

Short-term Benefits of Mobilization for Patients with Non-Specific Neck Pains: Executive Function and Neck Pain Intensity

Background: Cervical mobilization has been applied mainly for the improvement of arm and neck movements and pain reduction, and little research has been done to improve the executive function. Since this kind of so-called mechanical neck pain is one of most common symptoms, there are controversial issues about this with spine alignment. Posteroanterior (PA) mobilization from the Maitland concept is a process of examination, assessment, and treatment of neuromusculoskeletal disorder by manipulative physical therapy. **Objective:** To examine the short-term benefits of mobilization for patients with non-specific neck pain.

Design: Dual-group Pretest-Posttest Design from the Quasi-Experimental research

Methods: Fourteen participants (male 8, female 6; 20's of their age) with non-specific neck pains which are distributed all the unilateral or bilateral body side were recruited. Participants were categorized to Neck Pain with Movement Coordination Impairments (NPMCI) and Neck Pain with Mobility Deficits (NPMD) groups according to the results of physical examination. Professional physical therapist who has over 15-years-of clinical experience applied manipulative therapy for the neck pain, an occupational therapist only conducted evaluations; K-NDI (Korean version of the Neck Disability Index), VAS (Visual Analog Scale), BDS-K (Korean version of Behavioral Dyscontrol Scale) for decreasing possible adverse effects; there were no person who reported other symptoms followed 4 weeks from the trial.

Results: In the NPMCI group, data analysis indicated statistical differences between the PA mobilization interventions in NDI and BDS-K; even though, pain was reduced in VAS, this is not a significantly differ. In the NPMD group, data analysis represented statistical differences between the PA mobilization interventions in NDI, VAS and BDS-K; the scores were represented to be increased or the pain got relief.

Conclusions: PA mobilization techniques according to Maitland concept have beneficial effects in patients with neck pain and other clinical positive effects which included neck disability, pain itself and motor function of upper extremity.

Key words: *Posteroanterior mobilization, Manipulative therapy, Executive function, Neck pain*

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INTRODUCTION

Neck pain might be the most considerable symptoms nowadays. It could be induced from other disorders like temporomandibular disorders (TMD), weight issues, spine-related extremity symptoms,

non-ergonomic postures or even masticatory overuse¹⁾. Spine-related upper extremity pain or malfunction is defined as the constellation of symptoms featured by originated in the cervical into the upper arm with or without specific neurologic signs²⁾.

Non-specific neck pain (NP) is also known as pain

in the posterior or lateral side of the neck near the spinous process of the cervical vertebra which is interference with basic activities of daily life, make lower quality of life as well as with the absence of neurological signs and specific pathologies; such as: sprain, tumor, infectious or inflammatory cervical spondylolysis³⁾.

Clinical professionals have used manual therapy for relieving specific or non-specific neck pain. The manual therapy or manipulative therapy, is an important technique concept of physical therapy, mostly used by physical therapists to treat with many kinds of musculoskeletal pain and disability; it may include handling and manipulating of muscles, joint mobilization and joint manipulation^{4,5)}. The Maitland and Kaltenborn mobilization techniques are effective for improving pain and range of motion in frozen shoulder patients⁶⁾.

The international Maitland Teachers Association (IMTA) emphasized the Maitland concept would be one of a process of examination, assessment, and treatment of neuromusculoskeletal disorder by manipulative physical therapy⁴⁾. Physical therapist mostly accepted Grades I and II of Maitland mobilization techniques for handling joints limited by pain⁶⁾; generally, the high grades regards as Grade III-IV are targeted to manage the stiffness (resistance) dominant problems, while the small grades (I-II) are used to treat the pain dominant problems⁴⁾.

There have been reported contraindications for using manipulative therapy or manual therapy for specific or non-specific neck pain; some reports suggested that relatively mild adverse effects occur in 30% to 61 % of all patients⁷⁾. Other case-control studies suggested a causal relationship between spinal manipulative therapy and the adverse effect⁷⁾. Nevertheless, the manipulative therapy is still considered one of the most crucial methods for decrease specific or non-specific neck pain these days.

Executive function is regards as sort of cognitive function or cognitive processes that are necessary for the cognitive control of behavior: selecting and successfully monitoring behaviors that facilitate the attainment of chosen goals, but also, it is closely related to upper arm motor function. It is necessary to be considered with cognitive function and upper extremity motor function⁸⁾.

