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Impact of text neck symptoms on posture and mobility among college students: A study utilizing a self-designed questionnaire

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Abstract

Background: Young adults today have grown up with mobile phones as an integral part of their lives. Smartphones are increasingly central to our daily routines, serving as tools for tasks both at work and home. However, excessive smartphone use can adversely affect the neck and shoulder regions by altering their biomechanics, leading to pain and discomfort—a phenomenon now recognized as "TEXT NECK." The objective of this study is to determine the prevalence rate and assess key physical variables crucial to the biomechanics of the cervical region.

Methods: A total of 428 participants were selected from various colleges, and both the Neck Pain and Disability Scale (NPAD) and the Text Neck Questionnaire (TNQ) were completed by all participants. The TNQ was validated by comparing scores with those of the NPAD, and participants with a TNQ score of 15 or higher were identified for further analysis of physical parameters.

Results: The prevalence rates for neck pain, shoulder pain, continuous mobile phone use, and usage exceeding 4 hours per day among college students were 29.4%, 24.3%, 68.9%, and 49.5%, respectively. Sleep quality and neck discomfort were also impacted in the 428 participants. Following TNQ scoring, 35 participants with higher scores were selected, and their range of motion (ROM), endurance, and postural angles were compared with and without phone usage.

Conclusion: Significantly different results were observed in ROM, postural angles, and cervical muscle endurance. The prevalence of Text Neck among the 428 college students was 29.2%, with 80% of those having scores between 15 and 20, indicating a high prevalence among 35 participants. Physical parameters, such as ROM, endurance, and postural angles, were altered in these 35 participants, correlating with a higher rate of neck pain.

Keywords: Smartphone; Text Neck; Forward Head Posture; Range of Motion; Postural Angles; Endurance; Universal Goniometer

1. Introduction

To most people, the mobile has become a requirement primarily to young adults who are obsessed with gaming, texting and web surfing. This is also used for the purposes of communication and entertainment, such as texts, music, television, internet access, images and games. Thanks to online services and online work, people's contemporary lifestyle has been largely dominated by computer technology [1]. Young people have grown up as an apparent part of their lives with cell

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phones today. Mobile phones are now integral to our everyday lives. We act as a way of carrying out duties at home and at work [2].

It can even make it possible for some physicians to send electronic prescriptions 3-8 faster than usual consultancy, as well as providing online therapies and applications for nutrition and physical activity behavior change [3]. ECG and other vitals can also be measured by smart phone and smart watch which is very useful to reduce mortality rate in sensitive groups like hypertensive and asthmatic patients. Among other benefits are online shopping, working from home, free video-calling family or friends from the other side of the world.

Texting has become an integral part of everyday life due to technology that is being updated on a daily basis and the time spent using a cell phone and its tiny text keyboard is expected to increase due to the increased multi-functionality of smart phones [4]. A new survey reveals that 79 percent of the population between the ages of 18-44 have their mobile phones with them almost all the time, spending only 2 hours of their day walking without their mobile on back [5].

Excessive usage of cell phones, such as texting, emailing, and Web surfing, has been related to neck pain. Despite the drastic rise in the use of cell phones, questions have been raised about the adverse health effects of mobile phones on spinal posture. Neck pain is the fourth leading disability cause with an annual prevalence rate of over 30%.

Recently, it has been documented that Internet-based practices such as gaming, texting, and pornography have shown rates of addiction close to those of substance abuse. Furthermore, as the internet becomes more available via smart phone, the addiction trend associated with the smart phone has been more regularly demonstrated and questions about the phenomenon have increased [6].

Many acute neck pain episodes will resolve with or without care, but nearly 50% of people will continue to experience some degree of discomfort or regular occurrence. Users of mobile devices also take a prolonged forward head posture when gazing down on mobile display screens [7].

The repeated repetitive forward flexion of the neck and head induces changes in the cervical spine, curve, supporting ligaments, tendons, muscles and osseous parts, gradually causing the normal curvature of the neck to reverse, possibly leading to early spinal arthritis, disk degeneration, headaches and a reduction of up to 30 percent in lung capacity due to heavy use of smartphones. These leads to TEXT NECK [8].

Dr. Dean L. Fishman, who is a US chiropractor, invented the word "TEXT NECK."

