

# The Effects of the Cervical Deep Muscle Flexion Exercises on Pain and Cervical Function in Patients with Chronic Cervical Pain

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**Purpose** This study was conducted to verify that the cervical deep muscle flexion exercises (CDFE) benefit on stability in the neck so that the patients would have less pain and better cervical function. **Methods** The subjects in this study were assigned into an experimental group (EG) of 16 subjects and a control group (CG) of 16 subjects. The CDFE and stretching exercise (SE) were applied to the EG and CG, respectively. And, visual assessment scale (VAS) for pain and neck disability index (NDI) for cervical function were used to assess the subjects before and after the intervention. The subjects performed the exercises 3 times a week for 4 weeks. **Results** There was a significant difference in variations of cervical pain in between the EG and CG from  $25.16 \pm 13.29$  to  $6.38 \pm 8.14$  mm. There was a significant difference in variations of neck functional disability in between the EG and CG from  $4.94 \pm 2.17$  to  $0.25 \pm 1.73$  point. **Conclusion** The subjects performed the CDFE for 4 weeks were able to correct the spine alignment and strengthen the muscles around the cervical region, which was able to reduce stress on the neck so that cervical pain was reduced and the neck functional ability was increased.

**Key words** Chronic neck pain, Deep muscle flexion exercises, Neck functional disability, Stretching exercise, Visual pain scale

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## I. Introduction

Cervical lesion which is a high morbidity and costing disease is getting increased by overuse of muscles around the neck in repetitive and continuous tasks in a work place nowadays.<sup>1)</sup> Using a fixed gadget for a while in sitting position is prone to explore to static loading. And a desk and chair with unfitted physical condition as well as a lack of exercise can be possible causes<sup>2)</sup> to develop health problems in the neck because of a poor posture.<sup>3)</sup> If the neck pain goes consistently more than 3 months, it is regarded as a chronic cervical pain<sup>4)</sup>, and head forward protraction is the main cause of the pain in the neck<sup>5)</sup> causing increased lordosis in cervical region and shortness in muscles around the suboccipital region.<sup>6)</sup> Therefore, this posture induces weakness of the deep flexor muscles in cervical region and causes pain and in-

stability in the neck.<sup>7)</sup> The previous study showed that the exercises strengthening the deep flexor muscles in cervical region alleviated pain and got the subjects to have a right posture back. The exercises focused on improving functional problems of muscles around the cervical region.<sup>5)</sup> The previous study introduced the exercise program for stability in the neck. To place the cervical region in neutral position helped the cervical region be stabilized and minimize activation of the superficial muscles such as sternocleidomastoid and anterior scalene and facilitate more the deep flexor muscles such as longus coli and longus capitis.<sup>8)</sup> Therefore, the cervical deep muscle flexion exercises (CDFE) benefit on chronic neck pain and stability in the neck so that the patients with forward head protraction would have less pain and better cervical function.

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## II. Materials and Methods

Thirty-two subjects with chronic neck pain because of forward head protraction participated in this study and understood the purpose of the study and submitted the informed consent. This study was conducted from November 1<sup>st</sup> to 31<sup>st</sup>, 2017.

The including criteria were as follows: 1) below 49° of the Craniovertebral angle.<sup>9)</sup> 2) having constant or intermittent neck pain within last 3 months. The excluding criteria were as follows: 1) neurologic or vascular problems. 2) orthopedic problems in the neck or shoulder region. 3) a surgery in the spine before.

The subjects in this study were assigned into an experimental group (EG) of 16 subjects and a control group (CG) of 16 subjects by table of random number of Microsoft Excel 2010 Program.

The CDFE and stretching exercise (SE) were applied to the EG and CG, respectively. And, visual assessment scale (VAS) for neck pain and neck disability index (NDI) for cervical function were used to assess the subjects before and after the intervention. The subjects performed the exercises 3 times a week for 4 weeks. The assessments were performed 3 times and yielded the mean value of them.

