

## Impact of Jaw Functional Status on Neck Flexor Endurance among Females

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### ABSTRACT

**Background:** Opening and closing of mouth, biting, and chewing are all sensory-motor tasks that require both jaw and neck muscles to be contracted simultaneously. The postural stability of healthy people can be modified by changes in the position of the jaw.

**Objective:** To determine the impact of jaw functional status on neck flexor endurance among females and also to determine the association of neck flexion endurance with age and BMI.

**Methods:** It was a cross-sectional study in which the convenient sampling technique was used. It included 32 healthy females between 18-25 years of age. The study was conducted at the skills Lab of Shalamar School of Allied Health Sciences, Lahore. After consent from participants the neck flexor endurance test was performed in two positions: with the resting jaw (position I), and the jaw clenched maximally (position II) in supine position. Time was recorded by the stop watch to see how long the participant was able to maintain in these positions. The same test was performed again with five minutes gap in both positions of the jaw.

**Results:** It shows that there was a significant difference in neck holding time between resting jaw position and clenched jaw position. After five minutes of rest the neck holding time in both positions was decreased but it was statistically not significant. There was weak and inverse relationship between neck flexion endurance and age ( $r=-0.0264$ ) and weak but direct relationship between neck flexion endurance and BMI ( $r=0.283$ )

**Conclusion:** The neck holding time in clenched jaw position is less than the resting jaw position; this shows that a sensory-motor relationship exists between the neck and jaw. Variation in jaw positioning impacts neck flexor endurance.

**Key Words:** Neck flexors, Jaw functional status, Endurance test, Females

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### INTRODUCTION

Excessive neck flexion results in poor posture and more stress on the cervical spine, resulting in neckpain.<sup>1</sup> Holding the same posture for a long time weakens the neck flexors muscles.

Neck pain, as well as whiplash-related diseases and headaches, can be caused by poor muscular strength and stability of cervical spine.<sup>2</sup>

The Neck Flexor Endurance Test (NFET) is a valuable tool for therapeutic progress, it evaluates adult neck flexor endurance.<sup>3</sup>

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This test is a valuable tool for therapeutic progress. Temporomandibular dysfunctions are highly related to neck flexors and postural disorders. Co-contractions of both jaw and cervical tissues is required for sensory-motor activities regarding the jaw, such as mouth opening, biting, and grinding. The link between the jaw and the neck was reinforced by research that shows a link between neck issues and jaw abnormalities. The neck flexor muscles help control head acceleration by dynamically supporting the neck.<sup>4</sup> Mechano-receptors are triggered during head movement, triggering a muscular reflexive response that becomes stronger as the head accelerates. A deficit in these functions might induce neck pain and headache.

As a result of muscular endurance, a muscle's ability to resist, withstand, recover from and be immune to trauma, wounds, or fatigue is measured. Muscular endurance is affected by age, gender, circulation, and temperature. As well as improving physical activities, muscular endurance reduces the risk of injury.<sup>1</sup> Compared to asymptomatic people, patients with chronic neck pain have less flexor muscle endurance. According to previous research, the deep muscles of the neck maintain the spinal endurance of the head and neck. The cervical spine needs to function correctly so that the deep neck flexor endurance is maintained.<sup>5</sup>

Reduced neck flexor endurance has been found to cause and contribute to neck pain.<sup>6</sup> Deep neck flexor muscle stabilization is essential for head-controlled movements.<sup>4</sup> Deep neck flexor muscle functionality is related to proprioception.<sup>3</sup> Body posture abnormality for a prolonged time causes weakness in the cervical and deep flexor muscles.<sup>7</sup> Opening and closing the mouth, biting, and chewing are all sensory-motor tasks that require both jaw and neck muscles to contract simultaneously. Researchers have found that changes in the jaw position can modify the postural stability of healthy people. Changes in the contraction of the chewing muscles influence the whole body. Neck flexors endurance training has helped improve posture,

pain, and disability. Strength of distal muscles is increased by voluntary clenching.<sup>2</sup>

In order to assess cervical spine function, it is necessary to perform a neck flexor endurance test. The strength of the cervical flexor muscle can be determined accurately by applying this test.<sup>8</sup> As a result of several studies cervical flexor endurance test proved to be a reliable diagnostic tool.<sup>9</sup> There is a previous study on neck flexor endurance among males, but no data is available for females. The mean hold time of female neck flexor endurance is a measurement tool of early postural alterations.