"Text neck" is the term used to describe the neck pain and potential injury caused by continuously looking down for prolonged period of time on a cell phone, laptop or other wireless device. Because of this awkward position of the head, the muscles of the shoulder and neck must address this increased weight burden. The documented long-term effects can include irritation in the back, neck pain, stiffness, and headaches, which may get worse with time. Many people are required to use smart phones with the head bent forward and the mobile positioned near the waist or lap while sitting. This flexed posture of the neck can increase the tension of the cervical spine and inflict muscle strain in adjacent portions of the cervical spine. It is especially alarming as young, developing children can cause irreversible damage to their cervical spine which may lead to lifelong neck pain.

Smart phones have various conveniences, such as email sending and receiving, internet access and entertainment. To survive without a smart phone for two days is like living unarmed in a war zone. Not only does it allow us to stay connected, it is also a gateway to entertainment, networking, navigation, schedules, etc. [9]. For every new piece of technology, the list of illnesses is expanding. Millions of people do it every day and are utterly unaware that the use of smart phones can be harmful to the spine.

A new survey reveals that 79 percent of the population between the ages of 18-44 have their mobile phones almost all the time with them, spending only 2 hours of their walking day without their mobile at hand. Text neck most frequently causes discomfort and soreness in the arm. Additionally, looking down too often on your smart phone can lead to upper back pain ranging from constant, nagging pain to sharp and extreme spasm of the upper back muscles. Shoulder discomfort and tightness, which can lead to severe muscle spasms in the shoulder [5].

Good posture is characterized as ears aligned with the shoulders and the "angel wings," or the shoulder blades, retracted. Spinal discomfort is reduced when correctly positioned. It is the most powerful spine position [10].

The bending neck pose to look down does not only occur while you are texting. We've all looked down on reading for years. People tend to do this for much longer periods and it is especially worrying because young, growing children could cause permanent damage to their cervical spines which could lead to lifelong neck pain [9,11].

1.1. Symptoms associated with text neck

- STIFF NECK: Soreness and difficulty in moving the neck, particularly when attempting to turn the head back and forth after a long smart phone usage.
- HEADACHES: Sometimes an irritation in the neck can also affect muscles and nerve to the head. It may be a symptom of strain, such as stretching of the neck muscles.
- PAIN AND SPASM: Upper back pain ranging from constant, nagging to acute, extreme muscle spasms in the upper back. Pressure and tightness in the shoulder, probably contributing to painful spasm in the shoulder muscle.
- GENERAL SORENESS: The pain is mostly in one spot or area of neck and trapezius muscle region.
- WEAKNESS: The muscles of the shoulder and in particular the trapezius, scalenus, rhomboids and sternocleidomastoid muscles are the key ones to go for weakness.
- SHARP PAIN: Often the patient of the text neck may also experience this symptom, located to a spot and may believe it's stabbing or stinging. This form of pain also occurs on the lower neck levels.
- FATIGUE: Users of smart phones are more likely to complain of muscle tiredness, decreased neck mobility and reduced work capacity. Due to the activation of tonic gamma motor neurons resulting from the build-up of metabolites during muscle contraction, exhaustion of sub-occipital muscles may alter balance.

Considering all the aforementioned facts and symptomatic factors, it is evident that Text Neck can have adverse effects on neck movement, weaken neck muscles, and impact the posture of the upper body by increasing the load on the cervical spine. However, there is a dearth of research and articles that demonstrate the prevalence rate of Text Neck in college-going students. Additionally, there is a lack of studies highlighting the changes in the physical dimensions of the cervico-thoracic spine attributed to Text Neck.

Hence, there is a pressing need to determine the prevalence rate of Text Neck and investigate the alterations in the biomechanics of the cervico-thoracic spine. Conducting such research would contribute valuable insights into the extent of the issue and shed light on the specific physical changes occurring in the cervico-thoracic spine due to Text Neck.

