

# Effects of Specific Exercise on Chronic Neck Pain in Elderly Women



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**Purpose:** The main causes of chronic neck pain (CNP) are wrong postures and degenerative changes. This study investigated the effects of specific exercise on elderly women with CNP.

**Methods:** 29 elderly women who complain of CNP were classified into experimental group (14) and control group (15). The experimental group was treated with specific exercise and minimal conventional therapy, whereas the control group was treated only with conventional therapy. Then the effects on the visual analogue scale (VAS), neck disability index (NDI), self-rating anxiety scale (SAS), Korean form of geriatric depression scale (KGDS), and range of motion (ROM) were compared between the two groups.

**Results:** The experimental group showed significantly improved results in VAS, NDI, SAS, KGDS, and ROM after intervention ( $p < 0.05$ ), as did the control group ( $p < 0.05$ ). The comparison of changes in the experimental group before and after intervention showed superior results in the SAS, NDI, and ROM (flexion, rotation, lat. flexion) results when compared with the control group ( $p < 0.05$ ).

**Conclusion:** Specific exercise is effective in the improvement of SAS, NDI, and ROM for elderly women with CNP.

**Keywords:** Chronic neck pain, Cranio-cervical flexion, Specific exercise

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## 1. Introduction

The most significant physical change in elderly people is musculoskeletal problems.<sup>1</sup> These problems lead to declined physical abilities, dysfunction and malfunction of the elderly which are serious problems that cannot be ignored because they have direct influence on activities, hinder independent daily life and threaten the quality of life.<sup>2</sup>

Neck pain can be defined as a pain in the back of the neck between external occipital protuberance and the 7th cervical vertebra.<sup>3,4</sup> It is often accompanied by pain in occipital, scapular posterior, and upper thoracic regions as well as upper extremities. It may appear clinically along the spinal segments such as thoracic region and upper extremities even without any neural stimulus or pressure.<sup>4</sup> Furthermore, neck pain may medically manifest as chronic subjective symptoms such as chronic fatigue,

muscle tenderness, muscle spasm, and muscle weakness.<sup>5</sup> There are many factors that cause neck pain, but according to Dvorak and colleagues,<sup>6</sup> 87.5% of neck pain cases were brought about by soft tissue damage due to unspecific causes, 5.3% by sequela from accidents or impacts, and 4.5% by other causes. They concluded that habitual unstable postures induce soft tissue injury and muscle stiffness, and chronic lack of exercise combined with unstable postures cause pain.<sup>7-9</sup>

The neck plays important roles such as supporting the weight of head and transmitting the force from the trunk. The general musculoskeletal changes in the whole body of the elderly induce forward head posture (FHP) of the neck in proportion to age.<sup>10</sup> If such wrong postures with a considerable unbalance of muscles are continued, it causes abnormal posture control of muscles and joints resulting in abnormal tension in head and neck. This brings about decreased flexibility, pain and limita-

tions of motion, leading to changes in soft tissues and bones.<sup>11</sup> It has been reported that the chronic changes in neck postures decrease the isometric strength and endurance of the neck flexor and causes pain.<sup>12</sup>

Specific exercise to retrain cervical spine muscle function is advocated in the management of neck pain. This study chose cranio-cervical flexion exercise (CCFE) as an effective mechanism to activate muscular functions and support the cervical vertebrae. The emphasis of CCFE is on activation of the deep cervical flexor muscles (longus capitus, longus colli) by specifically targeting flexion motion of the upper cervical motion segments. This intervention has been shown to improve the temporal control of the deep cervical flexor muscles and proprioception of the neck, as well as leading to changes in pain and disability in painful neck disorders.

It has been reported that most neck pain cases are due to pathologic disease of tissues but nonspecific CNP such as wrong postures and degenerative changes.<sup>13</sup> However, clinical treatment generally focuses on decreasing pain because the pathological causes of neck diseases have not been clarified.<sup>13,14</sup>

Even though various therapeutic exercises such as mobility exercise, stretching exercise, isometric exercise, or dynamic strength training according to the therapist's decision based on the benefits of the therapies and the adequacy of many theories, the scientific evidences for the therapeutic effects are not sufficiently presented.<sup>15</sup> Therefore, this study intended to investigate the effects of specific exercises on CNP patients, present effective forms of therapeutic exercises, and stress the importance of active exercise. The purpose of this study is to compare the effects of conventional therapy and specific exercises for elderly women who complain of CNP.

