Annals of Clinical and Analytical Medicine
Original Research

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Abstract
Aim: The aim of this study was to compare the cervical muscle endurance of young people with and without neck pain. The second aim of this study was to explore the gender differences in people with neck pain for neck muscle endurance.
Material and Methods: The study included 130 university students aged between 18 to 25 years (55 females, 75 males). Forty-two of those students who have neck pain (NP) at least 3 months and 88 of the students without neck pain (C) constituted the sample. Pain intensity was assessed with Visual Analog Scale (VAS). Isometric neck muscle endurance of the participants was assessed using cervical flexor (NF) and extensor (NE) muscles endurance tests.
Results: The main pain intensity of the subjects with NP was 4,19±1.92. For all subjects, the mean endurance of both NF (p=0.03) and NE (p=0.05) muscles of the subjects without pain was higher compared with subjects with NP. When the analysis was classified by gender, male subjects without pain had higher NF (p=0.02) and NE (p=0.002) muscle endurance than male subjects with pain. On the other hand, there were no significant differences between female subjects with and without NP (p>0.05).
Discussion: These findings suggest that neck flexor and extensor muscle endurance are affected by neck pain. On the other hand, gender is a significant factor for neck muscle endurance in subjects with neck pain. Further investigations are needed to have a wide data to consider the gender and pain for neck muscle endurance.

Keywords
Neck; Pain; Cervical; Cervico; Endurance; Comparison; Muscle; Gender; Differences, Young; People

DOI:10.4328/ACAM.20113 Received: 2020-01-14 Accepted: 2020-02-04 Published Online: 2020-02-10 Printed: 2020-04-01 Ann Clin Anal Med 2020;11(Suppl 1): S23-26
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Introduction

Cervical region has a complex muscular system and movement mechanics due to several short and long muscles moving multiple joints, a wide range of motion and the nerve system. It seems that muscular dysfunction in the cervical spine refers to changes in structure [1] and function [2]. These changes included muscle fatigue, decrease in proprioception, changes related to muscle activation and endurance [3]. Some studies showed that there is a relationship between muscle endurance and neck pain [4].

Neck pain is a very common problem in the society [5, 6]. Some individual factors may affect the symptoms. These factors are age, sex, body mass index and lifestyle characteristics such as physical activity levels and smoking habits [7, 8]. Several possible factors related to neck pain are sedentary work, the increase in activities such as the use of personal computers and the Internet, the use of motor vehicles, and changes of work type [9].

According to the literature, chronic neck pain is an important complaint among young people [10]. On the other hand, only a few studies have investigated the endurance capacity of the neck muscles in subjects with and without neck pain. Also, earlier studies of NME in patients with NP [19, 20, 21] have not considered sex perspective. The aim of this is to investigate the cervical and flexor muscle endurance in young people with and without NP. The second aim is to explore the gender differences in young people with and without neck pain for neck muscle endurance.

Material and Methods

Subjects

This study was conducted at Pamukkale University School of Physical Therapy and Rehabilitation. One hundred and thirty students aged between 18 to 25 years participated in this study (55 females, 75 males). Forty-two of those students were with chronic neck pain and 88 students were asymptomatic. Each participant was informed about this study and informed consent was obtained. The inclusion criteria for NP group were having pain in cervical region at least 3 months and no neck history for the control group. The exclusion criteria for both groups were having any history of malignancy or surgery on the spine, having an orthopedic or neurological problem in the spine, pregnancy and doing exercises more than 2 days a week at least 6 months. This study was approved by the Ethics Committee of Faculty of Medicine, Pamukkale University.

Assessment

The demographic data of participants were recorded on special form.

Pain

Pain intensity was measured using a Visual Analogue Scale (VAS) measuring 10 cm (0: I have no pain, 10: I have an intolerable pain). Participants were asked to mark the severity of pain they felt during rest and activity on VAS.

Neck Flexor Endurance Test

NF endurance was measured when the subjects were in a supine position with legs straight and the arms positioned alongside the body. They were instructed to maintain the test position for as long as possible, stopping if fatigue or pain occurs. Subjects performed chin retraction and isometrically cervical flexion. The NF was measured by chronometer in seconds [11].

Neck Extensor Endurance Test

NE endurance was measured when the subjects were in a prone position with legs straight, arms positioned at the sides, and a load (2 kg for women and 4 kg for men) was applied around the head just above the ears. Then the subjects extended and raised their heads just above the examination table. The NE was measured by chronometer in seconds. They were instructed to maintain the test position for as long as possible, stopping if fatigue or pain occurs [11].

Statistical Analysis

Statistical analysis was done using SPSS (Statistical Package Program for Social Sciences) package program. Descriptive data were given as percent, mean, and standard deviation values. The Kolmogrov- Smirnov test was used for assessing the normality of the data. The Independent t- test (for data with normal distribution) and the Mann-Whitney U test (for data without normal distribution) were used for statistical analysis. The level of statistical significance was determined as $p<0.05$.

Results

One hundred and thirty participants (55 female, 75 male) were included in the study. The NP group consisted of 42 participants and the control group had 88 participants. The demographic and clinical data of participants of the groups are given in Table 1. There was no statistically significant difference between the groups for demographic data ($p>0.05$). The main pain intensity of subjects with NP was 4,19±1.92.

