the treated area. This soreness would mark the effectiveness of the IPA on pain intensity noted in the previous studies. Consequently, the recruited subjects might rate their pain intensity after the treatment higher than it should be.

5.3 Effectiveness of the contralateral cervical rotation technique and the IPA technique in improving active cervical ROM

Comparing the effectiveness of the cervical rotation technique to that of the IPA technique, there was no statistically significant difference on active cervical ROM between these two techniques. This would imply that the effectiveness of the cervical rotation technique is not superior to that of the IPA technique on improving in cervical ROM.

However, the within group analysis after the use of these two techniques revealed a significant difference on improving in almost all directions of cervical ROMs (p<0.05). In consideration to the change in the cervical ROM of each direction, it can be seen that the change scores of all ROM are less than the MDC of the use of the CROM device obtained from the intra-tester reliability of the recruited assessor (6 degrees). This would imply that the use of these two techniques is not effective on the improving in the active cervical ROM for UMNP. Generalization of these results should be made with care because the majority of recruited subjects were

chronic (more than 3 years) and had stiffness problem as a predominant factor, therefore, only single visit for treatment could not affect on cervical ROM. The different findings may be noted in either other groups of UMNP (i.e. shorter duration of neck pain or UMNP who has pain as a predominant factor) or after a course of treatment.

Even though the mean change of the active cervical ROM noted in the current study was less than MDC, most of the changes of the ROM are greater than the SEM (less than 3 degree) of the use of the CROM device obtained from the intra-tester reliability of the recruited assessor. It is noticeable that the means change of the contralateral rotation (5.6 degrees) and cervical extension (5.2 degrees) are the greatest improvement for the subjects who received contralateral rotation and IPA mobilization, respectively. This would be explained by the arthrokinematic movements occurred during the application of these techniques. When the rotation technique is applied, this would make the superior articulation primarily glided in PA and the medial directions on the inferior articulation (Bogduk & Mercer, 2000). Consequently, this would promote the rotation movement of the cervical spine.

Similarly to when the PA technique is applied, this would make the superior articulation primarily glided on the inferior articulation in the PA direction (Bogduk & Mercer, 2000). Consequently, this would promote the extension movement of the cervical spine.

5.4 Effectiveness of the contralateral cervical rotation technique and the IPA technique on GPE

After the application of these two techniques, the subjects rated the GPE to represent the satisfaction of the intervention. None of subjects got worse after the application both interventions. Approximately 30 percents of the subjects who received these two treatment techniques rated their scale as improved whereas all of the subjects in control groups rated their scale as unchanged. These findings are consistent with the previous study (Kanlayanaphotporn et al., 2009).

5.5 Limitations of this study

The results of this study should be interpreted with care because of some limitations. First, this study compared the immediate effect of the contralateral cervical rotation technique to the IPA technique in reliving neck pain and improving cervical ROM in the treatment of UMNP patients, different findings might be noted if there is a study investigating on a long term effect. Second, most of the recruited subjects are chronic, different findings may be noted in other groups of UMNP or after a course of treatment. Third, there are a number of outcome measures such as electromyography and nerve conduction velocity of the cervical muscles needed in order to explain the different in the mechanism of these two techniques.

5.6 Suggesting for further study

Repeating a study to compare the effectiveness of the contralateral cervical rotation to that of the IPA mobilization is needed. It would be interesting if the long term

effect of the application of the rotation technique is investigated. Then, a study comparing the long term effect of the rotation to that of the IPA mobilization is needed to conduct.

CHAPTER VI

CONCLUSION

Based on the result of this study, it suggested important clinical remarks in the application of the recommended mobilization techniques in the treatment of UMNP. First, the application of the rotation technique would be an alternative approach for a therapist to treat UMNP. Second, the results also suggested a therapist to deliver the mobilization technique to only 1 spinal level in order to not only get the most pain relief effect but also avoid adverse effects such as soreness of the treated area. Third, the cervical rotation should be selected if the IPA technique could not apply directly to the affected joint. Last, a therapist should firstly choose the contralateral cervical rotation technique to treat UMNP patients who mostly limit contralateral cervical rotation while a therapist should firstly choose the IPA technique to treat UMNP patients who mostly limit extension movement.

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APPENDICES

APPENDIX A

Ethical approval granted by the Ethical Review Committee for Research Involving Human Subjecting and/or Use of Animal in Research, Health Science Group of Faculties, Colleges and Institutes, Chulalongkorn University, Thailand

สำเนา

เลขที่ใบรับรอง 071/2550

คณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์และการใช้สัตว์ทดลองในการวิจัย
กลุ่มวิทยาศาสตร์สุขภาพ จุฬาลงกรณ์มหาวิทยาลัย

โครงการวิจัย : ประสิทธิผลของการเลือกใช้เทคนิคการดัดดึงกระดูกสันหลังเพื่อรักษาอาการปวดคอ
EFFECTIVENESS OF VARIOUS SPINAL MANIPULATIVE TECHNIQUES IN PATIENTS WITH NECK PAIN

ผู้วิจัยหลัก : ผู้ช่วยศาสตราจารย์ ดร.อดิษฐ์ จิรเดชนันท์ อาจารย์

หน่วยงาน : คณะสหเวชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

คณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์และการใช้สัตว์ทดลองในการวิจัย กลุ่มวิทยาศาสตร์สุขภาพ จุฬาลงกรณ์มหาวิทยาลัย

☑ อนุมัติในแง่จริยธรรมให้ดำเนินการศึกษาวิจัยเรื่องข้างต้นได้

.....ประธาน
(รองศาสตราจารย์ นายแพทย์ปริดา ทัศนประดิษฐ์)

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APPENDIX B

AGREEMENT OF MANUAL ASSESSMENT OF THE CERVICAL SPINE

B I Introduction

A physical therapist has to precisely assess both subjective examination and objective examination in order to design the most appropriate manipulative therapy for a patient with musculoskeletal disorder. Manual assessing using passive intervertebral movement is a very important procedure because the manual assessment results always give the therapist clue to select an appropriate target spinal level treated. Therefore, this pilot study aimed to investigate the agreement on the judgment made on selecting the spinal level treated between the recruited therapist and a manipulative therapy expert.

B II Procedure

The recruited physical therapist who enrolled in a graduate program in Musculoskeletal Physical Therapy Program, Faculty of Allied Health Sciences, Chulalongkorn University was fully informed and practiced in assessing a spinal segmental mobility by a manual therapy expert. The manipulative therapy expert who held a Master of Physiotherapy (Manipulative Physiotherapy) and a Doctor of Philosophy Degree, and had had clinical experience more than 20 years instructed the recruited therapist to assess five UMNP to find the cervical spinal level treated as a training session. To be selected as the cervical spinal level treated, the expert instructed the therapist to identify the most stiffness or painful cervical spinal level of the UMNP using passive accessory intervertebral movement. During the assessment, the expert allowed the therapist to assess each cervical spine using 2-3 the passive movement and the assessment would be able to repeat more than 2 times. Both therapists assessed five UMNP together. If the recruited therapist did not agree with the assessment result obtained by the expert, the expert would discuss the result with the therapist.

After the training session, ten patients with UMNP were recruited as subjects to investigate the agreement on the judgment of the cervical spinal level treated between the therapist and the expert. All subjects were assessed twice in prone position by these two therapists with 5 minutes break after the first assessment. The order of assessing was randomized using a computer generating the order. Then the first therapist assessed the spinal mobility using the passive accessory intervertebral movement test through the cervical spine both on the spinous processes and the facet joints. After completion of the assessment, the therapist recorded the spinal level treated, pre-dominant factor and grade of movement (Appendix L). Both therapists were blinded to each other's results and the results were kept for further analysis.

B III Data analysis

The kappa statistic (K) showed the agreement of three variables. K was calculated from formula 1. K score was interpreted as follows: the values less than 0.40 indicated poor to fair agreement, 0.40 – 0.60 indicated moderate agreement, 0.61 –

0.80 indicated substantial levels of agreement, and more than 0.81 indicated excellent agreement.

$$\underline{\text{Formula 1}} \quad K = \frac{\sum f_0 - \sum f_c}{N - \sum f_c}$$

K represents kappa statistic, $\sum f_0$ represents the sum of the frequencies of observed agreements, $\sum f_c$ represents the sum of the frequencies of agreement expected by chance, and N represents the number of pairs of scores that were obtained (Portney & Warkins, 2000).

B IV Results

Ten UMNP subjects (1 male and 9 female) were recruited in this study. The agreement of three variables varied from 0.8 – 1.0. The collecting data were shown in Table B.1.

Table B.1 The collecting data of two examiners

Subjects	Spinal level treated		Pre-dominant factor		Grade of movement	
	Expert	Therapist	Expert	Therapist	Expert	Therapist
1	Rt. C3	Rt. C3	R	R	IV	IV
2	Rt. C2	Rt. C3	R	R	IV	IV
3	Lt. C2	Lt. C2	R	R	IV	IV
4	Lt. C2	Lt. C2	R	R	IV	IV
5	Rt. C2	Rt. C2	R	R	IV	IV
6	Lt. C4	Lt. C4	R	R	IV	IV
7	Rt. C2	Rt. C2	R	R	IV	IV
8	Rt. C3	Rt. C3	R	R	IV	IV
9	Rt. C2	Rt. C2	R	R	IV	IV
10	Lt. C2	Lt. C2	R	R	IV	IV
K scores	0.8		1.0		1.0	

Lt**.,** Rt., R and K represent left facet joint, right facet joint, resistance and kappa statistic, respectively.

B V Discussion

The agreement on the judgment made on the spinal level treated, pre-dominant factor and the grade of movement between the expert and the recruited therapist are in excellent agreement. The recruited therapist who was trained by the manipulative physical therapy expert would be able to identify the treated spinal level, patient's problem using the passive accessory intervertebral movement test.

B VI Conclusion

Base on these results, the recruited therapist is capable to assess and identify the treatment dosage for the use of manipulative therapy in the treatment of MNP.

B VII References

Portney, L., & Watkins, M. (2000). Foundations of clinical research: applications to practice. In 2(Ed.). New Jersey: Trentice-Hall.

APPENDIX C

INTRA-TESTER RELIABILITY OF THE CERVICAL RANGE OF MOTION MEASUREMENT USING CERVICAL RANGE OF MOTION INSTRUMENT IN MECHANICAL NECK PAIN

C I Introduction

Cervical range of motion (ROM) is one of the outcome measures representing the effectiveness of the treatment intervention. There are a number of methods that could measure the cervical ROM including visual estimation, universal goniometer and cervical range of motion instrument (CROM). The CROM is one of devices that is claimed to be an appropriate in measuring the cervical ROM. There are a number of studies investigating the validity of the CROM in measuring cervical ROM. It has been showed that the CROM was valid against radiography in measuring the cervical ROM with the Pearson's r correlation ranging from 0.82 to 0.98 (Tousignant et al., 2000; 2002; 2006). Additionally the inter- and intra-tester reliability of the CROM in measuring cervical ROM was investigated. It has been stated that the correlation coefficient was 0.73 to 0.86 (Youdas et al., 1991) and

0.84 to 0.98 (Kanlayanaphotporn et al., 2009; Kongsawatvarakul & Chiradejnant 2007; Sakuna et al., 2007; Siriprapaporn et al., 2007; Youdas et al., 1991) for inter- and intra-tester reliability, respectively. Even though there are a number of studies reporting on the reliability values, it has been recommended to investigate the test-retest reliability of a recruited assessor for each study. This was to ensure if the pre- and post-intervention data were different, these would be the results from the intervention. Therefore, this pilot study aimed to investigate the intra-tester reliability of the recruited assessor in measuring the cervical ROM using the CROM in the mechanical neck pain (MNP) patients.