## II. Methods

### 1. Subjects

The subjects of this study were 65 or older elderly women who had received treatment for at least 6 months with nonspecific CNP as the main symptom in the "S" clinic in Daejeon who sufficiently understood the purpose of this study and consented to the intent of this study and who properly understood and could follow the directions of the researchers. Participants were excluded if they had signs of neurological involvement, or had

any other medical disorder that would contraindicate physical exercise. A person who was independent from the delivery of treatments and the measurement of outcomes used a randomly generated set of numbers to randomly allocate participants to either the specific exercise or conventional therapy intervention.

### 2. Intervention

Intervention of experimental group and control group were conducted six times in a week for 12 weeks. This study was performed from July 1 to September 30 in 2009.

#### 1) Control (conventional therapy) Group

The conventional therapy included hot pack for 20 min, therapeutic ultrasound for 5 min ( $1.0 \sim 1.2 \text{ W/cm}^2$ ), and electric therapy for 15 min (transcutaneous electrical nerve stimulation: TENS, frequency 100 Hz). The electrodes of the Low-frequency therapy were allocated to the trapezius upper fibers that had pain using unilateral placement. For ultrasound, continuous ultrasound waves were applied to the trapezius upper fiber that had the severest pain using stroking technique.

#### 2) Experimental (specific exercise) Group

The patients of the experimental group took the specific exercise for 20 min. with the conventional therapy that consisted of hot pack for 10 min, ultrasound for 5 min ( $1.0 \sim 1.2 \text{ W/cm}^2$ ), and electric therapy for 5 min (TENS, frequency 100 Hz). They were instructed to take the exercise at least once a day.

The specific exercise program consisted of cervical motions (lateral flexion, rotation, flexion, extension), standing against a wall with a flattened back, chest stretch in wall standing, and CCFE in reference to the exercise proposed by Wright et al.<sup>16</sup> and Oh<sup>17</sup> Participants performed a CCFE in supine. This task involves flexion of the cranium on the cervical spine while ensuring the back of the head remains in contact with the supporting surface in an effort to facilitate activation of the deep cranio-cervical flexor muscles with minimal activity of the superficial cervical flexors.

### 3. Measurement Tools and Methods

#### 1) Pain

The Visual Analog Scale (VAS) was used for measurement of pain. Participants rated their level of neck pain at rest on a VAS; a 10-cm sliding scale anchored by the descriptors "no pain" and

**Table 1.** General characteristics (N=29)

	Experimental group (n <sub>1</sub> =14)	Control group (n <sub>2</sub> =15)	t
Age (years)	77.6±4.1*	75.3±5.2	1.3 <sup>†</sup>
Height (cm)	148.6±4.0	149.8±6.1	-0.6 <sup>†</sup>
Weight (kg)	54.5±8.1	53.9±8.2	0.2 <sup>†</sup>
Medical history (years)	11.5±6.7	24.5±37.3	-1.3 <sup>†</sup>

\*mean±SD, <sup>†</sup>p>0.05

“worst pain imaginable”.<sup>18</sup>

## 2) Neck Disability Index (NDI)

The NDI is a self-reporting instrument for the assessment of perceived pain and physical disability of participants with neck pain.<sup>19</sup> Vernon<sup>20</sup> reported that it had a high reliability of 0.90 to 0.93 in the study of test-retest reliability of NDI and the internal consistency of the study results was 0.74 to 0.93. NDI was analyzed as a highly reliable evaluation tool. Korean version of the scale has also been validated.<sup>21</sup>

## 3) Depression Scale

The psychological Responses and depression level due to geriatric neck pain were measured using the Korean Form of Geriatric Depression Scale (KGDS) which was standardized by Kwon and Kim.<sup>22</sup> Geriatric Depression Scale (GDS) was developed by Yesavage et al.<sup>23</sup> KGDS consists of 40 positive and negative questions in total to which the subjects answer “Yes” or “No.” The 40 questions were recognized as having reliability and validity with the Cronbach  $\alpha$  factor of 0.88 and the split-half reliability of 0.79.

## 4) Anxiety Scale

Anxiety was measured using a structured questionnaire with 20 questions of the Self-rating Anxiety Scale (SAS) by Zung<sup>24</sup> which were translated by Lee.<sup>25</sup> The Anxiety Scale was shown to have statistically significant reliability with the reliability factor of 0.98 (p<0.01) and the internal consistency of 0.96 (p<0.01).

