

## Effect of Neck Posture on Abdominal Muscles Strength among University Students

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### Abstract

*Introduction & Background:* The university students spend their quarter (6 hours) of a day in a classroom include hours of a day in sitting position. Thus it become very hard to maintain a posture erect throughout the day this leads to stress in the ligamentous structures and may produce pain. The aim of this study was to investigate the influence of neck posture on abdominal muscle strength among university students. *Method:* This study recruited 50 young adults and was divided into 2 groups. Group 1 included student with forward head posture and group 2 included student with normal neck posture. After meeting the inclusion criteria, neck posture was assessed using Ruler method. Then timed sit up and DLLT were also added to check the upper abdominal strength and the lower abdominal strength simultaneously. *Results:* The comparison was done in between Tragus and wall distance (normal-cued) and timed sit up test that shows significant result. Again, the correlation was found in between Tragus to wall distance (normal -cued) and double leg lowering test and this shows non- significant result in both the groups. *Conclusion:* It is concluded that there is a significant relationship between neck posture and upper abdominal strength and there is no relation between neck posture and lower abdominal strength.

**Keywords:** Neck posture, Normal neck posture, Forward head posture, Abdominal muscle strength

### Introduction

The university students spend their quarter (6 hours) of a day in a classroom include hours of a day in sitting position.<sup>1</sup> Thus it become very hard to maintain a posture erect throughout the day this leads to stress in the ligamentous structures and may produce pain.<sup>2</sup> Correct posture is affected by several factors such as height of desk and chair, environmental factors such as room temperature and lighting, and other anatomical and anthropometric characteristics. But the major factor

includes a time spent in sitting position as most of the academics are done in this position, this will lead to incorrect posture such as slouch posture.<sup>3</sup>

Posture can be defined as maintaining a position of different joint segments of the body in relative to other segments at a particular time.<sup>4</sup> Ideal posture is a posture in which the body segments are aligned vertically along with the LOG passed through all joint axes. In case of head, this LOG passes slightly anterior to transverse axis and incase of cervical, it lies posterior to the vertebrae.<sup>5</sup> Thus, correct posture is defined as maintaining such position in which minimum stress is induced on each joint which can be highly influenced by intrinsic and extrinsic factors. Intrinsic factors such as ligaments, muscles and other soft tissues and extrinsic factors such as mobile or laptop usage etc.<sup>6</sup>

When a posture is maintained against gravity by enabling the balance is known as postural control. It helps to stabilize the posture during voluntary movements and maintain a balance after

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disturbances. This allows a frame of proprioception i.e. Position of joint sense when placed in a position.<sup>7</sup>

Correct sitting posture is defined as when feet is flat on the ground, head and upper body is straight with shoulder by the side and knee bend to 90° to maintain a normal/neutral curvature of the spine.<sup>8</sup> This can be achieved by proper ergonomically made desk and chair which helps to maintain a proper posture and prevent musculoskeletal problems.<sup>9</sup>

Due to decrease in physical activity and wrong posture, muscular and skeletal structures adopt an incorrect posture. Forward head posture occurred if there is an anterior translation of head deviation from normal posture.<sup>5</sup> This occurs due to the increase usage of media devices such as smart phones and computer progressively.<sup>10</sup>

Prolonged use of these devices results in incorrect posture. Incorrect posture leads to forward head posture that increases the upper cervical lordosis and flatten the lower cervical.<sup>10</sup> Change in head balance causes the imbalance of muscle, increase in tension of neck extensors and deep cervical flexors weakness. Due to forward head posture leads to weakening of SCM and scalene anterior but lengthen the levator scapulae, semispinalis capitis and pectoralis major. This will leads to abnormal proprioception and kinesthetic sensation.<sup>11</sup>

This incorrect posture has an negative effect on posture such as tendon and muscle imbalance limits the movements of joints and causes pain that shows an insufficient balance of structures.<sup>12</sup> Therefore, it is suggested that maintaining a good posture helps to support the structure, allow a complete movements on a joint without having any pain.<sup>13</sup>

The prevalence of anterior head translation was found to be 37% out of which 58% were female and 42% were male and according to the study done in 2018 have been show that there was only 35% people heard about the forward head posture and out of which 21% individual actually know about the preventive measures.<sup>14</sup>

It is shown that students spend their maximum time in sitting position. Mckinley also claimed that sitting in slouched posture is the most frequent posture. If it becomes habit at an early age, it will lead to imbalance of muscle, tendon, joints, bones and discs which leads to upper cervical spine extension and lower cervical spine flexion along with there is increase in compressive loading on soft tissue structure around the cervico-thoracic region and it also cause the abdomen to protrude out due to the weakness of muscle and can also cause lower back ache.<sup>15</sup>

Szeto<sup>16</sup> et al. and Moore<sup>17</sup> stated that keeping up the head forward for a prolonged period of time may cause musculoskeletal musculoskeletal problems, example, 'upper crossed disorder', which includes having decreased lordosis of the lower cervical, related to kyphosis of the upper thoracic vertebrae. Burgess-Limerick et al. recommended that such posture causes shortening of muscle fibers around the atlantooccipitalis articulation and overstretching of muscles around joints and causes chronic neck pain.