C II Procedure

A test-retest design was used to investigate the intra-tester reliability of the recruited assessor who was a graduate student in Musculoskeletal Physical Therapy Program, Faculty of Allied Health Sciences, Chulalongkorn University. The assessor was asked to train the use of CROM in a standardized protocol which

was identical to the protocol in the main study. Ten UMNP patients were recruited as subjects.

In order to measure active cervical ROM, the subject was set in a standard sitting position. The position included the buttocks closed against the back of chair, elbow flexion about 90 degrees with a pillow support, hips and knees positioned about 90 degrees and both feet flat on the floor. If the feet were higher from the floor, the foam was laid underneath their feet. After the position was set, the frame of the CROM was then positioned to the subject's head using a Velcro strap and the magnetic neck brace was positioned on the subject's shoulder. The subject received the consistent verbal instruction (Appendix D). The subject was asked to stay the neutral head position while the assessor read the inclinometer on 0 degree. Then, the subject was asked to perform maximal active cervical movement in each direction twice. The ROM measurements were recorded on the second trial. Six variables including cervical ROM on flexion, extension, lateral flexion to both sides and rotation to both sides were recorded. After the completing the first session, the subject was allowed to rest for 5 minutes and the CROM was removed

from the subject's head. The first session data were immediately kept away from the assessor. The CROM was then positioned to the subject's head and the data of the second session was obtained by the same procedure as the first session. ROM data from both sessions were kept (Appendix M) for further investigation.

C III Data analysis

Intraclass correlation coefficients ($ICCs_{1,2}$) were calculated to shown the reliability of the assessor in using the CROM. The ICC value was interpreted as follows: the value between 0 – 0.25 indicated no relationship, 0.25 – 0.50 indicated fair, 0.50 – 0.75 indicated moderate to good, and more than 0.75 indicated good to excellent (Portney & Warkins, 2000). Paired *t*-test was used to analyze the data between first and second session with a significant level set at 0.05. Both ICCs and Paired *t*-tests were analyzed using the SPSS program version 17.0 for Windows. Additionally, the standard error of measurement (SEM) and the minimal detectable change (MDC) were calculated using the formula 1 and formula 2, respectively.

Formula 1 $SEM = SD \times \sqrt{1-r}$

SEM, SD and r represent the standard error of measurement, standard deviation and reliability coefficient, respectively (Portney & Warkins, 2000).

Formula 2 $MDC_{95\%} = 1.96 \times SEM \times \sqrt{2}$

MDC represents the minimal detectable change, 1.96 is the standard normal score associated with a two-tailed 95% confidence interval, and the $\sqrt{2}$ is included to reflect the fact that there is measurement error associated with both the first and second repeated measures when calculating test–retest reliability (Piva et al., 2006).

C IV Results

Ten UMNP (2 males and 8 females) were recruited in this study. Table C.1 showed the ICCs values, SEM and MDC obtained from the recruited assessor. The ICCs values ranged from 0.85–0.98 of the recruited assessor in the use of the CROM to measure cervical ROM was noted. There was no statistical significant difference

between the data obtained from the first and second session. The SEM and MDC ranged from 1.39–2.12 and 3.85–5.88 degrees, respectively. The raw data were shown in APPENDIX N.

Table C.1 The intraclass correlation coefficients (ICCs) of the assessor

Variables	ICCs	95% CI	SEM (degree)	MDC (degree)	*p*
Flexion	0.98	0.92 – 1.00	1.68	4.66	0.64
Extension	0.95	0.83 – 0.99	2.01	5.57	0.77
Ipsilateral lateral flexion	0.94	0.76 – 0.98	1.39	3.85	0.41
Contralateral lateral flexion	0.85	0.51 – 0.96	2.09	5.79	0.82
Ipsilateral rotation	0.94	0.79 – 0.99	2.12	5.88	0.81
Contralateral rotation	0.91	0.68 – 0.98	1.50	4.16	0.86

ICCs, CI, SEM and MDC represent intraclass correlation coefficients, confidence interval, standard error of measurement and minimal detectable change, respectively

C V Discussion

The ICC values from this study are consistent with that of the previous studies (Kanlayanaphotporn et al., 2009; Kongsawatvarakul & Chiradejnant 2007; Sakuna et al., 2007; Siriprapaporn et al., 2007; Youdas et al., 1991). The SEM and MDC values are well in the range as noted in the previous studies (Kanlayanaphotporn et

al., 2009; Kongsawatvarakul & Chiradejnant 2007; Sakuna et al., 2007; Siriprapaporn et al., 2007). Base on these results, it can imply that the recruited assessor was reliable in measuring cervical ROM using the CROM. Additionally, the change in the cervical ROM more than 6 degrees after the treatment would represent the effectiveness of the treatment intervention.

C VI Conclusion

The assessor was reliable to measure active cervical ROM using CROM and the change in cervical ROM more than 6 degrees after the treatment would represent the effectiveness of the treatment intervention

C VII References

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APPENDIX D

INSTRUCTION FOR SUBJECTS

Instruction for all subjects to perform six active cervical range of motion in standard sitting position

ผู้วิจัยเริ่มกระบวนการวิจัยด้วยการวัดองศาการเคลื่อนไหวของคอในท่าตั้งต้น 1 ท่า คือ ท่านั่ง โดยผู้วัดจะวางมือไว้บริเวณไหล่ของผู้เข้าร่วมงานวิจัย เพื่อจำกัดการเคลื่อนไหวให้เกิดขึ้นเฉพาะส่วนของคอ โดยอธิบายให้ผู้เข้าร่วมการวิจัยทราบถึงขั้นตอนการวัด ดังนี้

“ในขณะทำการวัดองศาการเคลื่อนไหวของคอ ดิฉันจะให้คำสั่ง และให้คุณทำการเคลื่อนไหวในท่านั้นอย่างช้าๆ โดยเคลื่อนไหวเฉพาะส่วนของคอเท่านั้น ไม่ให้มีการเคลื่อนไหวของไหล่ ถ้ามีการเคลื่อนไหวของไหล่เกิดขึ้น ก็จะเกิดแรงต้านระหว่างไหล่และมือของดิฉันที่วางเอาไว้”

จากนั้น ผู้วัดทำการซ้อมและสาธิตท่าทางที่จะทำการวัดทั้ง 6 ท่า พร้อมสิ่งที่ควรระวัง ดังนี้

“*ท่าแรก* ดิฉันจะให้ก้มคอลง ตามองพื้น ก้มลงไปให้มากที่สุดเท่าที่จะทำได้ ปล่อยคอสบายๆ ไม่ต้องเกร็ง ก้มลงเฉพาะส่วนของคอ หลังพิงพนักเก้าอี้ไว้ ไม่ต้องเคลื่อนตามลงมา

ท่าที่สอง ให้เงยคอขึ้น ตามองเพดาน เงยขึ้นไปให้มากที่สุดเท่าที่จะทำได้ ปล่อยคอสบายๆ ไม่ต้องเกร็ง เงยเฉพาะส่วนของคอ หน้าอกไม่แอ่นตามมา

ท่าที่สาม ให้เอียงคอไปด้านซ้ายให้มากที่สุดเท่าที่จะทำได้ เอียงคอสบายๆ ไม่ต้องเกร็ง เอียงเฉพาะส่วนของคอ ไหล่ขวาไม่เอียงตามมา

ท่าที่สี่ ให้เอียงคอไปด้านขวาให้มากที่สุดเท่าที่จะทำได้ เอียงคอสบายๆ ไม่ต้องเกร็ง เอียงเฉพาะส่วนของคอ ไหล่ซ้ายไม่เอียงตามมา

ท่าที่ห้า ให้หันหน้าไปด้านซ้ายให้มากที่สุดเท่าที่จะทำได้ หันหน้าสบายๆ ไม่ต้องเกร็ง หันเฉพาะส่วนของคอ ไหล่ขวาพิงพนักเก้าอี้ไว้ไม่ให้หันตามมา

ท่าที่หก ให้หันหน้าไปด้านขวาให้มากที่สุดเท่าที่จะทำได้ หันหน้าสบายๆ ไม่ต้องเกร็ง หันเฉพาะส่วนของคอ ไหล่ซ้ายพิงพนักเก้าอี้ไว้ไม่ให้หันตามมา”

จากนั้น ให้ผู้เข้าร่วมงานวิจัยนั่งตัวตรงบนเก้าอี้ไม้ หลังส่วนล่างชิดพนักพิง สวมเครื่องมือและจัดท่าเริ่มต้นให้

1. Cervical flexion

   เมื่อผู้เข้าร่วมงานวิจัยอยู่ในท่าตั้งต้นที่กำหนดไว้แล้ว ผู้วิจัยให้คำสั่งดังนี้ “ก้มคอช้าๆให้เต็มที่ โดยไม่ให้มีการเคลื่อนไหวในส่วนของไหล่ไปทางด้านหน้า”

2. Cervical extension

   เมื่อผู้เข้าร่วมงานวิจัยอยู่ในท่าตั้งต้นที่กำหนดไว้แล้ว ผู้วิจัยให้คำสั่งดังนี้ “เงยคอช้าๆให้เต็มที่ โดยไม่ให้มีการเคลื่อนไหวในส่วนของไหล่ไปทางด้านหลัง”

3. Cervical left lateral flexion

เมื่อผู้เข้าร่วมงานวิจัยอยู่ในท่าตั้งต้นที่กำหนดไว้แล้ว ผู้วิจัยให้คำสั่งดังนี้ “เอียงคอไปด้านซ้ายช้าๆให้เต็มที่ โดยไม่ให้ไหล่ขวายกขึ้น”

4. Cervical right lateral flexion

เมื่อผู้เข้าร่วมงานวิจัยอยู่ในท่าตั้งต้นที่กำหนดไว้แล้ว ผู้วิจัยให้คำสั่งดังนี้ “เอียงคอไปด้านขวาช้าๆให้เต็มที่ โดยไม่ให้ไหล่ซ้ายยกขึ้น”

5. Cervical left rotation

เมื่อผู้เข้าร่วมงานวิจัยอยู่ในท่าตั้งต้นที่กำหนดไว้แล้ว ผู้วิจัยให้คำสั่งดังนี้ “หันหน้าไปด้านซ้ายช้าๆให้เต็มที่ โดยไม่ให้มีการเคลื่อนไหวในส่วนของไหล่ตามมา”

6. Cervical right rotation

เมื่อผู้เข้าร่วมงานวิจัยอยู่ในท่าตั้งต้นที่กำหนดไว้แล้ว ผู้วิจัยให้คำสั่งดังนี้ “หันหน้าไปด้านขวาช้าๆให้เต็มที่ โดยไม่ให้มีการเคลื่อนไหวในส่วนของไหล่ตามมา”

