

Clinical feasibility of cervical exercise to improve neck pain, body function, and psychosocial factors in patients with post-traumatic stress disorder: a randomized controlled trial

SEONG DOO PARK, PhD, PT¹⁾, SUHN YEOP KIM, PhD, PT^{2)*}

¹⁾ Department of Physical Therapy, The Graduate School, Daejeon University, Republic of Korea

²⁾ Department of Physical Therapy, College of Health and Medical Science, Daejeon University: 62 Daehakro, Dong-gu, Daejeon 300-716, Republic of Korea

Abstract. [Purpose] To investigate the effect of cervical exercise on neck pain, disability, and psychosocial factors in patients with post-traumatic stress disorder. [Subjects] Thirty patients with post-traumatic stress disorder, who also complained of neck pain. [Methods] The cervical exercise group (n = 15) participated in cervical exercises for 30 min, 3 times/week for 6 weeks, and the control group (n = 16) underwent conventional physical therapy alone, without exercise. The exercises were performed in the following order: cervical relaxation, local muscle stabilization, and global muscle stabilization using a sling system. [Results] Compared to the control group, the cervical exercise group demonstrated significant decreases as follows: Visual analogue scale score, 4.2 vs. 1.0; Neck disability index, 3.9 vs. 1.9; and depression on the Symptom checklist-90-revised, 9.4 vs. 4.3 and on the Hopkins symptom checklist-25, 6.3 vs. 2.8. However, anxiety on the Symptom checklist-90-revised (3.1 vs. 1.3) was not significantly different. Effect sizes were as follows: Visual analogue scale score, 1.8; Neck disability index, 0.9; depression, 1.0; and anxiety on Symptom checklist-90-revised and Hopkins symptom checklist-25, 0.6 and 0.8, respectively. [Conclusion] Cervical exercise is effective in improving neck pain, disability, and efficacy of psychological treatment for depression in patients with post-traumatic stress disorder.

Key words: Post-traumatic stress disorder, Neck pain, Psychosocial factors

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INTRODUCTION

Post-traumatic stress disorder (PTSD) is a general anxiety disorder that was first introduced in 1980 in an American Psychiatric Association publication, *Diagnosis of Mental Disability and Statistical Manual*¹⁾. PTSD occurs following an unexpected traumatic event or life-threatening physical and mental shock, and is characterized by symptoms of hyper-arousal, re-experience of the shock, and emotional avoidance²⁾.

PTSD includes mental and physical disabilities and is often associated with pain³⁾. Chronic pain interferes with the efficacy of psychological treatment⁴⁾, and PTSD patients with chronic pain experience greater pain and pain-related impairment than non-PTSD patients with chronic pain⁵⁾. Moreover, the occurrence of pain and disability involving the musculoskeletal system affects psychiatric health

and performance capability⁶⁾. PTSD causes physical and psychological problems⁷⁾. PTSD-related psychological problems (depression and anxiety) affect neck and shoulder pain, and a previous study was able to predict neck pain in 71.1% of 200 subjects with depression and anxiety⁸⁾. The regions of neck pain show higher electromyography values due to muscle tension, and a broader area is affected by the pain with increase in stress⁹⁾.

PTSD subjects have high levels of depression, which has been reported to be associated with neck pain, although not all subjects have neck pain. Neck pain is considered to influence psychological and social factors. However, studies on the relationship between specific neck pain and PTSD are still lacking. This studies provide evidence that exercise potentially relieves PTSD symptoms. Diaz and Motta reported a significant decrease in PTSD symptoms in 91% of the children who performed walking exercise¹⁰⁾. To date, studies on therapy for PTSD have been limited to medication and cognitive behavioral therapy, and only a few studies have focused on the accompanying neck pain. Studies employing exercise as a therapy for PTSD-related neck pain may help provide better treatment for the physical and psychological ailments associated with PTSD. In particular, exercise using a sling system that allows pain-free range of motion and minimizes the effect of gravity may be an appropriate

*Corresponding author. Suhm Yeop Kim (E-mail: kimsy@dju.kr)

exercise therapy for patients with pain.