Abdominal wall is made up of 4 muscles rectus abdominis, internal oblique, external oblique and transverse abdominis. Rectus abdominis is responsible for flexion of the trunk, obliques work while rotation of trunk, internal oblique rotates the trunk on the same side and external oblique rotates the trunk on opposite side and transverse abdominis work along with pelvic floor muscles support the pelvis.<sup>18</sup>

For trunk stabilization, abdominal muscles play a very important role and if it becomes weak, trunk stability decreases and low back occurs and when imbalance of trunk including abdominal muscle leads to abnormal posture.<sup>19</sup>

There have been studies showing effect of neck exercises on activation of core stabilizing muscles. Movement of neck provides exertional force onto the spine where magnitude of reactive force is directly proportional to the inertia of cervical movement. Restriction in activation of SCM appears to affect the activation of abdominal muscles.<sup>20,21</sup>

Strong abdominal muscles help in stabilizing the trunk and lessen lumbar spine stress. Abdominal muscles are usually activated by active flexion of the trunk through a concentric muscle contraction.<sup>22</sup>

According to the study done by jung Jh et al. in 2012 showed that forward head posture affect the neck muscles. Thus, posture is treated directly with neck management or indirectly by the treatment of neck posture including the treatment of the pelvic posture. Incorrect posture such as forward head posture, not only caused neck pain but also change spinal alignment and prevent efficient muscle recruitment that leads to the weakening of abdominal muscles. Murphy et al. suggested that the neck muscles are connected to the trunk structurally through fascia thus, trunk posture should be considered if neck problem should be considered.<sup>23</sup>

A recent study showed that change in the position of resting scapula resulting in change in the position of the position of cervical and thoracic

spine. During the elevation of arm, scapula has been found anteriorly tilted, downward rotated, and protracted in individual with FHP. It is due to the weakening of serratus anterior. This increase forward angulation leads to increase in thoracic curvature.<sup>24</sup>

**Need of the Study:** In recent few years, there is a sudden rise in use of electronic devices and it has tremendous effect on people around the world. Previous studies showed that prolonged use of these devices leads to change in neck posture. However, there is no specific study that evaluates the effect of neck posture on abdominal muscle strength. However this study aims to see Effect of neck posture on abdominal muscle strength among university students.

**Aim:** To study the effect of neck posture on abdominal muscle strength among university students

**Hypothesis:** the study was hypothesized to show association between neck posture and abdominal strength..

## Materials and Methods

- **Study Design:** Correlational Study Design.
- **Study Population & Sample:** University student of age between 18-25 years.
- **Place of Data Collection:** Amity University, Noida.
- **Sampling Method:** Simple Random Sampling.
- **Sample Size:** 50
- **Selection Criteria:**
  - ▲ Inclusion Criteria:
    - Subjects of age between 18-25 yrs
    - 50 healthy subjects (both male and female).
  - ▲ Exclusion Criteria:
    - History of any spinal pathologies such as stenosis.
    - History of any abdomen surgery in last 2 years.
    - Any cardiovascular disease
    - Psychological disorders
    - Scoliosis
- **Independent Variable:** Neck Posture.
- **Dependent Variable:** Abdominal Muscle Strength.

- **Instruments Required:** Ruler, Sphygmo manometer, Stop watch and Yoga mat.
- **Group Allocation:** It is divided into 2 groups with 20 participants each.
  - ▲ Group A comprises of patient with normal neck posture.
  - ▲ Group B comprises of patient with forward head posture.
- **Procedure:** Those who fulfill the inclusion criteria and willing to give consent form were selected. After meeting the inclusion criteria, neck posture was assessed by using *Ruler method*.<sup>25</sup> In this, tragus to wall distance was measured in normal and cued posture to check whether they have forward head posture or not.