There are many of studies in this matter, especially pain relief, but we could find few researches that are dealing with executive function or specific motor function of the upper extremity.

It is crucial that consider executive function with motor function of upper arm by mobilization for

patients with non-specific neck pains, and this is the focus for this study.

METHODS

Research design

This research contains case series and dual-group Pretest-Posttest Design from the Quasi-Experimental research. Each pre- and post-test for the dual-group was conducted for examining the sort-term outcomes of the cervical spine manipulative mobilization techniques to investigate executive function and neck pain intensity. One occupational therapist, physical therapist, and an assessor were involved in this study. The physical therapist handled with the process of all the trials; the occupational therapist assessed pain and motor function of upper extremities; another assessor recorded whole procedures. All the experimental procedure was fully explained for researchers and written informed consent was provided for the participants.

Subjects

Fourteen Participants with mechanical neck pains which are distributed all the unilateral or bilateral neck side; they had had the pain on the neck at least one month ago form the research. Their neck pains were greater than second grade from the VAS that could be have clinical effects and clinically valuable. Participants were excluded if they had (1) a positive neurologic test; (2) any contraindications to mobilization (eg. inflammatory arthropathy, disease of cauda equina and/or, spinal cord, presence of malignancy) ; (3) history of cervical spine surgery; (4) previous history of fractures and significant traumas on the cervical spine, and (5) undergone spinal mobilization or manipulation therapy within two months before the research procedures. The general symptoms of the NPMCI group are: (1) mechanism of onset linked to whiplash or trauma; (2) associated upper extremity or shoulder girdle pain; (3) referred to nonspecific concussive symptoms and signs; ⁴⁾ nausea / dizziness and ⁵⁾ hypersensitivity to mechanical, light stimuli, odor, acoustic, or thermal; headache, memory, or concentration difficulties; heightened affective distress; confusion. The characteristics of the NPMD group are as follows: (1) limitation of neck movement continuously reproduces the symptoms; (2) unilateral / central and/or neck pain, and ³⁾ referred upper extremity pain or shoulder girdle pain⁹⁾.

Intervention Procedures

An eligible physical therapist who has over 15-years-of clinical experience in manual therapy was involved in this study. Initially, the participants were asked to fill out the Korean version of the Neck Disability Index (K-NDI) questionnaires and demographics chart. An assessor collected the pretreatment data, which included the typing speed, coordination index (e.g., BDS-K), the body pain location chart, pain on the most painful movement, and neck pain at rest (e.g., VAS). After the procedure, the physical therapist who did not have the information of the pretreatment data performed secondly screening examination to establish the level(s) of the intervertebral joint of each person. The level(s) was the main future treatment point where the pain or hypomobility of the cervical bone is detected. Treatment details including the most appropriate technique of mobilization, the grade of movement to be applied, and the spinal level(s) to be treated were recorded. In general, the four major grades of movement (I-IV) indicate the amplitude of mobilization. The high grades (III-IV) are used to manage the stiffness (resistance) dominant problems, while the small grades (I-II) are used to treat the pain dominant problems⁴⁾.

Once participants were classified as eligible subjects in the preliminary examination, patients would be treated with mobilization technique. Central posteroanterior (PA) pressure was applied to the vertebral segments or unilateral PA pressure was applied to the symptomatic side according to the patient's response and physical therapist's judgment. The patients were comfortable lying down and breathing by using a plinth with a perforated hole in the face. The physical therapist stood on the patient's head and placed a thumb on the thumb, and the remaining fingers naturally stretched around the neck. When performing the central PA and the unilateral PA, respectively, therapist placed the tips of their thumb on the articular process and mobilized the spinous process of the cervical vertebra. Oscillatory pressure was applied for performing the unilateral PA pressure through the thumbs directed from posterior to anterior against an articular process of the vertebrae. For the central PA pressure, a similar procedure was performed except that the therapist's thumb was placed on the lamina rather than the spinous process. A slight adjustment of mobilization grade was possible in accordance with the subjects' symptoms. The oscillations were performed in the III-IV grade of the Maitland technique with the frequency of two vibra-

tions per second. The treatment for 3 minutes was set as one set and three sets were performed. Participants rested for one minute between sets.