Therefore, this study aimed to examine the impact of cervical exercise (CE) on neck pain, functional changes, and the psychological status of PTSD patients with psychological disabilities.

SUBJECTS AND METHODS

This study was a randomized controlled trial consisting of an intervention group that participated in CE and a control group that did not undergo any exercise therapy. At the Department of Physical Therapy of Psychological Center in Korea, from October 2013 to February 2014, 46 individuals were diagnosed with PTSD after a calamity. This study was approved by the psychological center, and all the participants provided their written informed consent. Of these, 31 were included in the study, excluding 20 who did not meet the criteria for neck pain and 7 who decided not to attend. The patients were assessed using the Post-traumatic stress diagnosis index ($r = 0.92$) including the DSM-IV Diagnostic Criteria and Severity²). Those with neck pain for >3 months and with Neck disability index (NDI) <15 were selected for assessment of neck pain (to prevent pain from aggravation during the exercise). Exclusion criteria included a history of cervical surgery within the previous 3 months, arthritis or cervical spine fracture, accompanying neurological damage, malignant neoplasm or vascular disease, and psychiatric problems with an inability to understand the details of the questionnaires. In addition, those who had started receiving psychiatric drugs or whose dosage of psychiatric drugs was changed within the previous 2 months were excluded from the analysis. The CE group ($n = 15$) received exercise therapy for the neck muscles and joints and conventional physical therapy (hot pack, ultrasound), and the control group ($n = 16$) received only conventional physical therapy. Group assignment was determined by a coin toss; the patient was assigned to the CE group if the result was heads and to the control group if it was tails. As superficial thermotherapy for pain control in both groups, therapist A applied a hot pack for 20 min to provide heat to deeper tissues and conducted ultrasound therapy for 5 min. This was done prior to the intervention, 6 weeks after pre-assessment and intervention, and upon a subsequent evaluation. Ethics approval was obtained from the Ethics Committees of Daejeon University (1040647-201403-HR-008-03).

The CEs selected for this study were those proposed by Kirkesola¹¹). Both groups had a 10-min warm-up session, which involved treadmill exercise and stretching prior to 4 different CEs. First, for relaxation, with the head neutral in the supine position, the subjects actively moved from side to side on a non-elastic strap. Second, to bend and stretch the neck, in the same position with the head neutral, the subjects stretched their heads using an elastic strap, and bent lying face downward. Third, as a stretching exercise, in the supine position, using a sling system (Redcord Tainer, Redcord AS, Norway) with a non-elastic strap supporting the back of the skull, the subjects kept their chin down for 30 sec. Fourth, to stabilize the cervical region, subjects kept their chin down with the non-elastic strap supporting the pelvis, shoulder, and occipital bone at knee height. The first exercise

was conducted for 5–10 min; the second exercise consisted of 3 sets (hold: 30 sec, rest: 10 sec) of 15 repetitions; and the third and fourth exercises consisted of 3 sets (hold: 30 sec, rest: 10 sec). Each intervention was conducted 3 times per week for 6 weeks.

To measure the intensity of the pain involving the musculoskeletal system, a 10-cm Visual analogue scale (VAS) was used. For measurement of neck function, the Neck disability index (NDI) was used; this questionnaire was developed based on the 10-question Oswestry disability index, focusing on activities of daily life restricted by neck pain. For measurement of psychological factors, the Symptom checklist-90-revised (SCL-90-R) was used; this is a 90-question self-reported testing tool for adults to measure psychopathological symptoms, consisting of 5 factors including somatization, obsessive-compulsive syndrome, interpersonal susceptibility, depression, and anxiety¹²). For the present study, depression (13 questions) included symptoms clinically corresponding to clinical depression, including feelings of withdrawal or emotional inactiveness due to lack of interest in life, lack of motivation, loss of vitality, hopelessness, and suicidal thoughts. Anxiety (10 questions) included physical symptoms related to tension, restlessness, nervousness, fear, and anxiety. The internal consistency of this scale is 0.77–0.90¹³). The Hopkins symptom checklist-25 (HSCL-25) gathers information about depression symptoms. The original version consisted of 90 questions; the HSCL-25 is an abbreviated version with 25 questions¹⁴). The internal consistency of this scale is 0.93¹⁵). The Shapiro-Wilk test was used to verify the normal distribution of the data. For parametric data, independent t-tests were used to compare differences in between-group means, and paired t-tests were used to compare within-group means, with the significance level set at $p < 0.05$. The effect sizes for each mean difference were calculated using Cohen's d ¹⁶). Statistical analyses were carried out using a statistical software package (SPSS for Windows version 18.0, SPSS, Chicago, IL, USA) and G*Power 3.1 (Christian-Albrechts-Universität, Kiel, Germany). Data are presented as mean (standard deviation).

