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Original Article

Effects of chin tuck exercise using neckline slimmer device on suprahyoid and sternocleidomastoid muscle activation in healthy adults

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Abstract. [Purpose] This study investigated the effect of chin tuck exercise (CTE) using a neckline slimmer device on suprahyoid (SH) and sternocleidomastoid (SCM) muscle activation in healthy adults. [Subjects and Methods] We measured activation of the SH and SCM muscles using surface electromyography in 20 healthy adults during head lift exercise (HLE) and CTE using a neckline slimmer device. The order of exercises was randomized and the mean and peak values of each muscle's activation were assessed. [Results] During the CTE using a neckline slimmer device, SH activation was significantly greater and SCM activation was significantly lower than during the HLE. [Conclusion] This study suggest that chin-tuck exercise using a neckline slimmer device may be more helpful than HLE for swallowing training.

Key words: Chin tuck exercise, Muscle activation, Sternocleidomastoid

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INTRODUCTION

Head lift exercise (HLE) was designed for patients with dysphagia by Shaker et al. and is effective for strengthening the suprahyoid (SH) muscle[1)]. This exercise enhances the upper esophageal sphincter opening and protects the airway by increasing movement of the hyoid during swallowing[2)]. However, it can be difficult to enhance SH strength with HLE because the sternocleidomastoid (SCM) can become highly fatigued[3)].

In order to overcome this limitation, chin tuck exercise (CTE) using a resistance instrument has been proposed[4–7)]. CTE is an exercise movement that, while seated, pulls the chin back into alignment over the shoulders against resistance from a device. This improves SCM endurance and makes HLE more effective in SH strengthening[4–7)]. Unfortunately, the CTE training tool is expensive[4, 5)]. Recently, an inexpensive neckline slimmer device designed to improve neck wrinkles has been

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Table 1. General characteristics

	Subjects
Gender (male/female)	10/10
Age (years)[a]	28.2 ± 3.8
Body Mass Index (kg/m^2)[a]	21.6 ± 1.9

[a]Value are expressed mean ± SD.

Table 2. Suprahyoid and sternocleidomastoid muscles activation during the two exercises

		HLE	CTE
		Mean ± standard deviation	Mean ± standard deviation
Suprahyoid	Mean (mV)	24.5 ± 14.6	42.9 ± 31.2*
	Peak (mV)	63.1 ± 37.9	115.9 ± 72.5*
Sternocleidomastoid	Mean (mV)	114.3 ± 46.6	56.7 ± 31.8**
	Peak (mV)	292.7 ± 119.7	128.8 ± 66.4**

HLE: Head Life Exercise; CTE: Chin Tuck Exericse. *p<0.05, **p<0.01.

marketed[8]. This device may serve as an alternative for CTE, although currently there is a lack of evidence validating its use.

The aim of this study was to investigate the effect of the CTE using the neckline slimmer device on SH and SCM muscle activation in healthy adults.

SUBJECTS AND METHODS

Twenty healthy adults participated in the study. We excluded subjects with a history of neck pain or neck surgery. This study was approved by the Gachon University Institutional Review Board (1044396-201708-HR-134-01).

Before the experiment, subjects were instructed for 5 minutes on how to perform the HLE and the CTE. In the HLE, subjects were supine with their shoulders retracted against the floor and the head was lifted enough to look at the feet[1, 2]. To perform the CTE, subjects were seated with 90° flexion at the hip joints and their feet close together on the floor. They straightened their back against the chair and then flexed their chin into the resistance provided[4, 5]. The Neckline Slimmer (USA) was used for the CTE[8]. Both exercises were performed isometrically for 10 seconds[5] and the rest time between the two exercises was 10 minutes.

Activation of the SH and SCM muscles was analyzed using surface electromyography (Noraxon Inc., USA). Before the measurements, the surface of the skin was cleaned with disinfecting alcohol and shaved with a razor. Based on a previous study, the electrode was attached between the mandible and the hyoid bone to measure the SH[6]. To measure the SCM, the electrodes were attached at the midpoint of the muscle[7]. A band-pass filter (20–350 Hz) was used to remove electrical noise and the signal was processed by filtering, smoothing, and applying root mean square (RMS). Each exercise was performed three times and the mean values were used for statistical analyses.

All data were analyzed using SPSS 22. The subject's general characteristics were analyzed using descriptive statistics. The comparison of SH and SCM muscle activation was analyzed using the paired t-test. The significance level was $\alpha=0.05$.

RESULTS

The general characteristics of the subjects are presented in Table 1. The CTE showed a significantly greater mean and peak value for SH activation compared to the HLE ($p<0.05$). The CTE showed a significantly lower mean and peak value for SCM activation compared to the HLE ($p<0.05$; Table 2).

DISCUSSION

Although HLE is effective in strengthening the SH, performing the HLE can be limited by fatigue of the SCM muscle[1, 2], using CTE exercises to improve SCM endurance has required expensive instruments[4, 5]. We compared the HLE and the CTE using the inexpensive neckline slimmer device. The CTE showed a significantly greater mean and peak value for SH activation than the HLE and the CTE showed a significantly lower mean and peak value for SCM activation than the HLE.

Watts found that the chin to chest (CTC) exercise using the Restorative Posture Device (RPD) achieves higher SH activation than HLE[5]. Kraaijenga et al. reported that CTE using the Swallow Exercise Aid (SEA) showed positive results by increasing swallowing muscle strength[4]. However, the price of these devices ranges from \$135–\$200[4, 5] making them more than 20 times more expensive than the neckline slimmer device ($5.89).

In this study, the CTE using the neckline slimmer device produced approximately two times greater activation of the SH than the HLE. In Watts's study, CTC using RPD produced 1.3 times higher activation in the SH than the HLE[5]. These results indicate that the neckline slimmer used in this study, while cheaper, has a greater effect. In the Sze study, the CTE produced 2.3 times less activation of the SCM compared to the HLE[7]. In our study, the CTE produced about 2 times less SCM activation than the HLE. These results indicate that the CTE using the neckline slimmer device is more effective for producing SCM fatigue than the HLE.

There are two limitations of our study. First, the sample size was small. Second, the subjects were healthy adults. Thus, the patients with dysphagia should be identified later.

In conclusion, the CTE produced significantly greater SH activation and significantly lower SCM activation than the HLE. Therefore, our findings suggest that the CTE using the neckline slimmer device may be more effective than the HLE for swallowing training.

Conflict of interest

None.

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