APPENDIX E

NECK DISABILITY INDEX

ดัชนีชี้วัดการจำกัดการทำกิจกรรมจากอาการปวดคอ (Luckumnueporn, 2007)

คำชี้แจง: แบบสอบถามนี้ถูกออกแบบขึ้นเพื่อให้ข้อมูลกับผู้รักษาว่าอาการปวดคอมีผลต่อการทำกิจวัตรประจำวันของคุณอย่างไร กรุณาตอบแบบสอบถามทุกข้อ หากมีตัวเลือกที่ตรงกับคุณมากกว่าหนึ่งข้อ ***โปรดทำเครื่องหมายหน้าตัวเลือกที่บรรยายลักษณะใกล้เคียงกับคุณมากที่สุดเพียงข้อเดียว***

1. ระดับความเจ็บปวด

- ☐ ในขณะนี้ ฉันไม่มีอาการปวดเลย
- ☐ ในขณะนี้ ฉันมีอาการปวดเล็กน้อย
- ☐ ในขณะนี้ ฉันมีอาการปวดปานกลาง
- ☐ ในขณะนี้ ฉันมีอาการปวดค่อนข้างรุนแรง
- ☐ ในขณะนี้ ฉันมีอาการปวดรุนแรงมาก
- ☐ ในขณะนี้ ฉันมีอาการปวดมากที่สุดเท่าที่จะจินตนาการได้

2. การดูแลตัวเอง (เช่น การอาบน้ำ การแต่งตัว เป็นต้น)

- ☐ ฉันสามารถดูแลตัวเองได้ตามปกติ โดยไม่มีอาการปวดเพิ่มขึ้น
- ☐ ฉันสามารถดูแลตัวเองได้ตามปกติ แต่มีอาการปวดเพิ่มขึ้น
- ☐ ในขณะที่ดูแลตัวเองฉันมีอาการปวด ฉันต้องทำช้าๆ ด้วยความระมัดระวัง
- ☐ ฉันสามารถดูแลตัวเองได้เป็นส่วนใหญ่ แต่ต้องการความช่วยเหลือบ้าง
- ☐ ฉันต้องการความช่วยเหลือในทุกๆวัน ในการดูแลตัวเองเกือบทุกอย่าง
- ☐ ฉันไม่สามารถแต่งตัวเองได้ ฉันอาบน้ำด้วยความลำบากและนอนอยู่บนเตียงเป็นส่วนใหญ่

3. การยกของ

- ☐ ฉันสามารถยกของหนักได้ โดยไม่มีอาการปวดเพิ่มขึ้น
- ☐ ฉันสามารถยกของหนักได้ แต่จะทำให้อาการปวดเพิ่มขึ้น
- ☐ ฉันไม่สามารถยกของหนักขึ้นจากพื้นได้เนื่องจากมีอาการปวด แต่ฉันสามารถยกของนั้นได้ ถ้ามันอยู่ในตำแหน่งที่สามารถยกได้สะดวก เช่น บนโต๊ะ
- ☐ ฉันไม่สามารถยกของหนักขึ้นจากพื้นได้เนื่องจากอาการปวด แต่ฉันสามารถยกของที่มีน้ำหนักเบาถึงปานกลางได้ ถ้ามันอยู่ในตำแหน่งที่สามารถยกได้สะดวก
- ☐ ฉันสามารถยกของที่เบาๆ ได้
- ☐ ฉันไม่สามารถยกหรือถือของได้เลย

4. การอ่านหนังสือ

- ☐ ฉันสามารถอ่านได้มากเท่าที่ต้องการ โดยไม่มีอาการปวดคอ
- ☐ ฉันสามารถอ่านได้มากเท่าที่ต้องการ แต่มีอาการปวดคอเล็กน้อย
- ☐ ฉันสามารถอ่านได้มากเท่าที่ต้องการ แต่มีอาการปวดคอปานกลาง
- ☐ ฉันไม่สามารถอ่านได้มากเท่าที่ต้องการ เนื่องจากมีอาการปวดคอปานกลาง
- ☐ ฉันไม่สามารถอ่านได้มากเท่าที่ต้องการ เนื่องจากมีอาการปวดคอรุนแรง
- ☐ ฉันไม่สามารถอ่านได้เลย

5. ปวดศีรษะ

- ☐ ฉันไม่มีอาการปวดศีรษะใดๆ
- ☐ ฉันมีอาการปวดศีรษะเล็กน้อย แต่ไม่บ่อย
- ☐ ฉันมีอาการปวดศีรษะปานกลาง แต่ไม่บ่อย
- ☐ ฉันมีอาการปวดศีรษะปานกลาง บ่อยๆ
- ☐ ฉันมีอาการปวดศีรษะรุนแรง บ่อยๆ
- ☐ ฉันมีอาการปวดศีรษะเกือบตลอดเวลา

6. การมีสมาธิ หรือความจดจ่อในการทำงาน

- ☐ ฉันมีสมาธิเต็มที่ตามที่ต้องการ โดยไม่ลำบาก
- ☐ ฉันมีสมาธิเต็มที่ตามที่ต้องการ โดยมีความลำบากเล็กน้อย
- ☐ ฉันมีความลำบากปานกลาง เมื่อฉันต้องการมีสมาธิ
- ☐ ฉันมีความลำบากมาก เมื่อฉันต้องการมีสมาธิ
- ☐ ฉันมีความลำบากอย่างยิ่งยวด เมื่อฉันต้องการมีสมาธิ
- ☐ ฉันไม่มีสมาธิเลย

7. การทำงาน หรือการประกอบอาชีพ

- ☐ ฉันสามารถทำงานได้มากเท่าที่ต้องการ
- ☐ ฉันสามารถทำงานประจำได้ตามปกติ แต่ไม่สามารถทำเพิ่มได้
- ☐ ฉันสามารถทำงานประจำได้เป็นส่วนมาก แต่ไม่สามารถทำเพิ่มได้อีก
- ☐ ฉันไม่สามารถทำงานประจำตามปกติได้
- ☐ ฉันแทบจะไม่สามารถทำงานใดๆได้
- ☐ ฉันไม่สามารถทำงานใดๆได้เลย

8. การขับรถ (ตอบเฉพาะผู้ที่ขับรถอยู่เป็นประจำ)

- ☐ ฉันสามารถขับรถได้โดยไม่มีอาการปวดคอ
- ☐ ฉันสามารถขับรถได้นานเท่าที่ต้องการ แต่มีอาการปวดคอเล็กน้อย
- ☐ ฉันสามารถขับรถได้นานเท่าที่ต้องการ แต่มีอาการปวดคอปานกลาง
- ☐ ฉันไม่สามารถขับรถได้นานเท่าที่ต้องการ เนื่องจากมีอาการปวดคอปานกลาง
- ☐ ฉันเกือบจะขับรถไม่ได้ เนื่องจากมีอาการปวดคอรุนแรง
- ☐ ฉันไม่สามารถขับรถได้เลย

9. การนอนหลับ

- ☐ ฉันไม่มีปัญหาในการนอนหลับ
- ☐ การนอนหลับของฉันถูกรบกวน จากอาการปวดคอ เล็กน้อย (นอนไม่หลับ น้อยกว่า 1 ชั่วโมง)
- ☐ การนอนหลับของฉันถูกรบกวน จากอาการปวดคอ ไม่มาก (นอนไม่หลับ 1-2 ชั่วโมง)
- ☐ การนอนหลับของฉันถูกรบกวน จากอาการปวดคอ ปานกลาง (นอนไม่หลับ 2-3 ชั่วโมง)
- ☐ การนอนหลับของฉันถูกรบกวน จากอาการปวดคอ อย่างมาก (นอนไม่หลับ 3-5 ชั่วโมง)
- ☐ การนอนหลับของฉันถูกรบกวน จากอาการปวดคอ ตลอดคืน (นอนไม่หลับ 5-7 ชั่วโมง)

10. กิจกรรมยามว่าง

- ☐ ฉันสามารถทำกิจกรรมยามว่างได้ โดยไม่มีอาการปวดคอ
- ☐ ฉันสามารถทำกิจกรรมยามว่างได้ โดยมีอาการปวดคอเล็กน้อย
- ☐ ฉันสามารถทำกิจกรรมยามว่างได้เป็นส่วนมากแต่ไม่ทั้งหมด เนื่องจากมีอาการปวดคอ
- ☐ ฉันสามารถทำกิจกรรมยามว่างได้เล็กน้อย เนื่องจากมีอาการปวดคอ
- ☐ ฉันเกือบจะไม่สามารถทำกิจกรรมยามว่างใดๆได้ เนื่องจากมีอาการปวดคอ
- ☐ ฉันไม่สามารถทำกิจกรรมยามว่างใดๆได้เลย

APPENDIX F

PARTICIPANT INFORMATION SHEET
(ข้อมูลสำหรับประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย)

ชื่อโครงการวิจัย ประสิทธิผลของการเลือกใช้เทคนิคการดัดดึงกระดูกสันหลังเพื่อรักษาอาการปวดคอ

ชื่อผู้วิจัยหลัก ผู้ช่วยศาสตราจารย์ ดร. อดิษฐ์ จิรเดชนันท์ โดยนางสาวฐานุตรี บัวมณี

สถานที่ปฏิบัติงาน ภาควิชากายภาพบำบัด คณะสหเวชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

โทรศัพท์ที่ทำงาน - **โทรศัพท์เคลื่อนที่** 086 759 9877 **E-mail** tanutree@yahoo.com

เรียน ผู้มีส่วนร่วมในการวิจัยทุกท่าน

ท่านเป็นหนึ่งในผู้ป่วยปวดคอ จำนวน 66 คน ที่ได้รับเชิญให้เข้าร่วมการวิจัยเรื่องการดัดดึงกระดูกสันหลังเพื่อรักษาอาการปวดคอ

วัตถุประสงค์

เพื่อศึกษาเทคนิคการดัดดึงกระดูกสันหลังว่าจะมีผลต่อประสิทธิภาพในการบรรเทาอาการปวดคอของผู้ป่วยหรือไม่

สถานที่ดำเนินการวิจัย

หน่วยปฏิบัติการวิทยาศาสตร์สุขภาพ คณะสหเวชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย 154 ถนนพระราม 1 เขตปทุมวัน กรุงเทพฯ 10330