RESULTS

There were no significant differences in age, height, weight, body mass index, time after neck pain, or post-traumatic diagnostic scale score between the 2 groups (Table 1). There were no significant differences in pre-test values for VAS, NDI, or depression or anxiety on the SCL-90-R and HSCL-25 between the groups (Table 2). There was a significantly greater change in the VAS score in the CE group (4.26 [2.21]) than in the control group (1.00 [1.19], $p = 0.000$). There was a significantly greater change in the NDI in the CE group (3.93 [2.54]) than in the control group (1.19 [1.43]; $p = 0.013$; Table 2). There was a significantly greater change in depression on the SCL-90-R in the CE group (9.40 [5.22]) than in the control group (4.33 [4.70], $p = 0.009$); however, the anxiety was not significantly different between the groups (3.06 [2.31] in the CE group vs. 1.26 [3.26] in the control group, $p = 0.092$). There was a significantly greater change in the HSCL-25 score in the CE group (6.33 [5.21]) than in the control group (2.80 [2.93], $p = 0.030$). In addition,

the effect sizes of VAS, NDI, and depression and anxiety on SCL-90-R and HSCL-25 were standard deviation units of 1.83, 0.97, 1.02, and 0.63 and 0.83, respectively (Table 2).

DISCUSSION

This study demonstrated significant decreases in VAS, NDI, depression, and anxiety on the SCL-90-R (indicative of psychological status) and the HSCL-25 in PTSD subjects who underwent CE for neck pain. Therefore, it is suggested that CE improves neck pain and NDI, and has favorable effects on psychological problems, depression, and anxiety in PTSD subjects with neck pain. Moreover, the CE group showed enhanced indices in the status of neck pain, disability, and depression compared with the control group. It is surmised that CE may initiate faster recovery of cervical function and psychological symptoms in PTSD subjects.

The subjects in this study differ from those with only neck pain, because in this case, the neck pain derives from their psychological problems. In general, subjects diagnosed with PTSD of 48–55% have major depressive disorders^{17, 18}. Treatment of PTSD patients mainly involves psychotherapy,

whereas musculoskeletal problems are overlooked. In fact, a high proportion of neck pain has been reported in subjects with psychological problems⁸. The CE used in this study is effective for treating cervical problems^{19, 20}. Except for the change in anxiety, there were significant differences between the CE and control groups. Therefore, CE may be clinically relevant as it helps to resolve neck pain and disability and improve psychological problems.

The present study showed that 6 weeks of CE after conventional physical therapy improved neck pain, reduced neck disability, and enhanced the depression index. The improvement in neck pain and NDI in the CE group is consistent with that reported in prior studies^{21, 22}. CE also improved depression as measured by the SCL-90-R and HSCL-25. Subjects with a high depression level are more susceptible to neck pain²³. Chronic pain and depression often occur simultaneously; individuals with pain have an increased risk of depression, and those with depression have an increased risk of pain²⁴. A recent systematic review examined risk factors and determinants of neck pain in the general population and found consistent evidence of musculoskeletal system problems and psychological factors in healthy individuals²⁵. This is in agreement with the current study, indicating that musculoskeletal and specific neck pain may be predictors of depression.