## 5) Cervical range of motion (CROM)

Neck mobility was assessed using the method described by Palmer and Epler.<sup>26</sup> A linear measurement is obtained through the use of a tape measure (Hoechstmass, Germany) for neck mobility. All assessments of neck mobility were performed while sitting on a chair with back support.<sup>26</sup> The head and neck are in the anatomical position. The back of the chair provides support

for the thoracic and lumbar spine. The subject was instructed to stabilize the shoulder girdle by holding the bottom of the chair, in order to prevent compensatory movements in the scapular, thoracic, and lumbar spine.

Neck flexion and extension were measured as the distance between the tip of the chin and the suprasternal notch at maximal flexion and extension of the neck. The measurement of neck rotation reflected the distance between the mastoid process of the skull and the acromion process at maximal neck rotation, and measurement of lateral flexion of the neck reflected the distance between the tip of the chin and the acromion process at maximal lateral flexion of the neck.

## 4. Statistical Analysis

SPSS (version 12.0) was used for statistical analyses. Differences between the pretreatment and posttreatment were analyzed using the Wilcoxon matched-pairs signed-ranks test. The Mann-Whitney U Test was conducted to compare the changes between the two groups. The significance level was set at p<0.05.

## III. Results

This study was conducted to investigate the effects of posture correction exercises on the VAS, NDI, SAS, KGDS, and CROM of women aged 65 or older who complain of chronic neck pain.

### 1. Subjects

Twenty-nine volunteers were participated in the study and divided into two groups; a control (15), and a experimental group (14). The general characteristics of subjects were found to be no difference between groups in age, height, weight, and medical history (Table 1).

### 2. Self-report measure; VAS, NDI, SAS and KGDS

The VAS, NDI, SAS, and KGDS scores of the experimental

**Table 2.** Comparison of VAS, NDI, SAS, KGDS between pre-treatment & post-treatment in both groups (N=29)

	pre-treatment (mean±SD)	post-treatment (mean±SD)	t
VAS			
Experimental	61.43±14.06	37.86±18.47	8.75 <sup>†</sup>
Control	63.33±16.33	43.33±20.24	7.25 <sup>†</sup>
NDI			
Experimental	32.21±7.91	26.57±8.63	7.19 <sup>†</sup>
Control	28.47±5.60	25.93±5.16	5.98 <sup>†</sup>
SAS			
Experimental	55.57±7.54	43.29±7.43	7.86 <sup>†</sup>
Control	53.40±8.88	49.53±7.67	4.85 <sup>†</sup>
KGDS			
Experimental	18.21±4.93	15.29±5.05	6.18 <sup>†</sup>
Control	12.53±5.82	11.87±5.73	2.47 <sup>†</sup>

VAS: Visual analogue scale, NDI: Neck disability index, SAS: Self-rating anxiety scale, KGDS: Korean form of geriatric depression scale  
<sup>†</sup>p<0.05

**Table 3.** Comparison of range of motion between pre-treatment & post-treatment in both groups (N=29)

	Pre-treatment (mean±SD)	Post-treatment (mean±SD)	t
Flexion			
Experimental	34.86±21.76	19.71±19.10	4.84 <sup>†</sup>
Control	33.73±14.50	31.07±14.48	2.08
Extension			
Experimental	144.86±15.22	156.79±15.28	-6.02 <sup>†</sup>
Control	148.33±24.40	154.40±17.55	-1.96
Rt. rotation			
Experimental	148.00±21.98	128.64±27.87	3.48 <sup>†</sup>
Control	146.00±19.59	144.60±19.42	2.25 <sup>†</sup>
Lt. rotation			
Experimental	156.29±14.03	139.57±25.05	3.84 <sup>†</sup>
Control	147.33±15.76	145.33±15.03	2.31 <sup>†</sup>
Rt. lateral bending			
Experimental	150.07±18.74	137.71±18.74	3.69 <sup>†</sup>
Control	160.53±13.85	159.00±15.09	1.35
Lt. lateral bending			
Experimental	152.43±13.67	138.86±16.22	3.76 <sup>†</sup>
Control	158.07±13.10	157.33±13.55	2.58 <sup>†</sup>

<sup>†</sup>p<0.05

group and the control group were measured before and after treatment. For the experimental group, the changes were all statistically significant (p<0.05). For the control group, the changes were all statistically significant (p<0.05)(Table 2).