วิธีการดำเนินการวิจัย

เมื่อท่านตกลงที่จะเข้าร่วมในการศึกษา ท่านจะได้รับการปฏิบัติ ดังนี้

1. ผู้วิจัยจะอธิบายให้ท่านทราบเกี่ยวกับขั้นตอนการวิจัยทั้งหมด จากนั้นจะให้ท่านลงชื่อยินยอมเข้าร่วมการวิจัย
2. ท่านจะได้รับการสัมภาษณ์และตรวจร่างกายโดยนักกายภาพบำบัด ด้วยวิธีทางกายภาพบำบัด เพื่อตัดสินว่า ท่านเหมาะสมที่จะได้รับการรักษาด้วยวิธีการดัดดึงกระดูกสันหลังส่วนคอหรือไม่ หากพบว่าท่านเหมาะสม การวิจัยก็จะดำเนินต่อไป หากไม่เหมาะสม ผู้วิจัยก็จะส่งตัวท่านเพื่อให้ได้รับการรักษาทางกายภาพบำบัดด้วยวิธีการอื่นต่อไป
3. กระบวนการวิจัยใช้เวลาประมาณ 45 นาที (รวมการรักษาทางกายภาพบำบัดที่ท่านได้รับภายหลังการวิจัย)
4. ผู้ช่วยวิจัยจะทำการวัดระดับความเจ็บปวด และทำการวัดช่วงการเคลื่อนไหวของคอด้วยเครื่องมือวัดมุมการเคลื่อนไหวในขณะที่ท่านอยู่ในท่านั่ง โดยจะให้ท่านทำการเงยหน้า ก้มหน้า เอียง และหมุนศีรษะไปทางซ้ายและขวา
5. จากนั้น ผู้วิจัยจะทำการแบ่งกลุ่มผู้ป่วยออกเป็น 3 กลุ่ม คือ กลุ่มที่ 1 จะได้รับการรักษาโดยขยับข้อต่อของกระดูกสันหลังส่วนคอในทิศทางการหมุน ในท่านอนหงาย กลุ่มที่ 2 จะได้รับการรักษาโดยการกดบนข้อต่อด้านข้างของกระดูกสันหลังส่วนคอ ในท่านอนคว่ำ โดยวิธีการขยับข้อต่อที่ใช้ทั้ง 2 วิธีนั้น เป็นวิธีการที่นักกายภาพบำบัดใช้ในการรักษาผู้ป่วยในคลินิกอยู่เป็นประจำ เป็นเวลาประมาณ 2 นาที และในกลุ่มที่ 3 จะได้รับคลื่นความร้อนลึก เป็นเวลา 10 นาที ในท่านอนหงาย
6. เมื่อเสร็จสิ้นการรักษาแล้ว ผู้ช่วยวิจัยกลับเข้ามาในบริเวณที่ทำการรักษา และทำการวัดความเจ็บปวดและช่วงการเคลื่อนไหวของคออีกครั้งหนึ่ง เป็นการสิ้นสุดการวิจัย
7. หากอาการปวดคอของท่านยังไม่บรรเทาเมื่อสิ้นสุดการวิจัย ท่านจะได้รับการรักษาทางกายภาพบำบัดด้วยวิธีอื่นๆเพิ่มเติมเพื่อบรรเทาอาการของท่าน

ประโยชน์ที่ท่านจะได้รับ

ท่านอาจไม่ได้รับประโยชน์จากการวิจัยนี้โดยตรง แต่ผลการวิจัยนี้จะก่อให้เกิดความก้าวหน้าทางวิชาการของการรักษาอาการปวดคอด้วยเทคนิคการดัดดึงกระดูกสันหลัง ซึ่งมีประโยชน์ในการพัฒนาเทคนิคทางการรักษาและฟื้นฟูสภาพผู้ป่วยที่มีอาการปวดคอข้างเดียวในอนาคต

ความเสี่ยงที่เกี่ยวข้องกับการศึกษาวิจัยนี้

ไม่มี

สิทธิของอาสาสมัคร

การเข้าร่วมในโครงการวิจัยนี้เป็นไปด้วยความสมัครใจ และท่านจะไม่ได้รับค่าตอบแทนในการเข้าร่วมการวิจัย ท่านมีสิทธิ์ที่จะปฏิเสธการเข้าร่วมหรือสามารถถอดถอนตัวออกจากโครงการวิจัยในครั้งนี้ได้ทุกเวลา โดยไม่ต้องได้รับโทษ หรือสูญเสียประโยชน์ซึ่งพึงได้รับ โดยไม่จำเป็นต้องแจ้งเหตุผลของการถอดถอน และจะไม่มีภาระผูกพันใดๆ ต่อไปในอนาคต

การเปิดเผยข้อมูล

ข้อมูลส่วนตัวและข้อมูลอื่นๆที่อาจนำไปสู่การเปิดเผยตัวของท่านจะได้รับการปกปิด ยกเว้นว่าได้รับคำยินยอมจากท่านหรือโดยกฎระเบียบและกฎหมายที่เกี่ยวข้องเท่านั้น ข้อมูลของท่านจะถูกเก็บไว้เป็นความลับเฉพาะคณะผู้วิจัย ผู้กำกับดูแลการวิจัย ผู้ตรวจสอบและคณะกรรมการพิจารณาจริยธรรม และจะเปิดเผยเฉพาะในรูปที่เป็นสรุปผลการวิจัย

ติดต่อสอบถามข้อมูลเพิ่มเติม

หากท่านมีคำถามหรือข้อสงสัยประการใด กรุณาติดต่อสอบถามที่ นางสาวฐานุตรี บัวมณี โทรศัพท์เคลื่อนที่ 086 - 759 - 9877 หรือ E-mail tanutree@yahoo.com

ขอขอบคุณที่กรุณาให้ความร่วมมือมา ณ โอกาสนี้

นางสาวฐานุตรี บัวมณี

APPENDIX G

INFORMED CONSENT FORM

(ใบยินยอมของประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย)

ชื่อโครงการวิจัย ประสิทธิผลของการเลือกใช้เทคนิคการดัดดึงกระดูกสันหลังเพื่อรักษาอาการปวดคอ

การศึกษา ผลของเทคนิคการดัดดึงกระดูกสันหลัง 2 เทคนิค คือ (1) ด้วยวิธีการหมุนศีรษะ (rotation) ไปในทิศทางตรงข้ามกับอาการปวดของผู้ป่วย และ (2) การออกแรงกดบนข้อต่อกระดูกสันหลังส่วนคอ (facet joint) ในผู้ป่วยที่มีอาการปวดคอด้านเดียวที่มีหรือไม่มีอาการปวดบริเวณบ่าข้างเดียวกันร่วมด้วย ว่าเทคนิคใดให้ผลในการบรรเทาอาการปวดต้นคอได้ดีกว่ากัน

เลขที่ประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย .....

ข้าพเจ้าได้รับทราบจากผู้วิจัย ชื่อ นางสาวฐานุตรี บัวมณี นิสิตปริญญาโท ภาควิชากายภาพบำบัด
โดยมี ผศ. ดร. อดิษฐ์ จิรเดชนันท์ เป็นอาจารย์ที่ปรึกษา
ที่อยู่ ภาควิชากายภาพบำบัด คณะสหเวชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ซึ่งได้ลงนามด้านท้ายของหนังสือนี้ ถึงวัตถุประสงค์ ลักษณะ และแนวทางศึกษาวิจัย เรื่อง ประสิทธิผลของการเลือกใช้เทคนิคการดัดดึงกระดูกสันหลังเพื่อรักษาอาการปวดคอ รวมทั้งทราบถึงผลดี ผลข้างเคียง และความเสี่ยงที่อาจเกิดขึ้น ข้าพเจ้าได้ซักถาม ทำความเข้าใจเกี่ยวกับการศึกษาดังกล่าวนี้ เป็นที่เรียบร้อยแล้ว

- ข้าพเจ้ายินดีเข้าร่วมการศึกษาวิจัยครั้งนี้โดยสมัครใจ เพื่อเป็นประโยชน์ต่อการศึกษาและมีสิทธิที่จะปฏิเสธการเข้าร่วมการวิจัยได้ตามต้องการ โดยไม่จำเป็นต้องแจ้งเหตุผล ซึ่งจะไม่มีผลใดๆต่อข้าพเจ้า
- ข้าพเจ้าได้รับการรับรองจากผู้วิจัยว่า ข้อมูลของข้าพเจ้าจะถูกเก็บรักษาเป็นความลับ
- ข้าพเจ้ายืนยันว่า ข้าพเจ้ามีอายุ 20 ปีบริบูรณ์ หรือมากกว่า
- ข้าพเจ้ายินดีเข้าร่วมการศึกษานี้ ภายใต้เงื่อนไขที่ได้ระบุไว้แล้วในข้างต้น

ลงนามประชากรตัวอย่าง หรือผู้มีส่วนร่วมในการวิจัย	..... ( )	..... สถานที่ / วันที่
ลงนามผู้วิจัยหลัก	..... (นางสาว ฐานุตรี บัวมณี)	..... สถานที่ / วันที่
ลงนามพยาน	..... ( )	..... สถานที่ / วันที่

APPENDIX H

SCREENING QUESTIONNAIRE

(แบบคัดกรองผู้เข้าร่วมงานวิจัย)

1. ชื่อ (นาย, นาง, นางสาว) ……. นามสกุล ……..…
2. อายุ ..... ปี น้ำหนัก ..... กิโลกรัม ส่วนสูง ..... เซนติเมตร
3. อาชีพ .....
4. ระยะเวลาที่เคยมีอาการปวดทั้งหมด ..... ปี ..... เดือน ..... วัน
5. คุณมีสภาวะต่อไปนี้หรือไม่

ก. ตั้งครรภ์	☐ ไม่มี	☐ มี .....
ข. มีไข้	☐ ไม่มี	☐ มี .....
ค. กระดูกพรุน	☐ ไม่มี	☐ มี .....
ง. อุบัติเหตุบริเวณคอ	☐ ไม่มี	☐ มี .....
จ. กระดูกหักบริเวณคอ	☐ ไม่มี	☐ มี .....
ฉ. ประวัติการผ่าตัดบริเวณคอ	☐ ไม่มี	☐ มี .....
ช. กระดูกคอไม่มั่นคง	☐ ไม่มี	☐ มี .....
ซ. ข้ออักเสบ (Rheumatoid arthritis)	☐ ไม่มี	☐ มี .....
ฌ. ไมเกรน	☐ ไม่มี	☐ มี .....
ญ. มีประวัติเนื้องอก	☐ ไม่มี	☐ มี .....
ฎ. VBI	☐ ไม่มี	☐ มี .....

☐ Dizziness ☐ Diplopia ☐ Dysarthria

☐ Dysphagia ☐ Drop attack ☐Tinnitus

6. คุณเคยได้รับการวินิจฉัยจากบุคลากรทางการแพทย์ด้วยโรคใดหรือไม่
   - ☐ ไม่เคย
   - ☐ เคย ระบุ .....
7. คุณเคยได้รับการถ่ายรังสี หรือการตรวจ MRI หรือ CT scan หรือไม่
   - ☐ ไม่เคย
   - ☐ เคย เมื่อวันที่ ..... ผล.....

8. คุณกำลังรับประทาน หรือใช้ยาใดหรือไม่

□ ไม่ใช้

□ ใช้ ระบุ .....

9. ภายใน 6 เดือนนี้ คุณเคยมีอาการปวดคอที่ต้องการการรักษา และต้องลาหยุดงานหรือไม่

□ ไม่เคย

□ เคย ระบุ .....

10. ในขณะนี้ คุณมีอาการปวดคอหรือไม่

□ ไม่มี

□ มี โดยมีอาการปวดคอครั้งนี้ติดต่อกันเป็นเวลานาน.....ปี.....เดือน..... วัน

11. กิจกรรมใดที่ทำให้อาการปวดคอเพิ่มขึ้น

.....

12. กิจกรรมใดที่ทำให้อาการปวดคอลดลง

.....

13. คุณได้ทำการรักษาอย่างไรบ้าง

□ ไม่ได้ทำการรักษา

□ พบแพทย์ และได้รับการรักษาด้วย.....

□ พบนักกายภาพบำบัด และได้รับการรักษาด้วย.....