### The intervention consists of the CDFE and SE.

#### 1. The cervical deep muscle flexion exercises

##### (1) General isometric exercise

Two general isometric exercises were performed separately according to a week. In first 1<sup>st</sup> and 2<sup>nd</sup> weeks, the subjects performed the conventional cervical isometric exercise 1. The subjects stand with the head and thoracic region leaning on a wall and the chin and shoulders in neutral. And then, the subjects perform isometric exercises as flexing independently their cervical region down until the lower cervical regions do not flex which was controlled by feedback of the base of the support in the ground. In 3<sup>rd</sup> and 4<sup>th</sup> weeks, the subjects performed the conventional cervical isometric exercise 2. The subjects stand facing toward the wall and put the forearm on the wall so that the scapulars should be placed in neutral. And

then, they flex only cervical regions down as they maintain their heads over and behind the shoulders. The exercises were performed 10 repetitions per 1 session, a total of 3 sessions, maintaining each repetition for 10 seconds and took 3-5 seconds rest between the repetitions and a 2-minute rest between the sessions.<sup>10)</sup>

##### (2) Exercises with pressure biofeedback unit

The subjects in hook-lying position take a look at the pressure scale as pressing down the air bag in the suboccipital portion by tucking the chin in (22mmHg in 1<sup>st</sup> week, 24mmHg in 2<sup>nd</sup> week, 26mmHg in 3<sup>rd</sup> week, 28 mmHg in 4<sup>th</sup> week). The exercises were performed 10 repetitions per 1 session, a total of 3 sessions, maintaining the pressure on the target level for 10 seconds and given a 2-minute rest between the sessions.<sup>11)</sup>

#### 2. Self-stretching exercises

SE<sup>12)</sup> were performed for pectoralis minor and major, levator scapular and upper trapezius which were shortened due to upper cross syndrome.

##### (1) Pectoralis major and minor stretching

A subject sits on a chair tall and tight with the chin tucked in and grabs an elastic band that he/she can pull the band down behind the head after putting his/her arms up over the head. The subject maintains the stretched position for 45 seconds which is 1 session and repeats 3 times for 1 session.

##### (2) Levator scapulae stretching

A subject sits on a chair tall and tight with the chin tucked in and holds the chair with the hand in the opposite side to the levator scapular stretched. The subject holds the back of the head with the other hand and pulls the head down with head rotated to the same side of the hand holding the head. The subject maintains the stretched position for 45 seconds which is 1 session and repeats 3 times for 1 session in the left and right side.

##### (3) Upper trapezius stretching

A subject sits on a chair tall and tight with the chin

**Table 1. General characteristics of the subjects (N=32)**

		EG (n=16)	CG (n=16)	<i>p</i>
		(n(%))/M±SD		
Gender	Male	8(50%)	11(68.8%)	0.280 <sup>a</sup>
	Female	8(50%)	5(31.2%)	
	Age(years)	30.1 ± 2.7	31.0 ± 5.2	0.525 <sup>b</sup>
	Height(cm)	164.4 ± 7.7	163.8 ± 8.2	0.843 <sup>b</sup>
	Weight(kg)	61.8 ± 10.5	63.4 ± 9.9	0.656 <sup>b</sup>

<sup>a</sup>, Chi-squared test; <sup>b</sup>, Independent-t test; EG, Experimental group; CG, Control group

**Table 2. Variations of cervical pain (N=32)**

		EG (n=16)	CG (n=16)	<i>t</i>	<i>p</i>
VAS	Pre-test	51.38 ± 22.93	46.06 ± 20.74	-2.252	0.033L
	Post-test	26.25 ± 14.08	39.69 ± 19.28		
(mm)	<i>t</i>	7.562	3.133		
	<i>p</i>	0.000**	0.007*		

M±SD; \*, *p* < .05 Significant differences pre and post tests; \*\*, *p* < .001 Significant differences pre and post tests; †, *p* < .05 Significant differences between the two groups; VAS, Visual analog scale; EG, Experimental group; CG, Control group

tucked in and holds the chair with the hand in the opposite side to the upper trapezius stretched. The subject holds the side of the head with the other hand and pulls the head down sideway to the same side of the hand holding the head. The subject maintains the stretched position for 45 seconds which is 1 session and repeats 3 times for 1 session in the left and right side.