Fig 1: Tragus to wall distance in normal posture

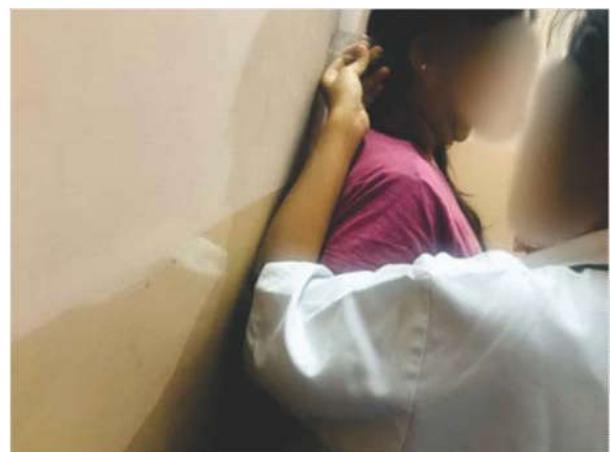


Fig 2: Tragus to wall distance in cued posture

Then abdominal strength was checked by using timed sit-up test and double leg lowering test.

**Method to measure abdominal strength:**

*Timed sit-up test*<sup>26</sup>: this test was performed in hook-lying position with arms across the chest. The subject was asked to do full sit-up as much as he could do in 1 minute.



Fig 3: Timed Situp Test (Ending Position)



Fig 4: DLLT (Step-3)

*Double leg lowering test*<sup>27</sup>: this test was performed in supine lying with their hip flexed to 90. BP cuff was placed under the L4-L5 region. The patient slowly lower the leg and maintain abdominal contraction. At the point where 40 mmhg pressure is dropped the range of hip was noted and compared with the grading table.

**Results**

Table 1: Table showing demographical details

Demographical Data (N= 50; M = 5, F = 45)		Mean ± SD
Age (years)		21.34 ± 0.94
BMI (kg/m <sup>2</sup> )		21.59 ± 3.91

Table 2: Correlation between FHP and abdominal strength

S. No.	Variables	Mean ± SD	R Value
1.	Tragus to wall distance (normal-cued)	2.34 ± 0.57	0.32*
	Timed situp Test	15.56 ± 4.07	
2.	Tragus to wall distance (normal-cued)	2.34 ± 0.56	0.16
	Double leg lowering test	56.08 ± 11.92	

\*Significant at p < 0.05

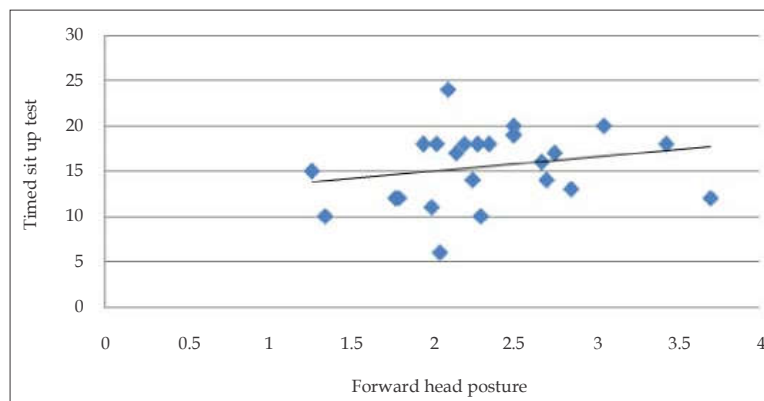


Fig 5: Correlation between FHP and TST

Table 2 shows the comparison in symptomatic individuals. The comparison was done in between Tragus and wall distance (normal-cued) and timed sit up test where mean was  $2.34 \pm 0.57$  and  $15.56 \pm 4.07$  respectively. The R value calculated was 0.22 that shows significant result at the level of 0.05. Again, the correlation was found in between Tragus to wall distance (normal -cued) and double leg lowering test. The R value was 0.16. and this shows non-significant result at the value of less than 0.05.

Table 3 shows the comparison in non-symptomatic individuals. The comparison was done in between Tragus and wall distance (normal-cued) and timed sit up test where mean was  $1.46 \pm 0.57$  and  $27.96 \pm 3.64$  respectively. The R value calculated was 0.324 that shows significant result at the level of less than 0.05. Again, the correlation was found in between Tragus to wall distance (normal -cued) and double leg lowering test. The R value was 0.16. and this shows non- significant result at the value of less than 0.016.

**Discussion**

The purpose of the study was to find out the effect of neck posture on abdominal muscle strength among university students. The study included two groups. Group A included .students with normal neck posture and group B included students with forward head posture. The subjects were of the age group between 18-25 years. Each subject was assessed according to the inclusion and exclusion criteria.