14. คุณคิดว่า อาการปวดคอนี้มีสาเหตุจากอะไร

.....

15. กรุณาทำเครื่องหมาย I ลงบนเส้นด้านล่าง เพื่อแสดงระดับความเจ็บปวดของคุณ

ก. ระดับความเจ็บปวดในขณะนี้

ไม่มีอาการปวด มีอาการปวดมากที่สุดเท่าที่จะมีได้

ข. ระดับความเจ็บปวดเมื่อทำการเคลื่อนไหวคอในทิศทางที่ปวดมากที่สุด

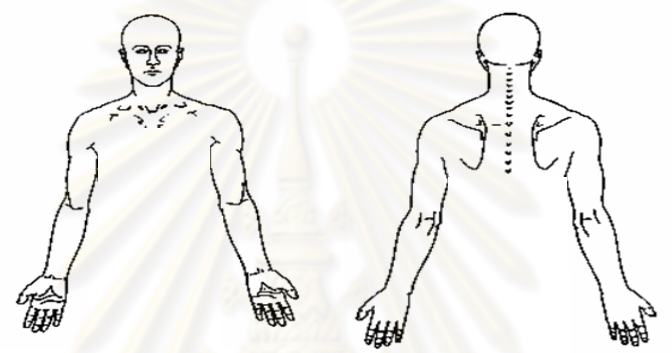
ไม่มีอาการปวด มีอาการปวดมากที่สุดเท่าที่จะมีได้

APPENDIX I

DATA COLLECTION SHEET

ข้อมูลการตรวจร่างกายก่อนการรักษา (Pre-intervention data)

1. กรุณาระบุบริเวณ และลักษณะอาการในขณะนี้บนแผนภูมิ



2. กรุณาทำเครื่องหมาย I ลงบนเส้นด้านล่าง เพื่อแสดงระดับความเจ็บปวดของคุณ

- ระดับความเจ็บปวดในขณะนี้

ไม่มีอาการปวด มีอาการปวดมากที่สุดเท่าที่จะมีได้

- ระดับความเจ็บปวดเมื่อทำการเคลื่อนไหวคอในทิศทางที่ก่อให้เกิดความเจ็บปวดมากที่สุด

ไม่มีอาการปวด มีอาการปวดมากที่สุดเท่าที่จะมีได้

3. ช่วงการเคลื่อนไหวของคอก่อนการรักษา

Motion	ROM (degrees)	* For worst movement
Flexion		
Extension		
Ipsilateral lateral flexion		
Contralateral lateral flexion		
Ipsilateral rotation		
Contralateral rotation		

ข้อมูลการตรวจร่างกายหลังการรักษา (Post-intervention data: 5 minutes later)

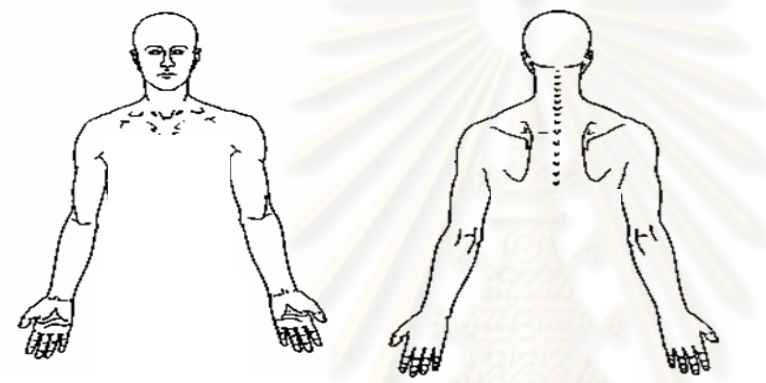
Treatment technique

☐ Contralateral cervical rotation ☐ Ipsilateral PA ☐ Detuned SWD

Treatment dosage

Cervical level …… Grade ……. Set ……

1. กรุณาระบุบริเวณ และลักษณะอาการในขณะนี้บนแผนภูมิ



2. ระดับความเจ็บปวด (อ้างอิงแผนภูมิใน Pre-intervention form)

- ระดับความเจ็บปวดในขณะนี้…….....
- ระดับความเจ็บปวดเมื่อทำการเคลื่อนไหวคอ…….....

3. ระดับอาการโดยรวมของคุณภายหลังการรักษา…….....

4. ช่วงการเคลื่อนไหวของคอหลังการรักษา

Motion	ROM (degrees)	* For worst movement
Flexion		
Extension		
Ipsilateral lateral flexion		
Contralateral lateral flexion		
Ipsilateral rotation		
Contralateral rotation		

APPENDIX J

GLOBAL PERCEIVED EFFECT

การวัดอาการโดยรวมภายหลังการรักษา (modified from Ostelo & de Vet, 2005)

กรุณาเลือกตัวเลขที่ระบุระดับอาการ โดยรวมของคุณภายหลังการรักษา

1	อาการ โดยรวมดีขึ้นจนหายเป็นปกติ (completely recovered)
2	อาการ โดยรวมดีขึ้นมาก (much improved)
3	อาการ โดยรวมดีขึ้นเล็กน้อย (slightly improved)
4	อาการ โดยรวมไม่เปลี่ยนแปลง (no change)
5	อาการ โดยรวมแย่ลงเล็กน้อย (slightly worsened)
6	อาการ โดยรวมแย่ลงมาก (much worsened)
7	อาการ โดยรวมแย่ลงมากที่สุดอย่างที่ไม่เคยเป็นมาก่อน (worse than ever)

APPENDIX K

RAW DATA OF MAIN STUDY

Table K.1 The demographic data of subjects (N=66)

Subjects	Group[α]	Sex	Age (years)	Height (m.)	Weight (kg.)	Duration[β] (days)	NDI (%)	Symptomatic side	Problem[δ]	Grade[π]
1	Rot.	F	24	1.64	52.0	180	31.1	Rt. C2	P	III
2	I	F	28	1.60	50.0	60	13.3	Lt. C2	R	-
3	C	F	69	1.58	63.0	180	2.2	Rt. C3	P	III
4	I	F	60	1.58	62.0	1,095	32.0	Rt. C2	R	IV
5	C	F	24	1.53	60.0	365	26.7	Lt. C3	P	-
6	I	F	51	1.50	74.0	1,095	32.0	Rt. C3	R	IV
7	C	F	50	1.60	67.0	1,095	26.7	Lt. C2	R	-
8	I	F	42	1.60	47.5	1,825	20.0	Rt. C3	R	IV
9	Rot.	F	42	1.60	47.5	44	53.3	Lt. C2	R	IV
10	Rot.	F	45	1.50	54.0	1,095	26.7	Lt. C3	R	IV
11	I	F	58	1.55	50.0	730	14.0	Rt. C3	P	III
12	C	F	27	1.70	62.0	365	42.0	Rt. C3	R	-
13	Rot.	F	54	1.50	65.0	3,650	40.0	Lt. C3	P	III
14	C	F	20	1.64	49.0	1,460	36.0	Lt. C4	R	-
15	I	F	44	1.54	58.0	3,650	24.4	Lt. C4	R	IV
16	Rot.	M	32	1.65	72.0	2,190	24.0	Rt. C3	R	IV
17	C	F	57	1.67	74.5	5,475	11.1	Lt. C6	R	-
18	I	F	47	1.60	54.0	730	40.0	Rt. C4	P	II
19	I	F	31	1.65	55.0	1,095	15.6	Lt. C6	R	IV
20	C	M	43	1.69	79.0	3,650	44.0	Lt. C2	R	-
21	I	M	57	1.67	74.5	5,475	8.9	Lt. C2	R	IV
22	Rot.	F	22	1.60	55.0	2,190	40.0	Rt. C3	R	IV

[α]Rot., I and C groups represent rotation, IPA and control groups, respectively. [β]Duration represents duration of neck pain.

[δ]P and R problem represent pre-dominant factor as pain and resistance, respectively. [π]Grade represents grade of mobilization.

Subjects	Group α	Sex	Age (years)	Height (m.)	Weight (kg.)	Duration β (days)	NDI (%)	Symptomatic side	Problem δ	Grade π
23	C	F	31	1.65	55.0	1,095	15.6	Lt. C3	R	-
24	Rot.	F	38	1.60	55.0	1,460	40.0	Lt. C4	R	IV
25	Rot.	F	57	1.49	57.0	365	22.2	Rt. C4	P	III
26	I	M	27	1.70	62.0	365	42.0	Rt. C2	R	IV
27	C	F	38	1.69	74.0	3,650	22.0	Lt. C4	R	-
28	Rot.	F	40	1.55	70.0	1,095	37.8	Rt. C3	R	IV
29	I	F	24	1.53	60.0	365	26.7	Lt. C2	R	IV
30	C	F	47	1.60	54.0	730	40.0	Rt. C5	P	-
31	C	F	53	1.73	81.0	1,825	24.0	Lt. C3	P	-
32	I	F	41	1.57	48.0	730	30.0	Lt. C4	R	IV
33	Rot.	F	55	1.50	50.0	1,825	22.0	Lt. C4	R	IV
34	C	F	44	1.54	58.0	3,650	24.4	Lt. C4	P	-
35	I	F	27	1.53	48.0	1,095	11.1	Lt. C3	R	IV
36	Rot.	F	26	1.60	65.0	730	40.0	Rt. C6	R	IV
37	Rot.	F	49	1.51	43.0	180	8.9	Rt. C4	P	II
38	I	F	49	1.56	56.0	365	40.0	Lt. C4	P	II
39	C	F	46	1.60	54.0	1,460	22.0	Rt. C2	R	-
40	Rot.	F	45	1.57	64.0	2,920	37.8	Lt. C4	R	IV
41	I	F	49	1.75	56.0	3,650	28.9	Lt. C2	R	IV
42	C	F	58	1.50	50.0	730	16.0	Rt. C4	R	-
43	Rot.	F	37	1.45	46.0	365	31.1	Rt. C4	R	IV
44	C	F	29	1.56	44.0	730	26.7	Lt. C2	R	-
45	C	F	42	1.60	47.5	1,825	20.0	Rt. C3	P	-
46	Rot.	F	67	1.60	55.0	90	6.7	Rt. C3	R	IV
47	I	F	20	1.50	54.0	1,095	20.0	Rt. C3	R	IV
48	I	F	49	1.50	52.0	60	12.0	Rt. C3	R	IV
49	I	F	45	1.57	64.0	365	44.4	Rt. C4	R	IV
50	Rot.	F	47	1.55	55.0	3,650	28.9	Rt. C2	R	IV

α Rot., I and C groups represent rotation, IPA and control groups, respectively. β Duration represents duration of neck pain.

δ P and R problem represent pre-dominant factor as pain and resistance, respectively. π Grade represents grade of mobilization.