Visual analog scale(VAS) was used to assess pain in the neck.<sup>13)</sup> And, neck disability index (NDI) was used to assess functional disability in the neck. NDI consists of 10 questions (pain scale, activity of the daily living, lifting, reading, headache, attention, work, driving, sleeping and leisure) and was developed to assess the level of functional disability. Each item scales from 1 to 5 points and if the total points are from 0 to 4 points, it means “No disability”, 5 to 14 points means “mild disability”, 15 to 24 points means “moderate disability”, 25 to 34 points means “severe disability” and above 25 points means “complete disability”.<sup>14)</sup>

### III. Results

#### 1. General characteristics of the subjects

There were 16 subjects in the EG (8 males and 8 females, mean age of 30.1 ± 2.7 years old, mean height of 164.4 ± 7.7 cm, mean weight of 61.8 ± 10.5kg) and the CG (11 males and 5 females, mean age of 31.0 ± 5.2 years old, mean height of 163.8 ± 8.2 cm, mean weight of 63.4 ± 9.9kg) each. There was not a significant difference in homogeneity between the groups. Table 1 shows the general characteristics of the subjects in this study.

#### 2. Variations of cervical pain

There were significant differences from 51.38 ± 22.93 mm to 26.25 ± 14.08 mm and from 46.06 ± 20.74 mm to 39.69 ± 19.28 mm in the EG and CG, respectively. There was a significant difference in between the EG and CG from 25.16 ± 13.29 mm to 6.38 ± 8.14 mm. (Table 2)

#### 3. Variations of neck functional disability

There was a significant difference from 18.25 ± 3.79 to 13.31 ± 2.70 points in the EG. There was a significant difference in between the EG and CG from

**Table 3. Variations of neck functional disability (N=32)**

		EG (n=16)	CG (n=16)	t	p
NDI (score)	Pre-test	18.25 ± 3.79	16.25 ± 3.92	-2.375	.025 †
	Post-test	13.31 ± 2.70	16.00 ± 3.63		
	t	9.082	.577		
	p	0.000**	.572		

M±SD; \*\*, p < .001 : Significant differences pre and post tests; †, p < .05 Significant differences between the two groups; NDI, Neck Disability Index

4.94 ± 2.17 to 0.25 ± 1.73 points. (Table 3)

#### IV. Discussion

The subjects with chronic cervical pain in this study has conducted the CDFE and SE for 4 weeks and analyzed variations of cervical pain and NDI. Pain in the both groups was reduced after 4-week exercises significantly. In previous study, deep muscle flexion exercises influenced pain control and proper spine alignment<sup>15)</sup>, and the similar study showed that the group performed deep muscle exercises benefited in pain and function significantly than the control group.<sup>16)</sup> This study showed that the CDFE for neck reduced pain. This is because the CDFE can influence on maintaining a neutral position of the neck from forward protracted neck by increased muscle strength and stability of the deep muscle flexors which reduced superficial tension in the neck. Moreover, the CG showed a significant difference in cervical pain. This is because stretching exercises could elongate the muscles shortened in cervical and the thoracic regions due to upper cross syndrome, which got the shortened muscles to go back to normal length of the muscles so that the range of motion in the cervical and thoracic regions increased and the alignment of these came back to normal range of the alignment. The previous study applied stretching to the subjects proved that the exercises influenced pain control.<sup>17)</sup>

In this study, the EG showed a significant difference in NDI. The previous study showed that deep flexors exercises applying to the patients with chronic cervical pain for 6 weeks influenced neck functional disability and pain.<sup>18)</sup> And another study applied deep

flexor muscle exercises to the patients with a particular occupation for 4 weeks proved decreased pain and neck functional disability.<sup>19)</sup> In addition, the previous study showed that the muscle strength and endurance exercises for 12 months influenced chronic cervical pain and neck functional disability.<sup>20)</sup> These studies support the results of this study that the CDFE more influenced positively on cervical pain and NDI than other regular exercises. As a whole, the subjects performed the CDFE for 4 weeks were able to correct the spine alignment and strengthen the muscles around the cervical region, which was able to reduce stress on the neck so that cervical pain was reduced and the neck functional ability was increased.

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