Table 1. Demographics data of the groups

	Neck Pain (n=42) X±SD	Control (n=88) X±SD	p-value
Age (year)	21.11±1.32	20,85±1.40	0,40*
Height (cm)	170.28±9.11	171.73±9.05	0.38*
Weight (kg)	63.38±12.22	65.38±13.48	0.54*
BMI (kg/m2)	21.33±1.63	21.42±2.83	0.78**

n: number, X: mean, SD: standard deviation, cm: centimetre, kg: kilogram, m: metre, BMI:body mass index
* Mann-Whitney U Test ** Independent T-Test

The mean endurance test values of the subjects with NP were 32,19 ± 24,34 seconds for the NF test and 109,1+ ± 70,65 seconds for the NE test while test values for subjects without pain were 43,31± 30,10 for NF test and 140,75± 86,79 seconds for NE test. For all subjects, the mean endurance of both NF ($p=0.03$) and NE ($p=0.05$) muscles of the subjects without pain was significantly higher compared with subjects with NP (Table 2).

When the analysis was classified by gender, male subjects without pain had a higher NF ($p=0.02$) and NE ($p=0.002$) muscle endurance than male subjects with pain. On the other hand, there were no significant differences between female subjects with and without NP ($p>0.05$) (Table 2).

Table 2. Neck muscle endurance test values of the groups

		Neck Pain X±SD	Control X±SD	p
All subjects	NE (seconds)	109.19 ± 70.65	140.75± 86.79	0,05*
	NF (seconds)	32.19 ± 24.34	43.31± 30.10	0,03*
Female	NE (seconds)	117.20±75.18	105.45±68.52	0.42**
	NF (seconds)	29.50± 29.98	30.17± 21.74	0.62*
Male	NE (seconds)	97.31±55.50	164.51±90.22	0.002*
	NF (seconds)	34.63±18.19	51.73±31.83	0.02*

X: mean, SD: standard deviation, NE: neck extension, NF: Neck flexion
* Mann-Whitney U Test ** Independent T-Test

Discussion

The aim of this study was to compare the cervical muscle endurance of young people with and without neck pain. Our results showed that for all subjects, the mean endurance of both NF and NE muscles of subjects without pain were higher compared with subjects with NP.

Parazza at al. [12] investigated whether the neck flexors endurance is related to extensor endurance, and whether cervical muscle endurance is related to disability, amount of pain and stage of pain in subjects with neck pain. Thirty subjects (18 women, 12 men, mean ± SD age: 43 ± 12 years) who have neck pain were included the study. Visual Analogue Scale (VAS), Neck Pain and Disability Scale-Italian version (NPDS-I) and the timed endurance tests for the cervical muscles were used for assessment. The results suggested that neck flexors and extensors endurance are correlated and that cervical endurance is not significantly altered by the duration of symptoms in subjects with neck pain. But the study did not consist of healthy people. In another study [13], 30 patients with chronic neck pain and 30 asymptomatic subjects' cervical extensor muscle endurance were compared. Endurance, thickness, cross-sectional area, and shape ratio of the cervical extensor muscles (splenius capitis, semispinalis capitis, semispinalis cervicis, and multifidus) were assessed. Pain intensity was measured by the visual analog scale (VAS), Disability was evaluated by neck disability index (NDI). Thickness, cross-sectional area, and shape ratio of the muscles were measured by ultrasonography and clinical extensor muscle endurance test was done to evaluate the endurance. The findings of this study showed higher levels of global muscle fatigability and smaller size of deep neck extensor muscles in CNP patients. Disability and extensor endurance were found to be associated with extensor muscle size.

We know that neck pain is highly prevalent in the general population [14] and approximately one-third of students are reporting persistent and disabling neck pain[15]. Thus, neck pain is very common among young people. The reasons for neck pain in students are leisure activities, reporting difficulties sitting during classes, and reporting sleep problems [10]. In the past few decades, young people have been spending a lot of time with computers and smartphones. Thus, students have sedentary lifestyles. A few studies investigated the cervical muscle endurance among the students [16,17]. In a previous study, students of the University of Aveiro reporting subclinical neck pain (n=22) and asymptomatic participants (n=22) were matched for sex and age to the neck pain group. The deep neck flexor endurance test and the extensor endurance test were used to asses the muscle endurance. They found that the participants with neck pain have lower extensor and flexor muscle endurance when compared with the asymptomatic participants [18]. This results are similar to the findings of our study.

Earlier studies related to neck muscle endurance in patients with NP [19,20,21] have not considered sex perspective. The second aim of this study was to explore the gender differences in people with neck pain for neck muscle endurance. When the analysis was classified by gender, male subjects without pain had a higher NF and NE muscle endurance than male subjects with pain. On the other hand, there were no significant differences between female subjects with and without NP.

Peolsson and Kjellman [11] measured neck muscle endurance in patients with non-specific neck pain (n = 78) and after cervical decompression (n = 25) before and after the treatment period, and their results were compared with each other and with sex-specific reference values from controls (n = 116). The participants' age range was from 25 to 64 years for control group and from 18 to 65 for neck pain group. Their results showed that participants had significantly decreased neck muscle endurance compared with control subjects for all samples. When the analysis was classified by gender for males and females, similarly participants had significantly decreased neck muscle endurance compared with control subjects. Their findings for female gender are not similar to our results. The reason might be differences in age of the samples. Our study consisted only of young subjects.

The results of our study suggest that neck flexor and extensor muscle endurance are affected by neck pain in young people. On the other hand, gender is a significant factor for neck muscle endurance in young people with neck pain. Further investigations with wide data are needed to consider the gender and pain for neck muscle endurance.

Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: *None*

Conflict of interest
None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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How to cite this article:

Emine Aslan Telci, Ummuhan Bas Aslan, Ayse Nur Oymak Soysal, Fatma Uguz Selcuk. Comparison of cervical muscles endurance in young people with and without neck pain. Ann Clin Anal Med 2020;11(Suppl 1): S23-26