2. Materials and methods

A cross-sectional study was conducted among students at S.S. Agrawal Group of Colleges in Navsari. The selection of participants was accomplished through purposive sampling, following specific inclusion and exclusion criteria. The inclusion criteria for this study encompass college-going students who regularly use smartphones. Participants must fall within the age range of 17 to 24, engage in mobile phone usage for a minimum of one hour daily, express a voluntary willingness to participate in the research, and agree to complete the informed consent form. These criteria have been carefully defined to ensure a targeted and relevant participant group, facilitating a focused investigation into the prevalence of Text Neck and its associated biomechanical impacts on the cervico-thoracic spine in this specific demographic. The exclusion criteria for this study involve individuals with a history of neck trauma or surgery, those affected by congenital diseases related to the neck, and individuals diagnosed with cervical radiculopathy. Additionally, participants who decline to fill out the consent form are excluded from the study. These exclusion criteria are designed to ensure the selection of a cohort free from pre-existing conditions that could potentially confound the study's findings, thereby enhancing the reliability and specificity of the research outcomes.

The tools and materials employed in this study include a Universal Goniometer for accurate measurement of joint angles, the Web Plot Digitizer Software (WPDS) to convert graphical data into numerical values, a camera for capturing relevant images, a marker for anatomical point identification, and a stopwatch for precise timing during assessments. These instruments have been carefully selected to facilitate comprehensive and precise data collection, ensuring the study's accuracy in evaluating the biomechanical aspects of the cervico-thoracic spine and the prevalence of Text Neck among college-going students.

The outcome measures for this study include the Text Neck Questionnaire (TNQ) score and the Neck Pain and Disability Scale (NPAD) score, which provide subjective assessments. Additionally, objective measures involve the evaluation of Cervical Range of Motion, Deep Neck Flexor Endurance, and Postural Angles. These outcome measures have been carefully chosen to offer a comprehensive understanding of the prevalence of Text Neck and its associated impacts on both subjective experiences and objective biomechanical parameters among college-going students.