Subjects	Group[α]	Sex	Age (years)	Height (m.)	Weight (kg.)	Duration[β] (days)	NDI (%)	Symptomatic side	Problem[δ]	Grade[π]
51	C	F	50	1.65	48.0	1,095	20.0	Lt. C4	R	-
52	I	F	39	1.53	63.0	30	24.0	Rt. C4	R	IV
53	Rot.	F	51	1.63	62.8	365	17.8	Rt. C3	R	IV
54	C	F	51	1.50	74.0	1,095	32.0	Rt. C2	R	-
55	C	M	55	1.78	70.0	1,095	20.0	Lt. C3	R	-
56	I	F	37	1.66	53.0	365	24.4	Rt. C3	R	IV
57	C	F	69	1.58	63.0	180	6.7	Rt. C4	R	-
58	I	M	24	1.78	71.0	2,190	56.0	Lt. C4	P	III
59	Rot.	F	50	1.58	55.0	7,300	46.0	Lt. C4	R	IV
60	Rot.	F	38	1.72	105.0	365	13.3	Lt. C2	R	IV
61	I	F	50	1.60	63.5	1,825	37.8	Lt. C2	R	IV
62	C	M	44	1.65	60.0	730	16.0	Rt. C3	P	-
63	C	F	40	1.50	70.0	1,095	37.8	Rt. C2	R	-
64	Rot.	F	59	1.53	51.0	1,825	22.0	Rt. C2	R	IV
65	Rot.	F	46	1.50	46.0	3,650	26.7	Rt. C2	P	III
66	I	F	51	1.55	53.0	365	18.0	Rt. C2	R	IV

[α]Rot., I and C groups represent rotation, IPA and control groups, respectively. [β]Duration represents duration of neck pain.
[δ]P and R problem represent pre-dominant factor as pain and resistance, respectively. [π]Grade represents grade of mobilization.

Table K.2 Pre- and post intervention data of subjects (N=66)

Subjects	Pain intensity (mm.)				Active cervical ROM (degrees)														GPE
	At rest		On most painful movement		Flexion		Extension		Ipsilateral lateral flexion		Contralateral lateral flexion		Ipsilateral rotation		Contralateral rotation		On most painful movement		
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	
1	56	30	80	66	46	54	60	70	42	42	44	44	62	60	64	62	60	70	2
2	46	40	55	51	54	56	56	58	40	38	40	38	68	68	68	64	54	56	4
3	22	11	25	12	42	42	44	44	24	24	20	26	34	42	34	42	34	42	2
4	29	20	37	24	42	48	56	60	38	38	34	40	52	56	58	60	52	56	2
5	72	72	63	63	42	36	60	48	40	36	38	38	64	62	62	62	62	62	3
6	43	12	42	9	40	40	64	70	44	42	32	36	58	72	48	58	32	36	2
7	56	42	68	59	38	42	68	60	28	26	32	30	64	66	66	64	28	26	3
8	31	28	39	32	54	54	84	84	34	40	42	40	60	60	40	40	42	40	2
9	65	43	73	65	46	50	56	64	40	40	40	38	60	64	66	72	56	64	3
10	46	38	52	30	56	52	58	60	30	34	32	38	50	56	66	72	32	38	2
11	64	59	72	70	50	42	58	60	42	38	36	32	68	66	56	58	36	32	3
12	20	17	33	33	32	28	52	52	42	42	32	32	52	52	56	56	56	56	4
13	48	10	65	13	52	60	48	50	32	34	28	32	64	68	54	62	28	32	2

pre and post represent pre- intervention and post- intervention data, respectively.

Subjects	Pain intensity (mm.)				Active cervical ROM (degrees)														GPE
	At rest		On most painful movement		Flexion		Extension		Ipsilateral lateral flexion		Contralateral lateral flexion		Ipsilateral rotation		Contralateral rotation		On most painful movement		
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	
14	41	41	44	40	46	44	46	50	26	28	26	28	42	44	50	52	46	50	4
15	62	53	68	68	38	34	56	54	34	34	36	36	46	44	56	56	56	54	3
16	30	26	61	61	40	40	56	52	34	32	28	28	56	56	46	46	28	28	4
17	26	26	49	49	36	32	46	50	36	36	34	32	60	54	52	52	46	50	4
18	74	74	100	100	44	38	26	32	32	32	24	28	54	52	52	52	26	32	4
19	70	55	100	76	68	68	70	68	40	44	44	46	68	68	74	78	44	46	3
20	58	58	64	64	38	40	50	48	46	40	36	36	58	54	74	76	50	48	4
21	20	11	33	21	32	32	52	60	42	40	32	36	52	52	56	60	56	60	3
22	51	38	76	54	78	80	64	60	38	46	42	46	60	62	62	62	42	46	3
23	80	80	100	100	44	34	42	26	32	30	24	24	54	44	52	46	42	26	4
24	44	37	51	47	36	42	56	70	40	40	40	38	66	64	58	62	56	70	3
25	25	12	24	18	50	44	58	66	40	40	38	38	62	70	56	64	58	66	4
26	72	56	63	46	42	42	60	66	40	42	38	46	64	70	62	64	64	70	3
27	28	42	28	40	60	60	50	50	34	34	34	34	64	64	68	68	64	64	5

pre and post represent pre- intervention and post- intervention data, respectively.

Subjects	Pain intensity (mm.)				Active cervical ROM (degrees)														GPE
	At rest		On most painful movement		Flexion		Extension		Ipsilateral lateral flexion		Contralateral lateral flexion		Ipsilateral rotation		Contralateral rotation		On most painful movement		
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	
28	52	44	68	61	28	40	56	60	30	40	28	40	66	60	56	66	28	40	3
29	54	41	66	60	30	42	50	56	38	38	36	36	50	66	66	72	36	36	3
30	62	62	68	68	38	46	56	54	34	36	36	38	46	46	56	56	56	54	4
31	44	37	45	44	32	30	60	56	40	38	40	42	64	62	60	60	60	60	4
32	37	34	73	69	36	36	66	68	40	42	52	56	64	62	80	90	80	90	3
33	36	22	74	51	34	50	66	74	42	42	40	44	66	70	70	80	66	74	3
34	64	64	72	72	50	44	58	56	42	38	36	32	68	58	56	56	36	32	4
35	20	11	35	8	44	46	42	48	32	32	30	32	52	54	56	66	56	66	2
36	86	79	90	86	36	46	28	38	32	36	28	38	48	64	32	44	28	38	4
37	34	23	66	57	42	46	68	64	46	44	50	50	68	64	68	68	46	44	3
38	39	26	67	48	38	50	50	66	34	42	40	46	60	68	70	72	50	66	3
39	40	70	76	100	68	68	70	70	46	40	44	42	66	68	68	74	44	42	5
40	55	50	83	83	40	42	70	68	34	36	36	38	64	70	66	76	70	68	3

pre and post represent pre- intervention and post- intervention data, respectively.

Subjects	Pain intensity (mm.)				Active cervical ROM (degrees)														GPE
	At rest		On most painful movement		Flexion		Extension		Ipsilateral lateral flexion		Contralateral lateral flexion		Ipsilateral rotation		Contralateral rotation		On most painful movement		
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	
41	46	29	38	9	36	36	50	74	34	52	32	40	62	60	60	66	32	40	2
42	31	31	39	36	54	50	84	80	34	36	42	34	60	58	40	40	42	34	3
43	32	17	50	36	40	40	72	58	36	38	40	42	58	64	64	70	72	58	3
44	44	41	40	38	60	60	68	74	30	32	38	38	68	68	78	80	30	32	3
45	43	39	42	40	40	36	64	60	44	36	32	34	58	68	48	50	32	34	4
46	44	32	67	44	56	60	54	62	40	52	38	44	70	72	66	78	56	60	3
47	41	36	70	61	56	48	70	64	30	36	40	48	68	64	52	58	40	48	3
48	52	43	79	63	50	50	72	82	40	40	40	42	64	70	62	66	40	42	3
49	64	58	74	74	56	60	46	56	28	28	28	28	50	52	50	52	46	56	4
50	37	21	37	24	64	58	58	60	34	38	36	38	64	64	72	72	36	38	3
51	34	29	50	50	50	46	60	64	40	38	40	38	72	70	70	68	40	38	3
52	52	34	64	26	46	44	58	68	30	38	38	40	66	70	52	66	46	44	3
53	62	47	85	67	40	42	54	58	30	28	36	34	58	60	58	60	36	34	3
54	22	22	25	12	42	46	44	46	24	26	20	24	34	38	34	40	34	38	3

pre and post represent pre- intervention and post- intervention data, respectively.

Subjects	Pain intensity (mm.)				Active cervical ROM (degrees)														GPE
	At rest		On most painful movement		Flexion		Extension		Ipsilateral lateral flexion		Contralateral lateral flexion		Ipsilateral rotation		Contralateral rotation		On most painful movement		
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	
55	51	51	69	69	42	40	58	52	32	30	34	36	56	50	54	48	34	36	4
56	66	5	66	4	52	58	74	68	32	30	34	38	48	60	50	54	74	68	2
57	32	32	50	50	34	24	46	46	26	28	20	22	50	50	58	64	26	28	4
58	37	26	70	62	26	34	36	42	16	30	24	32	40	46	48	54	36	42	3
59	60	25	78	43	52	50	78	80	36	34	30	30	60	66	64	70	78	80	3
60	24	0	31	0	48	50	54	52	28	28	28	32	40	40	50	60	48	50	2
61	28	17	51	32	50	44	52	58	34	38	28	30	50	50	60	58	28	30	2
62	54	49	66	66	30	40	50	50	38	40	36	38	50	56	66	68	36	38	3
63	52	52	68	70	28	40	56	60	30	36	28	40	66	60	56	56	28	40	4
64	22	11	46	31	48	40	58	58	22	26	28	32	46	56	54	58	46	56	3
65	30	17	50	24	44	48	70	82	40	36	40	48	68	68	66	70	40	48	2
66	47	39	92	85	50	48	42	48	40	38	38	40	60	60	52	50	50	48	3

pre and post represent pre- intervention and post- intervention data, respectively.

APPENDIX L

DATA COLLECTION SHEET

FOR AGREEMENT OF MANUAL ASSESSMENT STUDY

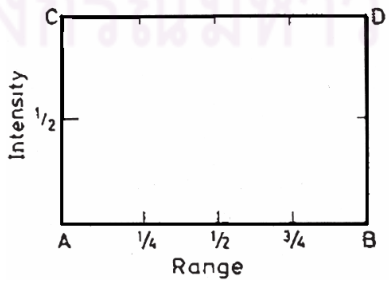
ID…….. Date……..

ชื่อ (นาย, นาง, นางสาว)……นามสกุล……

ทำเครื่องหมาย x ณ ตำแหน่งของข้อต่อกระดูกสันหลังส่วนคอที่ต้องรับการรักษามากที่สุด

	Lt.	Rt.
C1		
C2		
C3		
C4		
C5		
C6		
C7		

Movement diagram



Grade of mobilization .....

APPENDIX M

DATA COLLECTION SHEET

FOR INTRA-TESTER RELIABILITY STUDY

ID…….. Date……..