### 3. CROM measure

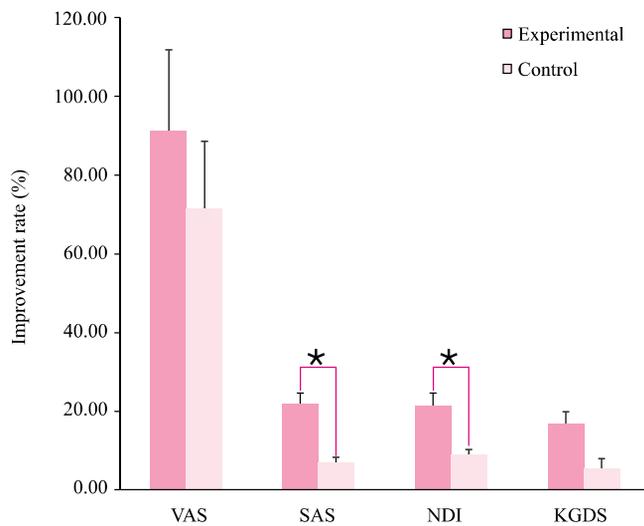
The CROM values of the experimental group and the control group were measured before and after treatment. For the experimental group, the changes of CROM were all statistically

significant (p<0.05)(Table 2).

For the control group, the right rotation, left rotation and left lateral flexion were statistically significant (p<0.05). However, the changes in flexion, extension and right lateral flexion were statistically insignificant (p>0.05)(Table 3).

### 4. Interaction between groups

The changes were compared between the two groups. The difference in VAS changes was statistically insignificant: 91.50



**Figure 1.** Comparison of change in VAS, SAS, NDI, KGDS between experimental group & control group (\* $p < 0.05$ ). VAS: Visual analogue scale, NDI: Neck disability index, SAS: Self-rating anxiety scale, KGDS: Korean form of geriatric depression scale

$\pm 20.44$  for the experimental group and  $71.62 \pm 16.94$  for the control group ( $p > 0.05$ ). The difference in SAS changes was statistically significant:  $21.83 \pm 2.54$  for the experimental group and  $6.95 \pm 1.25$  for the control group ( $p < 0.05$ ). The difference in the NDI changes was statistically significant:  $21.25 \pm 3.38$  for the experimental group and  $5.34 \pm 2.28$  for the control group

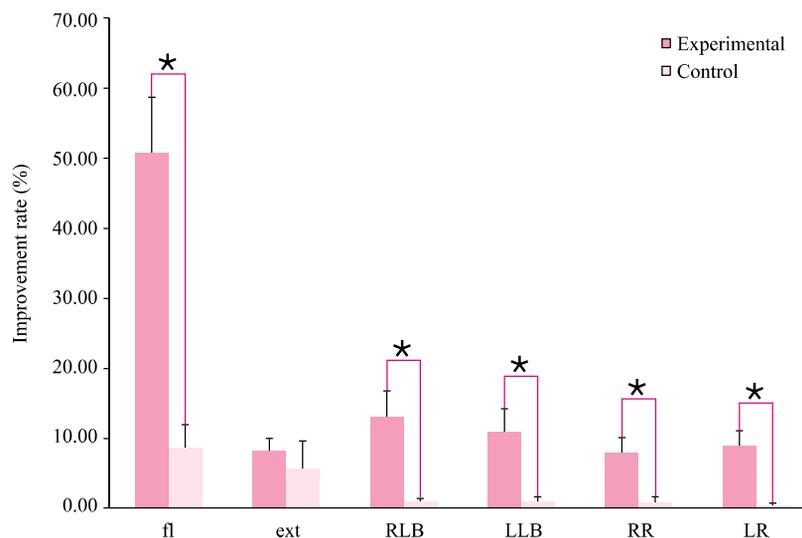
( $p < 0.05$ )(Figure 1). The difference in KGDS was statistically insignificant:  $16.76 \pm 3.03$  for the experimental group and  $5.34 \pm 2.28$  for the Control group ( $p > 0.05$ )(Figure 1).

For the difference in the changes in CROM between the experimental group and the Control group, the differences in the changes of flexion, lateral flexion, and rotation were statistically significant ( $p < 0.05$ ). However, the difference in the changes of extension was statistically insignificant ( $p > 0.05$ )(Figure 2).