Outcome Measures

K-NDI (Korean version of the Neck Disability Index)

The NDI was developed for assess the neck pain-induced disability by Howard Vernon in 1989. The NDI was invented as a modification of the Oswestry low back pain disability index with the permission of the original author¹⁰⁾. Total of the 10 items scores from 0 to 5, and the highest score is 50. The obtained score can be multiplied by two to produce a percentage-version of the scores. NDI has score intervals as below; 0 to 4 = no disability, 5 to 14 = mild, 15 to 24 = moderate, 25 to 34 = severe, Above 34 = complete. Korean version (K-NDI) of this scale was edited by Song et al.¹¹⁾ and showed .902 of test-retest reliability and correlation of the NDI with VAS was $r=.489$ ($p=.002$).

VAS (Visual Analog Scale)

Visual Analog Scale (VAS) is a tool that tries to measure pain development range across a continuum of ten of digitized values¹²⁾. VAS have been used in epidemiologic and clinical research to assume the intensity of pain or related symptoms here in Korea.

BDS-K (Korean version of Behavioral Dyscontrol Scale)

The Behavioral Dyscontrol Scale¹³⁾ has features with simply evaluating of the multidimensional measure and originally developed for the assessment of geriatric patients' ability or frontal lobe and independent of upper extremity functioning. This instrument has been shown to have high level of reliability^{13,14)} and validation¹⁵⁾. Korean version of this assessment is now called BDS-K, and could assess movement planning, upper extremity motor functions¹⁶⁾. In this assessment, higher score means better functional ability level.

Statistics and Analysis

Differences upon NDI, VAS, BDS-K during the cervical PA mobilization between pre- and post-intervention; these values were assessed using a paired t-test or Mann-Whitney U test due to the statistical value's properties. Since the NDI and VAS are ordinal scale-based evaluation, we accepted Mann-Whitney U test and used a paired t-test for BDS-K which had normal distribution. Statistical analyses were performed using the SPSS software (ver. 17.0 for Windows;

SPSS Inc., Chicago, USA) with a critical p value of .05.

RESULTS

Characteristics of the participants (male 8, female 6) were suggested through table 1. Fourteen Participants with mechanical neck pains which are distributed all the unilateral or bilateral body side;

they had had the pain on the neck at least one month before the research.

In the NPMCI group, data analysis showed statistical differences between the PA mobilization interventions in NDI and BDS-K (Table 2); even though, pain was reduced in VAS, this is not a significantly differ. In the NPMD group, data analysis showed statistical differences between the PA mobilization interventions in NDI, VAS and BDS-K (Table 2); the scores were represented to be increased or the pain got relief (Table 3).

Table 1. Demographic information of the participants (N=14, NPMD=9, NPMCI=4)

Age	Height (cm)	Weight (kg)	Sex	Duration (month)	Pre -NDI	Post -NDI	Pre -VAS	Post -VAS	Pre -BDS	Post -BDS	Patient Type
23	165	48	M	1	12	13	5	4	18	19	NPMD
23	157	57	F	0,1	9	1	3	0	17	19	NPMD
25	172	70	M	10	7	0	2	1	17	19	NPMCI
23	158	54	F	2	8	5	4	1	17	19	NPMCI
26	177	73	M	0,5	4	3	2	1	19	19	NPMD
23	162	65	F	0,1	7	6	4	3	18	19	NPMD
26	170	75	M	10	6	0	2	2	18	19	NPMCI
25	175	77	M	0,1	8	3	4	1	18	19	NPMD
28	157	62	F	3	15	10	5	3	15	17	NPMD
24	175	68	M	0,2	5	4	2	1	18	19	NPMD
21	158	51	F	0,4	11	6	5	3	16	18	NPMCI
24	181	73	M	5	6	0	4	1	16	19	NPMD
25	170	110	M	3	8	1	2	1	17	18	NPMD
23	155	70	F	3	12	9	5	2	16	19	NPMD

M: Male; F: Female; NPMD: Neck Pain with Mobility Deficits; NPMCI: Neck Pain with Movement Coordination Impairments; NDI: Neck Disability Index; VAS: visual analog scale; BDS-K: Korean version of Behavioral Dyscontrol Scale.

Table 2. NPMCI group : Descriptive statistics of NDI, VAS, and BDS-K during the cervical PA mobilization.

Variables	Mean ± SD		Mean Difference	t	p
	Pre-intervention	Post-intervention			
NDI	8,00 ± 2,16	2,75 ± 3,20	,854	6,148	,009*
VAS	3,25 ± 1,50	1,75 ± ,95	,646	2,234	,103
BDS-K	17,00 ± ,81	18,75 ± ,50	,250	-7,000	,006*

NDI: neck disability index; VAS: visual analog scale; BDS-K: Korean version of Behavioral Dyscontrol Scale, SD: Standard Deviation

*p < .05.