ชื่อ (นาย, นาง, นางสาว)……นามสกุล……

อายุ.....ปี น้ำหนัก.....กิโลกรัม ส่วนสูง.....เซนติเมตร

Motion	ROM (degrees) First repetition	ROM (degrees) Second repetition
Flexion		
Extension		
Ipsilateral lateral flexion		
Contralateral lateral flexion		
Ipsilateral rotation		
Contralateral rotation		

APPENDIX N

RAW DATA OF INTRA-TESTER RELIABILITY STUDY

Table N.1 The active cervical range of motion measurement (N=10)

Subjects	Active cervical ROM (degree)											
	Flexion		Extension		Ipsilateral lateral flexion		Contralateral lateral flexion		Ipsilateral rotation		Contralateral rotation	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
1	28	30	54	50	34	42	32	30	62	60	60	64
2	40	40	78	78	40	38	42	46	50	52	56	54
3	68	66	68	66	46	40	36	42	62	60	58	60
4	48	48	72	70	48	34	46	44	70	68	56	60
5	32	26	56	56	40	34	40	40	46	46	70	70
6	52	48	56	52	40	32	42	40	56	58	62	60
7	52	48	56	60	36	46	42	42	40	40	56	58
8	42	40	74	74	30	40	32	34	54	52	66	68
9	56	52	56	60	42	40	32	36	58	60	66	66
10	34	32	58	56	30	40	32	30	50	42	56	58

1st and 2nd represent first measurement and second measurement, respectively.

APPENDIX O

PUBLICATION

Some part of the results of this study has been scheduled to publish in Thai Journal of Physical Therapy as:

Buamanee, T., Chiradejnant, A., Gaogasigam, C. (2010). The immediate effect of the contralateral cervical rotation mobilization in unilateral mechanical neck pain: a pilot study. *Thai Journal of Physical Therapy 1*(32): 28-36.

บทความวิจัย

ผลการรักษาทันทีของการหมุนศีรษะอย่างเป็นจังหวะไปทางตรงข้ามกับด้านที่มีอาการปวดในผู้ป่วยที่มีอาการปวดคอด้านเดียวเนื่องจากสาเหตุเชิงกล: การศึกษานำร่อง

The immediate effect of the contralateral cervical rotation mobilization in unilateral mechanical neck pain: a pilot study

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Submitted: 14 Dec 2009 Accepted: 28 Jan 2010

บทคัดย่อ

การเลือกใช้เทคนิคการขยับข้อต่อในการรักษาผู้ป่วยที่มีอาการปวดคอด้านเดียวเนื่องจากสาเหตุเชิงกลนั้น ผู้เชี่ยวชาญในการรักษาด้วยวิธีการขยับข้อต่อได้แนะนำให้ใช้การขยับข้อต่อในทิศทางการกดจากด้านหลังไปด้านหน้าบริเวณด้านข้างของกระดูกสันหลังด้านที่มีอาการเจ็บปวด หรือการขยับข้อต่อในทิศทางการหมุนศีรษะอย่างเป็นจังหวะไปในทิศทางตรงข้ามกับด้านที่มีอาการเจ็บปวดซึ่งเป็นเทคนิคแรกในการรักษามีงานวิจัยที่ศึกษาถึงประสิทธิภาพของเทคนิคการกดจากด้านหลังไปด้านหน้า แต่ยังไม่มีการศึกษาถึงประสิทธิภาพของเทคนิคการหมุนศีรษะในการรักษาผู้ป่วยที่มีอาการปวดคอด้านเดียวเนื่องจากสาเหตุเชิงกล งานวิจัยนี้จึงมีวัตถุประสงค์เพื่อศึกษาผลการรักษาทันทีด้วยการหมุนศีรษะไปในทิศทางตรงข้ามกับด้านที่มีอาการเจ็บปวดต่ออาการปวดคอและช่วงการเคลื่อนไหวของคอในผู้ป่วยที่มีอาการปวดคอด้านเดียวเนื่องจากสาเหตุเชิงกล โดยรูปแบบงานวิจัยเป็นแบบ Pretest-posttest design ผู้ป่วยที่มีอาการปวดคอด้านเดียวเนื่องจากสาเหตุเชิงกล จำนวน 10 คน อายุ 20 ปีขึ้นไป มีอาการปวดต้นคอขณะพัก 20 มม.เมื่อวัดด้วย Visual analogue scale (VAS) และไม่ได้ทานยาในวันที่มารับการรักษา จะได้รับการคัดเลือกให้เข้าร่วมงานวิจัยนักกายภาพบำบัดตรวจประเมินร่างกายทางกายภาพบำบัดแก่ผู้ป่วย และระบุถึงระดับของข้อต่อ และเกรดของการขยับข้อต่อที่จะให้การรักษา หลังจากนั้น ผู้วัดจะบันทึกข้อมูลเริ่มต้น ได้แก่ ระดับความเจ็บปวดและช่วงการเคลื่อนไหวของคอผู้ป่วยจะได้รับการรักษาด้วยการหมุนศีรษะไปในทิศทางตรงข้ามกับด้านที่มีอาการเจ็บปวดเป็นจำนวน 2 ชุด ชุดละ 1 นาที ภายหลังจากการรักษา 5 นาที ผู้วัดจะบันทึกระดับความเจ็บปวดและช่วงการเคลื่อนไหวของคอ การวิเคราะห์ข้อมูลจะใช้ Descriptive statistic ในการบรรยายทางคุณลักษณะ ความเจ็บปวดและช่วงการเคลื่อนไหวของผู้เข้าร่วมงานวิจัย และใช้ Paired t-test เพื่อเปรียบเทียบประสิทธิผลของการหมุนศีรษะหลังการรักษา โดยกำหนดระดับความเชื่อมั่นที่ 0.05 ผลการวิเคราะห์ข้อมูลทางสถิติ พบว่า อาการปวดต้นคอขณะพัก และขณะเคลื่อนไหวในทิศทางที่ปวดมากที่สุด มีค่าลดลงอย่างมีนัยสำคัญทางสถิติ ($p=0.001$ และ $p=0.012$ ตามลำดับ) นอกจากนี้ ช่วงการเคลื่อนไหวของคอมีการเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติในทิศทางของการเงยคอ ($p=0.04$) การหมุนคอไปด้านตรงข้ามกับที่ปวด ($p=0.01$) และในทิศทางที่ปวดมากที่สุด ($p=0.001$) ดังนั้น สรุปผลการศึกษาได้ว่า การขยับข้อต่ออย่างเป็นจังหวะในทิศทางการหมุนศีรษะไปทางตรงข้ามกับด้านที่มีอาการปวด มีประสิทธิภาพในการบรรเทาความเจ็บปวด และเพิ่มช่วงการเคลื่อนไหวของคอ

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ในการรักษาผู้ป่วยที่มีอาการปวดคอด้านเดียวเนื่องจากสาเหตุเชิงกล

ABSTRACT

The selection of the use of mobilization technique for unilateral mechanical neck pain (UMNP) has been followed the recommendation of the therapy experts. It has been suggested to firstly use either the ipsilateral posteroanterior (IPA) technique or contralateral cervical rotation technique to treat a patient who has UMNP. The effectiveness of the use of IPA technique has been investigated but there is no study investigating the effectiveness of the use of the contralateral cervical rotation technique in the treatment of UMNP. The objective of this study was to investigate the immediate effect of use of the contralateral cervical rotation technique on pain and active cervical range of motion (ROM) in the treatment of UMNP patients. The research design was the pretest-posttest design. Ten UMNP patients who had their age over 20 years old, neck pain intensity at rest more than 20-mm on a visual analogue scale (VAS), and did not take any medications on the treatment day were recruited in this study. A physical therapist fully assessed the patients; and identified the treatment dosage including cervical spinal level treated and grade of treatment. Then, an assessor established baseline data including pain intensity and active cervical ROM. The patients received the contralateral cervical rotation mobilization technique for 2 sets of 1-minute repetition. Five minutes after the treatment, the assessor was then called to note the post-treatment data. Mean and standard deviation were calculated for the demographic data and all variables. Paired t-test was used to analyze the effect of cervical rotation mobilization with a significant level set at 0.05. Statistical analysis showed that pain at rest and pain on most painful movement was significantly decreased with p=0.001 and p=0.012, respectively. Additionally, the significant increased in active neck extension (p=0.04), contralateral rotation (p=0.01) and on most painful movement (p=0.001) were noted. In conclusion, the contralateral cervical rotation mobilization is effective in both relieving neck pain and improving the active cervical ROM in the treatment of UMNP patients.

Key words: Neck pain, Cervical spine, Mobilization, Manual technique, Rehabilitation

Introduction

Neck pain is one of the common symptoms reported in general populations. Approximately 50% in adult populations experienced neck pain once during their lifetime.[1] About 23% of such patients reported an incidence of one year recurrence.[2] Due to a large number of patients with neck pain, the cost of treatment reported to be numerous.[3]

Based on the causes of neck pain, the majority of patients with neck pain are diagnosed as mechanical neck pain (MNP).[4,5] MNP refers to neck pain causing by mechanical basis such as poor posture, sport injury, occupational activities, etc.[4,5] Additionally, it has been hypothesized that the MNP would result from any dysfunction of various anatomical structures such as ligaments, muscles, facet joints, intervertebral disks, or neural tissues.[6] Therefore, the symptom is normally aggravated with neck movements. The MNP can be categorized into 2 sub-groups regarding to the distribution of symptoms; unilateral and bilateral MNP.[7] Briefly the unilateral MNP (UMNP) refers to any symptoms noted on one side of the neck, and the symptom can accompany with any symptoms in the ipsilateral side of the upper

extremity while the bilateral MNP refers to any symptoms noted in both the center and bilateral of the neck, and the symptoms can accompany with any symptoms in both sides of the upper extremities.

There are several treatments aiming to reduce neck pain and restore the cervical range of motions (ROM). These include surgical and non-surgical treatments.[8] Physical therapy plays an important role in the non-surgical treatment for MNP. There are a number of physical therapy interventions offering for such patients, for example thermotherapy, traction, exercise therapy and spinal manipulative therapy (SMT). SMT is one of the most common approaches for treating MNP.[9,10] This approach includes both spinal manipulation and spinal mobilization. Briefly, spinal manipulation is a single small passive movement applied with high velocity at the end or just beyond the end of range of the treated joint while spinal mobilization is a set of passive oscillatory movements either large or small movement applied within an available ROM of the treated joint. It has been suggested that the spinal mobilization should be firstly selected before spinal manipulation.[11] This might be because there is more frequently reported the episode of adverse effects such as discomfort, headache, dizziness, after the application of spinal manipulation than that of spinal mobilization.[11,12]

The selection of the use of mobilization technique for MNP is based on the distribution of symptoms.[11] It has been suggested that a therapist would firstly use the central posteroanterior technique for treating a patient who has bilateral symptoms while a therapist would firstly use either the ipsilateral posteroanterior (IPA) technique or contralateral cervical rotation technique to treat a patient who has unilateral symptoms. Up to date, the effectiveness of the use of unilateral PA has been investigated both immediate[13] and long term effects[14] while the effectiveness of the use of cervical rotation does not. In consideration of arthrokinematic movements occurred between the joint surfaces, the cervical rotation mobilization would provide more movements than the unilateral PA.[15] Based on the movement occurred during cervical rotation, it would be possible that the use of the cervical rotation mobilization might be more effective than that of the IPA mobilization. Therefore, it was a clear need to investigate the effectiveness of the contralateral cervical rotation mobilization in order to provide evidence regarding the use of this technique in the treatment of UMNP patients.

Methods

◈ Design

The pretest-posttest design was used to investigate the immediate effects of the contralateral cervical rotation technique in the treatment of UMNP patients. This study was approved by the Ethical Review Committee for Research Involving Human Subjecting and/or Use of Animal in Research, Health Science Group of Faculties, Colleges and Institutes, Chulalongkorn University, Thailand.