The present study was conducted to determine the effect of jaw positions on neck flexor endurance by recording average holding time among females.

## METHODS

It was a cross-sectional study conducted from April 2022 to July 2022 in the physiotherapy department of Shalamar School of Allied Health Sciences, Lahore. Study was approved from the Ethics committee of Shalamar School of Allied Health Sciences, Lahore (SSAHS-IRB/AL/33/2022). This study included 32 healthy females between 18-25 years of age. A convenient sampling technique was used to collect data. The sample size was calculated by keeping the significance level of 95%. The females with normal BMI and without any history of dental restoration were included while females with cervical injury, and neck pain were excluded. Written consent was taken from the study participants. The neck flexor endurance test was performed in two positions: with the resting jaw (position I), and the jaw clenched maximally (position II).

Ask the patient lying in supine position to lift the head and neck until the head is 2.5cm above the table while keeping the chin tucked in. A spoken command such as "tuck your chin in" was part of the test. Participants head was placed on plinth with the investigator's hand placed on the table below the patient's occipital bone. If there was any head drop or loss of cervical flexion during the test, the test was stopped immediately. It is recorded by the stop watch to

see how long the participant was able to maintain this position. The same test was performed with a clenched jaw position and baseline readings were taken.

The same test was performed after five minutes gap in both positions of the jaw. Neck flexors holding time before and after the 5-minute gap which is considered as first and second reading.

### Statistical Analysis

The data was analyzed by SPSS version 25. Mean and standard deviation were calculated for quantitative variables. (Position I with resting jaw, position II with clenching jaw). An Independent sample t-test was applied to compare the neck flexor endurance between resting jaw position and clenched jaw position. The Pearson correlation was also determined neck flexion endurance and age

### RESULTS

The mean age and body mass index of study participants is given in Table: 1

It shows that baseline neck holding time in the resting jaw position was significantly high compared to a clenched jaw position. After five minutes of rest there was no significant difference in neck holding time in both positions, however neck holding time was less after 5 minutes as compared to baseline.

Mean neck flexor endurance with resting jaw was significantly high compared to clenched jaw (p=0.011) (Table 2)

Overall there was a weak and inverse relationship between neck flexion endurance and age (r=-0.0264) (Figure:1) there was weak but direct relationship between neck flexion endurance and BMI (r=0.283) (Figure: 2)

**Table 1: Age and BMI of study participants**

	Age (years)	BMI (kg/m <sup>2</sup> )
(mean±SD)	22.38±1.20	27.35±1.57

**Table 2: Comparison of neck flexor endurance between resting jaw position and with clenched jaw position**

	Resting Jaw (mean±SD)	Clenched Jaw (mean±SD)	p-value
Baseline neck flexion endurance (sec)	6.69±2.09	4.75±.68	0.002*
After 5min rest neck flexion endurance (sec)	5.81±2.48	4.50±1.03	0.060
Mean neck flexor endurance (sec)	6.25±2.19	4.63±0.70	0.011*

Independent t-test was applied; \* p-value significant at 0.05

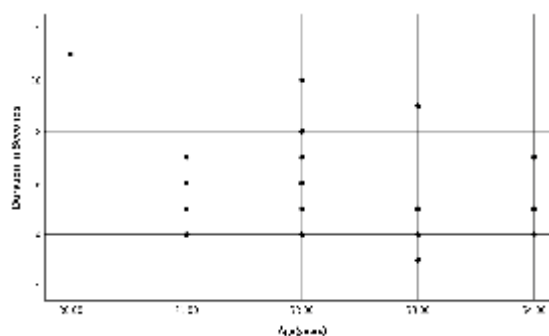
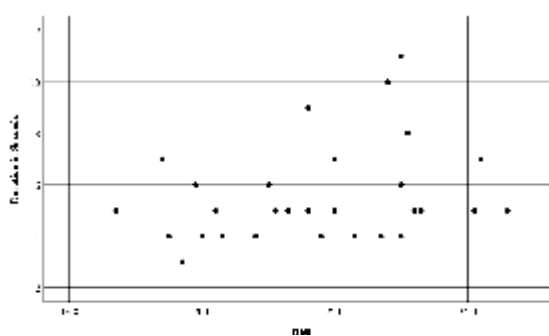