The current study has significance as a promising therapeutic strategy for subjects with psychological problems like PTSD, and it provides preliminary results for a specific intervention for psychological problems and pain involving the musculoskeletal system. Currently, there are no studies or guidelines on CE for PTSD subjects. In the present study, CE consisted of a sling system, which has beneficial effects and is safe. Additionally, this program was designed as a method most frequently used by patients with common chronic neck pain¹¹. Since the sling-based CE minimizes the effect of gravity, patients need to exert less effort; moreover, it is a regular exercise that utilizes the therapist's manual resistance, weights, and elastic bands and applies closed-kinetic chain or open-kinetic chain exercises. Furthermore, this exercise has no serious side effects and is used in physical therapy intervention and rehabilitation. CE is a promising approach for subjects with neck pain as it reduces pain

Table 1. General characteristics of the subjects

	CE group (n ₁ = 15)	Control group (n ₂ = 16)
Age (years)	57.5 (6.7) ^a	62.8 (7.9)
Gender (male/female)	13/2	12/4
Height (cm)	167.4 (5.1)	168.7 (7.6)
Weight (kg)	63.5 (11.6)	67.5 (11.4)
BMI (kg/m ²)	23.3 (3.5)	23.7 (3.3)
Duration of neck pain (months)	24.6 (12.1)	20.2 (10.1)
PDS		
Re-experiencing	12.8 (1.3)	12.3(1.4)
Avoidance	14.4 (1.1)	13.9 (1.1)
Arousal	13.1 (1.1)	13.0 (1.1)

^aMeans (SD).

CE: cervical exercise; BMI: body mass index; DSM: diagnostic and statistical manual of mental disorder;

PDS: post-traumatic diagnostic scale

Table 2. The within-group and between-group comparisons for the outcome measures

	CE group		Difference (post-pre)	Control group		Difference (post-pre)	Between groups 95% CI	Effect sizes
	Pre-test	Post-test		Pre-test	Post-test			
Pain (VAS)	7.7 (2.4) ^a	3.4 (3.1)*	-4.3 [†]	8.7 (1.9)	7.7 (1.7)*	-1.0	(1.9 to 4.6)	1.8
Disability (NDI)	9.6 (2.2)	5.6 (2.9)*	-3.9 [†]	9.5 (2.3)	7.6 (2.4)*	-1.9	(0.5 to 3.5)	0.9
SCL-90-R								
Depression	37.7 (6.9)	28.3 (5.5)*	-9.4 [†]	36.5 (4.9)	32.1 (4.1)*	-4.3	(-8.8 to -1.4)	1.0
Anxiety	29.1 (4.7)	26.0 (5.0)*	-3.1	29.2 (3.9)	27.9 (4.5)	-1.3	(3.9 to 0.3)	0.6
HSCL-25	53.8 (8.1)	47.5 (8.8)*	-5.3 [†]	48.5 (7.2)	45.7 (7.4)*	-1.8	(-6.7 to -0.4)	0.8

^aMeans (SD).

*Significant difference within group (p < 0.05); [†]Significant difference between groups (p < 0.05).

CE: cervical exercise; CI: confidence interval; VAS: visual analogue scale (range 0–10);

NDI: neck disability index (range 0–50); SCL-90-R: symptom checklist-90-revision (range; depression 0–52, anxiety 0–40), HSCL-25: Hopkins symptom checklist-25 (range 0–75).

Cohen's effect sizes: 0.15 = small, 0.4 = medium, 0.75 = large, 1.1 = very large, 1.45 = huge effect size

and disability and improves the psychological status.

This study has some limitations. The PTSD in the study subjects was caused by a calamity; it is therefore difficult to generalize the findings to all PTSD patients. In addition, as the sample size was relatively small, the results may not be statistically significant, and the study duration may be too short to demonstrate the effects of the CE. Lastly, there is a lack of questions for measuring neck pain and disability with psychological factors, making it difficult to generalize the results.

In this study, an exercise intervention was applied specifically to subjects with neck pain. Future studies should address other musculoskeletal problems and changes in psychological factors, and additional interventions for patients with PTSD and neck pain should be developed.

In conclusion, CE reduces pain levels and cervical disability as well as the level of depression in PTSD subjects with neck pain. However, it has no impact on anxiety.

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