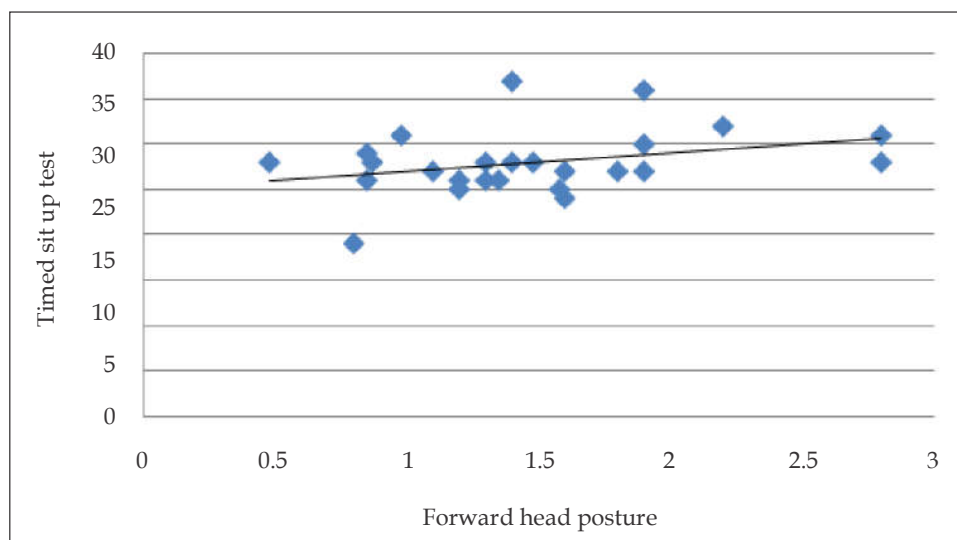
This study measured abdominal muscle strength through timed sit up test and double leg lowering test and neck posture through ruler measurement to determine the difference in abdominal muscle activities according to changes in the neck posture.

In this study, it is found that there is a significant relation between the neck posture and the timed sit up test that is relation between the two was significant in both the groups which suggested a relationship between the two variables. On the other hand, there was an insignificant relation

**Table 3:** Correlation between normal neck posture and abdominal strength

S. No.	Variables	Mean $\pm$ SD	R Value
1.	Tragus to wall distance (normal-cued)	$1.46 \pm 0.57$	0.324*
	Timed situp Test	$27.96 \pm 3.64$	
2.	Tragus to wall distance (normal-cued)	$1.46 \pm 0.57$	0.016
	Double leg lowering test	$48.70 \pm 12.55$	

\*Significant at  $p < 0.05$



**Fig 6:** Correlation between normal neck posture and TST

between neck posture and double legged lowering test that meant that there was no relation between the two variables in both the groups.

In a Study Jung Gil Su et al. showed that there was a relationship between the neck posture and the upper abdominals as the subjects with normal neck posture were able to perform timed situp test up to the average numbers in one minute. On the other hand, subject with forward head posture found it difficult and were not able to perform test up to the average value. Fella et al. also suggested that If neck exercises were performed in good lumbar posture that help to recruitment the neck muscles. In the same context, subject with good neck posture can affect lumbar alignment, which leads to abdominal muscle recruitment as they are responsible for lumbar stabilization. This indicates that all structure is interconnected to each other by joints or muscles. A change in one region of the body can affect the other region. So, it can be said that incorrect postures, such as forward head posture not only causes neck pain but also leads to change in spinal alignment and prevents efficient muscle recruitment that leads to the weakening of abdominal muscles.

However in case of neck posture and lower abdominal strength, it was found that there was no relationship between them as the subjects with normal neck posture and subject with forward head posture were able to perform double legged lowering test below 45° without any difficulty. According to Alxex at. et al. this might be due to hamstring tightness which was not chosen as a parameter. it was found that subject with hamstring tightness found difficulty while doing DLLT. They were not able to take legs to optimal level (90°). Thus, we had to continue the test from the available range. So, hamstring tightness must be included for further studies.

#### *Clinical Implication of the Study*

- Mobile Phones must not be used in neck bend; it should be kept at eye level.
- One should avoid slouch sitting.
- After every 45 to 50 min, one should change his/her inertial position.
- One should do exercises on daily basis.
- One should include crunches exercise in order to strengthen abdominal muscle.

#### *Limitation of the Study*

1. Small number of subjects.
2. The study was done on young adults only.

#### *Future Scope of the Study*

In future we have to try for finding relation between neck posture and lower back muscles. This study was done for only the forward posture but In future, we have to try to find out relationship between sway posture and abdominal muscles and this study can be extended to different age groups also.

#### **Conclusion**

This study was done to find out the relation between the neck posture and abdominal strength. So, two groups are made one with normal neck posture and other with FHP and their upper abdominal strength and lower abdominal strength is checked. Thus, with this study it is concluded that there is a significant relationship between neck posture and upper abdominal strength and there is no relation between neck posture and lower abdominal strength.

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