Figure 1: Correlation between age and neck flexor endurance



\*Correlation was measured by symmetric measures

Figure 2: Correlation between BMI and neck flexor endurance

## DISCUSSION

This research examines the impact of resting jaw and voluntary clenching on neck flexor endurance. The results demonstrated that neck flexor endurance differed between the two test positions. The endurance time of clenching of jaw was less than when the jaw was resting. Neck discomfort and muscle endurance have been linked to various characteristics, including gender, Age, and cause. To perform an endurance task, pain and exhaustion cause weakness, diminished power, and poor performance.<sup>10</sup> The jaw and head-neck position have been connected to the body throughout the motor activity.<sup>11</sup> In the upright sitting posture, the cervical, thoracic muscle activity is diminished. Long-term non-neutral spinal postures have been demonstrated to generate greater activation of the neck and shoulder stabilizers, which can lead to pain.<sup>12</sup> When performing actions that require much power or carrying large objects, it is natural to clench your jaw. Patients with temporomandibular problems have been observed to have decreased cervical flexor endurance.<sup>13</sup>

One of the reasons for reduced neck endurance is a forward head posture which alters the position sense of joint.<sup>14</sup> The results of present study add to the previous literature that states the inverse correlation between joint position error value and craniovertebral angle by showing a positive relationship exists between jaw functional status and neck flexor endurance.

A previous study showed that chronic neck pain reduces the endurance hold time of the neck flexor<sup>15</sup>, but the present study further explains that in addition to chronic neck pain and a slight change in jaw position also reduces the hold time of the neck flexor.

A previous study conducted an average population based on neck flexor endurance showed that male flexor endurance is more than that of females<sup>16</sup> but does not show any sensory-motor relation.

Orosomucoids suppress estrogen, which reduces muscle endurance.<sup>17</sup> Females are more prone to get fatigue. So, the present study shows the impact of jaw on endurance among females.

A previous study showed that neck flexor exercises reduced neck pain and improved the range of motion.<sup>18</sup>

The limitation of this study is that a simple neck flexor endurance test has been used rather than pressure biofeedback unit which is more useful in both assessments of flexors. Secondly, aging effects on neck flexor endurance have not been documented because this study was only focused on young people.

## CONCLUSION

The neck holding time in the jaw clenched position is less than the resting jaw position, showing that a sensory-motor relationship exists between the neck and jaw. Variation in jaw positioning impacts neck flexor endurance.

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### Conflict of interest:

All authors and co-authors declare that they have no conflict of interest.

### Contributors:

**MS:** Idea conception, manuscript writing, investigation,

**QK:** proofread, and supervised the work

**AS:** Statistical analysis, result interpretation

**HW:** Critical review of the manuscript, editing

**JA:** Study design, manuscript writing

**MG:** Literature search, data collection

**KR:** Data Collection, critical review

**NA:** Data Collection, drafting

All authors approved the final version and signed the agreement to be accountable for all aspects of the work.

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### Data sharing statement:

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### REFERENCES

1. Sun Y, Qin Z, Wan JJ, Wang PY, Yang YL, Yu JG, et al. Estrogen weakens muscle endurance via estrogen receptor-p38 MAPK-mediated orosomucoid (ORM) suppression. *Exp Mol Med*. 2018; 50(3): e463.doi:10.1038/emm.2017.307.
2. Ghamkhar L, Kahlaee AH, Nourbakhsh MR, Ahmadi A, Arab AM. Relationship between proprioception and endurance functionality of the cervical flexor muscles in chronic neck pain and asymptomatic participants. *J Manipulative Physiol Ther*. 2018; 41(2):129-136.doi:10.1016/j.jmpt.2017.08.006.
3. Zafar H, Alghadir AH, Iqbal ZA. Effect of jaw functional status on neck muscle endurance. *Arch Oral Biol*. 2019; 101: 30-33.doi:10.1016/j.archoralbio.2019.03.001.
4. Jarman NF, Brooks T, James CR, Hooper T, Wilhelm M, Brismée J-M, et al. Deep neck flexor endurance in the adolescent and young adult: normative data and associated attributes. *PMR*. 2017; 9(10): 969-975.doi:10.1016/j.pmrj.2017.02.002.
5. Lee SC, Lee YR, Yu SK, Seo DK. Deep neck flexor endurance in university students: normative data and reliability. *Physical Therapy Rehabilitation Science*. 2018; 7(4):186-190.doi:10.14474/ptrs.2018.7.4.186
6. Iqbal ZA, Alghadir AH, Anwer S. Efficacy of deep cervical flexor muscle training on neck pain, functional disability, and muscle endurance in school teachers: A Clinical Trial. *Biomed Res Int*. 2021; 2021:7190808.doi:10.1155/2021/7190808
7. Lee HJ, Lee YS, Jeong JY, Seo DK. Correlation between tone of suboccipital muscle and endurance of deep neck flexor muscle according to angle changes in college students. *J Korean Soc Phys Med*. 2019; 14(2):137-44.doi:10.13066/kspm.2019.14.2.137
8. Osailan A. The relationship between smartphone usage duration (using smartphone's ability to monitor screen time) with hand-grip and pinch-grip strength among young people: an observational study. *BMC Musculoskeletal Disorders*. 2021; 22(1): 1-8. doi: 10.1186/s12891-021-04054-6
9. Lourenço AS, Lameiras C, Silva AG. Neck flexor and extensor muscle endurance in subclinical neck pain: intrarater reliability, standard error of measurement, minimal detectable change, and comparison with asymptomatic participants in a university student population. *J Manipulative Physiol Ther*. 2016; 39(6):427-433. doi: 10.1016/j.jmpt.2016.05.005.
10. Desai N, Ansari AM. Correlation of Intensity of Pain, Functional Disability and Deep Neck Flexor Endurance in Individual with Chronic Non-Specific Neck Pain: An Observational Study. *IJHSR*. 2022; 7(2):417-423.doi:10.52403/ijshr.20220459
11. Böthun A, Häggman-Henrikson B, Wiesinger B, Wänman A, Hellström F, Österlund C. Jaw-neck motor strategy during jaw-opening with resistance load. *J Oral Rehabil*. 2022; 49(5):514-521.doi:10.1111/joor.13291.
12. Alghadir AH, Zafar H, Ahmed Iqbal Z, Anwer S, Iqbal A. Effect of static and dynamic jaw positions on postural stability among people with blindness. *Brain Behav*. 2022; 12(9):e2645. doi:10.1002/brb3.2645.
13. Jo Y-e. The effect of trunk stabilization exercises accompanied by deep neck flexor strengthening exercises on the sitting balance and head alignment of children with spastic diplegia. *JKPT*. 2022; 26(1):35-41.doi:10.17817/2022.02.06.1111715
14. Yong MS, Lee HY, Lee MY. Correlation between head posture and proprioceptive function in the cervical region. *J Phys Ther Sci*. 2016; 28(3): 857-860.doi:10.1589/jpts.28.857.

15. Şekeröz S, AslanTelci E, Akkaya N. Effect of chronic neck pain on balance, cervical proprioception, head posture, and deep neck flexor muscle endurance in the elderly. 2019. *Turk Geriatri Dergisi*. 22(2):163-171.doi:10.310 86/tjgeri.2019.89
16. Domenech MA, Sizer PS, Dedrick GS, McGalliard MK, Brismee JM. The deep neck flexor endurance test: normative data scores in healthy adults. *PMR*. 2011; 3(2):105-110.doi:10. 1016/j.pmrj.2010.10.023.
17. Borisut S, Vongsirinavarat M, Vachalathiti R, Sakulsriprasert P. Effects of strength and endurance training of superficial and deep neck muscles on muscle activities and pain levels of females with chronic neck pain. *J PhysTher Sci*. 2013; 25(9):1157-1162.doi:10.1589/jpts.25.1157
18. Lee GC, Lee DY. The effects of deep neck flexor exercise on pain and neck disability index of the patients with chronic neck pain. *Journal of the Korea Academia-Industrial Cooperation Society*. 2010; 11(11):4331-4337.doi:10.5762/K AIS.2010.11.11.4331