◈ Subjects

UMNP patients attending the Health Sciences Service Center, Chulalongkorn University were asked if they wished to participate. To be eligible, the patients needed to have their age over 20 years old, neck pain intensity at rest more than 20-mm on a visual analogue scale (VAS), and did not take any medications including non-steroid anti-inflammation drugs, muscle relaxant and pain killer on the treatment day. The patients were asked to fill out a questionnaire including the demographic data, the duration of symptoms, the area of pain and screening questions for any contraindications for the use of mobilization.[11]

The patients were excluded if they have any of these conditions: (1) the contraindication of mobilization such as spine infection and recent spinal fracture, (2) positive neurological problems, (3) positive vertebrobasilar insufficient syndrome sign, (4) history of cervical spine surgery.[11] The patients who met the inclusion criteria were recruited, hereby called subjects.

◈ Physical therapist and assessor

A physical therapist who has been studying in a Master degree of Physical Therapy Program, Faculty of Allied Health Sciences, Chulalongkorn University involved in this study. The therapist was responsible to assess the subject both subjective and physical examinations, establish the treatment dosage and treat all subjects. Additionally, the therapist had to train the manual assessment of the cervical spinal in order to identify a spinal treated level and the application of the cervical rotation from a manual therapy expert who has both clinical experience and degree in manipulative therapy. The training aimed to validate the assessment procedure and the application of the cervical rotation techniques in this study. The application of the cervical rotation technique has been explained elsewhere.[11] Briefly, the therapist has to set a starting position by wiring up the position of the target cervical spine in order to localize a set of oscillatory movements in rotation direction while the subject is in supine position. In order to present the type II error, an assessor was recruited. The assessor was responsible to note outcome measures including pain intensity and active cervical ROM both before and 5 minutes after treatment.[13,16]

◈ Outcomes measures

▣ *Pain intensity*

The visual analogue scale (VAS) was used to record the pain intensity both at rest and on most painful movement. This scale was shown to all subjects as a 100-mm line; the left and right end was labeled "no pain" and "pain as bad as it could be", respectively. The reliability and validity of the VAS was reported to be high to measure the pain intensity.[17] In order to record the pain intensity, the subjects were asked to mark both before and 5-minute after the treatment on the same VAS to represent their pain intensity. A metal ruler was used to measure the distance from no pain to the marker to quantify the pain intensity.

▣ *Active cervical ROM*

Active cervical ROM was measured including flexion, extension, lateral flexion and rotation to both sides using the CROMa device (Performance Attainment Associates, Lindstrom, Minnesota). The CROM consists of a magnetic neck brace and 3 inclinometers mounted to the frame (Figure 1). The inclinometer in sagittal plane responds to measure the flexion and extension ROM. The inclinometer in frontal plane responds to measure the lateral flexion ROM. The inclinometer in horizontal plane responds to measure the rotation ROM. The CROM was shown to be valid for measuring of all cervical movements against the radiograph and the optoelectronic system.[18,19,20] The inter- and intra-rater reliability was reported to be high with intraclass correlation coefficients (ICCs) ranging from 0.76 to 0.98 and 0.84 to 0.98, respectively.[13,14,21]

In order to measure active cervical ROM, the subject was instructed to practice all cervical movements prior to the measurement in a standard sitting position. The position included the buttocks closed against the back of chair, elbow flexion about 90 degrees with a pillow support, hips and knees positioned about 90 degrees and both feet flat on the floor. The frame of the CROM was then positioned to the subject's head using a velcro strap and the magnetic neck brace was positioned on the subject's shoulder.

The subject was asked to perform each movement twice and the measurement was noted on the second trial. The intra-tester reliability of the recruited assessor was also investigated prior to the data collection. It was shown that the assessor was reliable to measure active cervical ROM with the ICCs ranging from 0.85 to 0.98 which was consistent with previous studied.[13,14,21] Additionally, the standard errors of measurements (SEM) were calculated using the standard deviation obtained from the intra-tester reliability. It was shown that the SEM of the recruited assessor using the CROM was less than 3 degrees.

◈ Procedure

UMNP patients were asked if they wish to participate in this study. The details of the study were then fully explained to the subjects. The agreed subjects gave consent in writing and filled out a questionnaire including the area of pain and the duration of symptoms.

The physical therapist fully assessed the subject and identified the treatment dosage including spinal level treated and grade of treatment. Then, the assessor was asked to establish pre-intervention data including pain intensity and active cervical ROM. The subject received 2 sets of 1-minute repetition of the contralateral cervical rotation applied to the identified cervical spinal level when the subject was in supine position. Five minutes after the treatment, the assessor was then called to note post-intervention data.

◈ Data analysis

Mean and standard deviations (SDs) were calculated for the demographic data and all variables. Paired t-test was used to analyze within groups effect. All data were analyzed using the SPSS program version 17.0 for Windows based on type one error of 0.05. The clinical important change for pain on VAS was set to be more than 14 mm22 and the clinical important change for active cervical ROM from the pilot study was set to be more than 6 degrees.

Results

Thirteen UMNP subjects were recruited in this study. Three subjects were excluded because their pain at rest was less than 20 mm. A total of ten UMNP subjects were recruited. The demographic data are shown in Table 1. The mean and SDs of the baseline data, post-treatment data and mean of the change scores of all variables are shown in Table 2. Statistical analysis showed that pain at rest and pain on most painful movement was significantly decreased with $p=0.001$ and $p=0.012$, respectively. Additionally, the significant increase in active neck extension ($p=0.04$), contralateral rotation ($p=0.01$) and on most painful movement ($p=0.001$) were noted.

Discussions

This study was the first report on the immediate effect of the contralateral cervical rotation technique in the treatment of UMNP subjects. The results suggest that the contralateral cervical rotation technique was effective in pain reduction both at rest and on most painful movement which is consistent with the previous studies investigating on another mobilization technique in the same group of subjects.[13,14] The decreased pain score both at rest and on most painful movement are significant clinical relevant.[22]

With regard to the hypoalgesia effect, this would be clearly explained by the gate control theory[23] and the descending pain inhibitory pathway.[24,25] Additionally, the mean of the change in pain intensity at rest of the current study (15.5 mm) was more than that of the previously studies (10.8 mm[13], 8.1 mm[14]). A plausible explanation for the hypoalgesic effect at rest would be the manner of the application of the

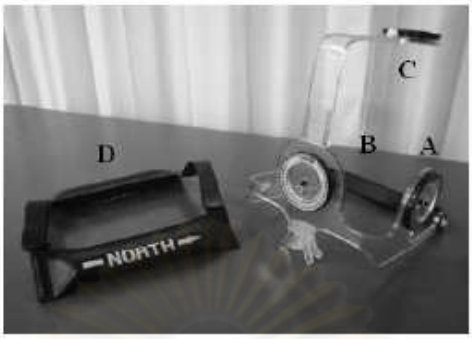

Figure 1 The cervical range of motion device (CROM). The A, B and C represent the inclinometer in sagittal plane, frontal plane and horizontal plane, respectively. The D represents the magnetic neck brace.

Table 1 Demographic data (N=10)

Variables	Mean ± SDs
Sex (male/female)	1/9
Age (years)	41.4 ± 13.1
Height (m)	1.6 ± 0.1
Body weight (kg)	59.0 ± 8.0
Duration of neck pain (days)	1327.4 ± 1113.9

Table 2 Baseline and post-treatment data of the variables.

Variables	Mean ± SDs			*t* value	*p* value
	Pre-intervention	Post-intervention	Change score		
Neck pain intensity (millimeters)					
At rest	45.3 ± 13.1	29.8 ± 12.4	15.5 ± 10.3	4.75	0.001*
On most painful movement	58.7 ± 17.9	43.9 ± 20.7	14.8 ± 15.0	3.13	0.012*
Active cervical range of movement (°)					
Flexion	47.4 ±13.5	51.0 ± 12.1	3.6 ± 5.6	-2.02	0.074
Extension	56.8 ± 4.0	61.2 ± 6.7	4.4 ± 5.8	-2.40	0.040*
Ipsilateral lateral flexion	36.4 ± 4.5	38.6 ± 4.2	1.2 ± 2.9	-1.77	0.111
Contralateral lateral flexion	35.8 ± 5.8	38.2 ± 5.2	2.8 ± 4.4	-2.00	0.077
Ipsilateral rotation	59.8 ± 5.5	61.6 ± 5.0	1.8 ± 4.3	-1.34	0.215
Contralateral rotation	59.4 ± 6.6	62.8 ± 7.3	4.6 ± 3.5	-3.28	0.010*
On most painful movement	44.0 ± 13.8	51.0 ± 16.2	7.0 ± 4.2	-5.22	0.001*

* represent statistically significant difference ($p < 0.05$)

technique. Due to the arthrokinematic movements occurred during the application of the rotation and the PA mobilization, the available range of rotation movement is larger than that of the PA movement. This would therefore allow the therapist to apply the rotation technique in a larger range of movement and more controllable than that of the PA technique. This is matched to the recommendation proposed by Maitland et al.[11] It has been suggested to apply a mobilization in a larger range and low frequency to ease the subject's pain. Therefore the more hypoalgesic effect at rest after the application of rotation technique noted in the current study than that of the IPA technique noted in the previous studies would be explained by this evidence.

The use of this technique was also effective in an increasing in active cervical ROM including extension, contralateral rotation and ROM on most painful movement with the mean change to be 4.4, 4.6 and 7.0 degrees, respectively. The mean changed in active cervical ROMs are greater than the SEM previously noted to be 3 degrees from the intra-tester reliability of the recruited assessor. However, only the change in ROM on most painful movement is considerable to be clinical relevant. This finding is inconsistent with the previous studies.[13,14]

The current study noted an important remark for the effectiveness of the mobilization technique on the active cervical ROM which is inconsistent with the previous studies. This would be explained by the movements occurred during the application of these techniques. When the PA technique is applied, this would make the superior articulation primarily glided on the inferior articulation in the PA direction while the rotation technique would make the superior articulation glided on the inferior articulation primarily in both PA and medial directions.[15] Comparing the movement occurred during the rotation technique to that of the IPA technique, it is noticed that the rotation technique would provide more arthrokinematic movements than the other. This would result in the clinical relevant effect on cervical mobilization.

However, interpreting these results would be with care because this study conducted with a small sample size. In order to generalize these results, a further study needs to investigate a larger number of subjects. Additionally, a further study is indicated to compare the effectiveness of the use of the rotation mobilization to the unilateral PA mobilization in order to best select an appropriate technique for UMNP.

Conclusion

The contralateral cervical rotation mobilization is effective in both relieving neck pain and improving the active cervical ROM in the treatment of UMNP patients.

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BIOGRAPHY

Ms Tanutree Buamanee was born on June 16, 1985 in Bangkok, Thailand. She graduated her high school from Satriwatrakhang School, Bangkok, in 2003. In 2007, she graduated her Bachelor's degree in Physical Therapy (second class honors) from the Faculty of Allied Health Science, Srinakharinwirot University. After she graduated her degree, she had been working for Saladeang Physiotherapy Clinic as a therapist until 2008. She then decided to further study and enrolled in a Master degree in Musculoskeletal Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University in June 2008. During her study, she also got the awards as the excellent student as well as a scholarship from the Faculty of Allied Health Sciences until she completed her degree.