Table 3. NPMD group : Descriptive statistics of NDI, VAS, and BDS-K during the cervical PA mobilization. (n=21)

Variables	Mean \pm SD		Mean Difference	t	p
	Pre-intervention	Post-intervention			
NDI	8.60 \pm 3.47	5.00 \pm 4.37	.957	3.762	.004*
VAS	3.60 \pm 1.26	1.70 \pm 1.25	.315	6.042	.000*
BDS-K	17.20 \pm 1.23	18.70 \pm .675	.307	-4.481	.001*

NDI: neck disability index; VAS: visual analog scale; BDS-K: Korean version of Behavioral Dyscontrol Scale, SD: Standard Deviation* $p < .05$.

DISCUSSION

Physical therapists have used manual therapy for relieving specific or non-specific neck pain. The manual therapy or manipulative therapy, has been considered one of alternative way that might have positive efficacy, mostly used by physical therapists to treat for any kinds of musculoskeletal pain and disability; it may include physical drive on the neck targeting manipulation of muscles, joint mobilization or even joint manipulation^{4, 5}.

It is already distributed to clinical field that cervical spine mobilization therapy surely provided at least short-term benefits for some patients with neck pain or even related headaches. Although contraindication or complication rate of manipulative therapy is not very controversial, expected adverse outcomes must be considered due to possibility of permanent impairment or death¹⁷. In this study, only the professional physical therapist who has over 15-year-of clinical experience applicated manipulative therapy for the neck pain, an occupational therapist only conducted evaluations for decreasing possible adverse effects; there were no person who reported other symptoms followed 4 weeks from the trial.

We accepted the Maitland concept due to benefits and the applicator's competency¹⁸. Previous works commonly mentioned to compare the effectiveness of Maitland and Mulligan concept for mobilization on pain response, range of motion (ROM) and functional ability in patients with mechanical neck pain; and any of manual therapy interventions were proceeded supervised self-exercises in reducing pain, improving ROM and neck disability¹⁹. Although, many of the contemporary people encounter tons of information of self exercises or ergonomic daily routines, some people would not accomplish their goal and there might be the limit of environment issues; in this manner, sometimes manipulative therapy could be the best solution for reducing neck pain.

It is short of evidence and we do not have enough

logic of the results; data analysis showed statistical differences between the PA mobilization interventions in NDI and BDS-K in the NPMCI group, secondary result showed statistical differences between the PA mobilization interventions in NDI, VAS and BDS-K in the NPMD group; but it could suggest further study that PA mobilization has short-term benefits for different types of neck pains.

The application of an applied mechanical force such as using manual therapy initiates a cascade of neurophysiological responses, including the autonomic nervous, peripheral, and endocrine systems²⁰. Changes in endocrine biomarkers like as cortisol hormone following manual spinal therapy have been recently summarized²¹. Cortisol is an anti-inflammatory and vital catabolic hormone regulated by the hypothalamic-pituitary-adrenal axis through the feedback and feedforward loops, that was a link to the modulation of stress-induced analgesia and nociception. Spinal manipulative therapy elicits a rise the levels in cortisol immediately after treatment, which might partly clarify the antinociceptive effect of spinal manipulative therapy²¹. Cervical mobilization also alleviates neck pain through the mechanism of this endocrine system^{21, 22}. However, there are few studies on biochemical processes supporting the antinociceptive effects of cervical mobilization.

Increase of sodium channel density, neural conduction block, mechanical sensitization, and intraneural edema have been reported in the sub-acute and acute stages of nerve root compression^{23, 24, 25}. Dysfunction can affect primary sensory neurons in the dorsal root ganglion²⁴, and the result of this change is likely to increase mechano-sensitivity²⁶. One of the solution to deal with this problem, mobilization has been used as a very suitable treatment method to remove nerve compression by securing the space of vertebral foramen. In our study, we observed that during BDS-K recording after cervical mobilization, body movement was more comfortable with reduced pain.

In this study, we did not measure hormones, but we presume that the mechanism of previous studies has reduced pain. This reduction in pain and resolution of the radiculopathy would have improved NDI and BDS-K by facilitating brain activity and freeing physical activity.

CONCLUSION

Overall, PA mobilization techniques according to Maitland concept have beneficial effects in patients with mechanical neck pain and other clinical positive effects which included neck disability, pain itself and motor function of upper extremity.

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