#### IV. Discussion

The purpose of this study was to investigate the effects of specific exercise on the elderly women who complained of CNP for at least 6 months. The VAS, NDI, SAS, KGDS, and CROM of the neck could be more effectively improved when the specific exercise was applied to CNP patients. Also, the difference in the SAS, the NDI and some of the CROM changes between control group and experiment group were statistically significant.

The deep flexors of neck are important muscles for the control and support of scapula and neck, and enable the effective movement of upper extremities by supporting and stabilizing the head against gravity.<sup>27</sup> CCFE which was conducted in this study flexes the upper cervical segments and activates the deep muscles (longus capitis, longus colli) of the cervical flexors.<sup>27</sup>



**Figure 2.** Comparison of change in range of motion of neck between experimental group & control group (\* $p < 0.05$ ).

fl: flexion, ext: extension, RLB: Right lateral bending, LLB: Left lateral bending, RR: Right rotation, LR: Left rotation

Many CNP patients report instability of 2/3 top segment of the cervical region, and CCFE can immediately bring about stabilization of the upper cervical region and reduction of the local pain.<sup>27</sup> O'Leary et al.<sup>27</sup> reported that the application of CCFE to CNP patients brought about immediate pain reduction and improvement in VAS and the follow-up measurement after 12 months found increased CROM, pain reduction, and loss of upper cervical tenderness. Similarly in this study, specific exercise brought about pain reduction and CROM increase, and the cervical flexibility was improved by individual manual stretching exercise for superior trapezius and levator scapulae.

Due to a change in spinal alignment, the elderly experiences an increase of thoracic kyphosis and FHP as a result.<sup>28</sup> FHP generates excessive pressure to the apophyseal articular and the back of vertebral body, thus affecting the physiological dynamics of the head and neck and limiting the mobility of the cervical region.<sup>29</sup> Such abnormal position of the head limits CROM and excessively moves forward the center of gravity of the head, which shortens the cervical extensor and weakens the cervical deep flexors such as longus capitis and longus colli.<sup>30,31</sup> The study by Chae et al.<sup>32</sup> instructed headache patients with FHP to conduct cranio-cervical exercise which brought about significant changes in CROM except lateral flexion and decreased headache. In this study, the patients performed flexibility exercise for muscles around the neck together with CCFE which brought about significant changes in CROM ( $p < 0.05$ ).

Many studies on neck pain focus on pain reduction and improvement of functional disabilities, and not many studies have been conducted on the mental and psychological problems and prognosis related to pain. Such emotional factors as depression and anxiety are closely associated with pain, and pain increases as the level of such factors is higher.<sup>33</sup> Leclerc et al.<sup>34</sup> claimed that the psychological factors and problems are the prognostic factors of neck pain. A study on the relationship between pain and depression reported that neck is the region at which pain occurs the most frequently and the percentage of people with depression who develop neck pain was very high.<sup>35</sup> Moreover, depression is the most frequent psychological disorder of the elderly. It was found that the percentage of minor or higher depression levels among the elderly patients was 90.8%, and the percentage of severe or higher depression levels was 27.5%.<sup>23</sup> This study used KGDS to evaluate the depression levels of the elderly patients in each group. KGDS was devel-

oped by Kwon and Kim<sup>22</sup> who adapted the GDS developed by Yesavage to the elderly in Korea.

This study limited the subjects to female participants to avoid potential confounding because it was reported that the pain perception differed by sex and more women than men were exposed to CNP because the muscle power of women was lower than that of men.<sup>36,37</sup> Another limitation of this study is that no follow-up was conducted for the subjects and the continuity and long-term effects of the specific exercise could not be known. Future studies should include male participants who complain of CNP, increase the number of subjects, and include a research method for follow-up on the posture maintenance and changes.

## V. Conclusion

This study instructed elderly women aged 65 or older who complained nonspecific CNP to perform specific exercise six times a week, and analyzed its effects on VAS, NDI, SAS, KGDS, and CROM. It was found that the specific exercise for enhancement of the deep cervical flexor muscles was effective in VAS, NDI, SAS, KGDS, and CROM for elderly women with nonspecific CNP.

## Author Contribution

Research design: Shin SH, Choi JD

Acquisition of data: Shin SH, Choi JD

Analysis and interpretation of data: Shin SH, Choi JD

Drafting of the manuscript: Shin SH, Choi JD

Administrative, technical, and material support: Shin SH, Choi JD

Research supervision: Choi JD

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