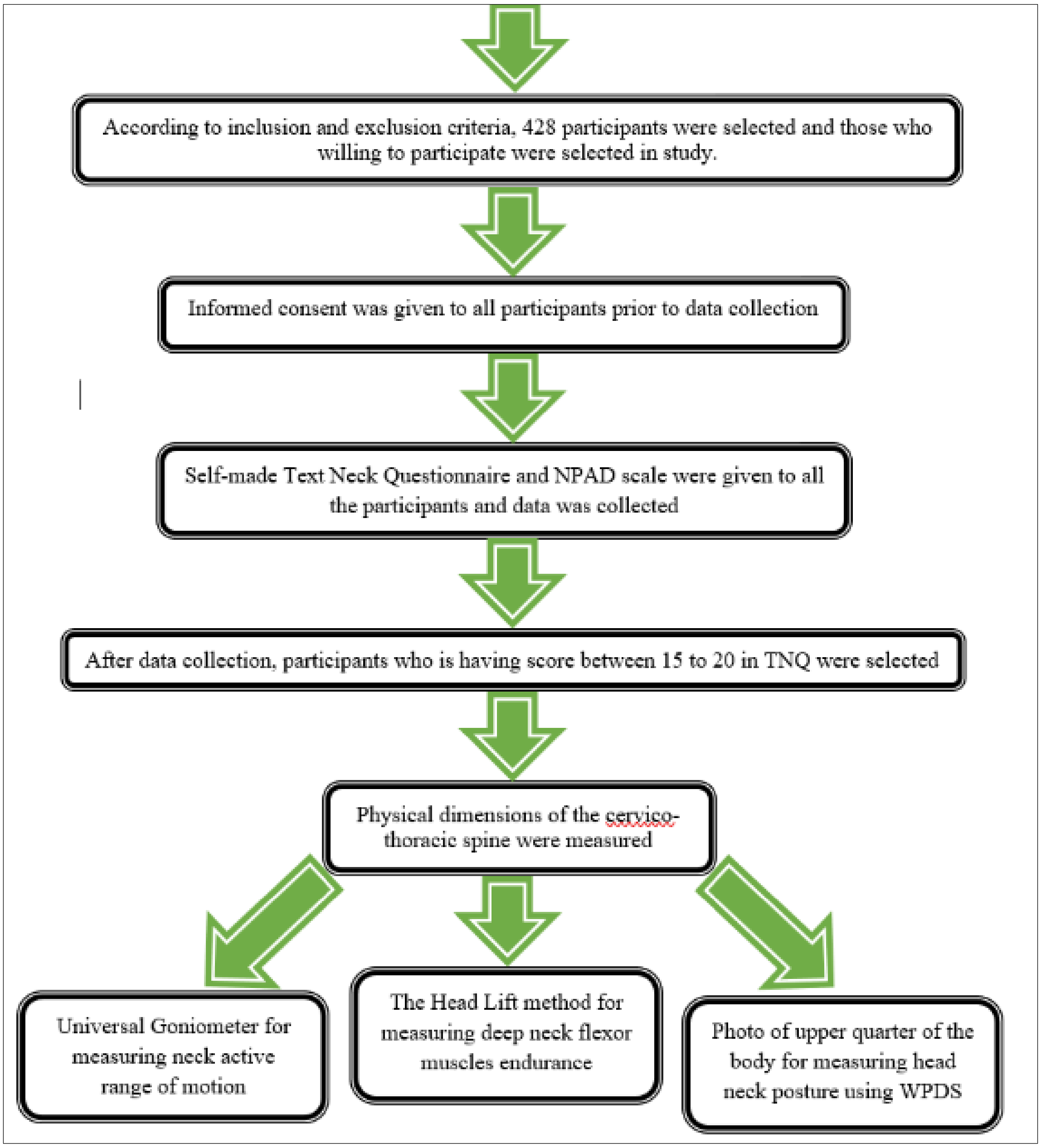

Figure 1 Methodology Flow Chart

2.1. Self-made Questionnaire (TNQ)

The Text Neck Questionnaire consists of a set of 20 questions that were designed according to the common complaints faced by text neck patients and this was also compared with NPAD questionnaire. The group of 428 samples was taken for this study. The text neck questionnaire consists of closed ended questions in the form of "Yes" or "No" where the participants are allowed to choose the answers accordingly and based on this the scoring is done.

2.2. Neck Pain and Disability using NPAD SCALE

The Neck Pain and Disability Scale (NPAD) was developed using the Million Visual Analogue Scale as a template. The 20 items in the NPAD measure the intensity of pain; its interference with vocational, recreational, social, and functional aspects of living; and the presence and extent of associated emotional factors. The NPAD is intended to be worded clearly and easy to complete. Patients respond to each item by marking along a 10-cm visual analogue scale. Item scores range from 0 to 5, and the total score is a total of the item scores. Completion of NPAD usually requires less than 5 minutes [12].

2.3. Active range of neck motion by Universal Goniometer

Figure 2 Measuring Cervical ROM by Universal Goniometer

Cervical flexion, extension, rotation and lateral flexion ranges of motion were measured with the Universal Goniometer device. Subjects were in an upright sitting, looking straight ahead arms resting on their lap, and feet flat on the floor during all range of motion tests [13-15].

2.4. Endurance of deep neck flexor muscle by the Head Lift Method

Figure 3 Deep Neck Flexor Endurance Test for Measuring DNF Muscle Endurance

The DNF endurance test based on Harris et al and Olson et al was performed in the following manner. The subjects began in a supine, hook-lying position, with the hands resting on the abdomen. If the subject could not lie flat on the plinth because of excessive kyphosis, then the subject's head was supported by a standardized flat sandbag in the kyphotic position. Upon request, with the chin in maximally tucked position and maintained isometrically, the subject lifted the head and neck approximately 2.5 cm from resting position. While in this position, a line was drawn across 2 approximated skin folds along the subject's anterior-lateral neck, and the tester slid the widths of stacked index and middle fingers under the subject's head at the most posterior aspect of the occiput (Figure 3.4). The subject was then asked to relax the neck, resting the head on the tester's fingers. Next, the subject again was directed to "tuck the chin" completely and then raise the head to the point that the back of the subject's head-maintained contact with the tester's stacked fingers. During the test, the examiner gently moved the stacked fingers side to side under the subject's head, which provided a tactile cue for maintaining proper head position above the plinth.

Time recording was started when the subject raised his or her head and was terminated when 1 of 4 criteria was met: (1) the edges of the drawn lines across the skin folds no longer approximated each other because of a loss of chin tuck, (2) the subject's head rested on the tester's folded fingers for more than 1 second, (3) the tester note when the subject raised his or her head such that there was no longer maintained contact with the tester's fingers, or (4) the subject was unwilling to continue.

The subject was only allowed one deviation from the test position, corrected by providing a verbal cue ("tuck your chin" or "hold your head where you just slightly feel my fingers") that directed him or her to resume the proper position and continue the trial. The subject was tested twice, with a 5-minute break between tests to allow muscular recovery During this time, the subject was instructed to remain supine and turn the neck from side to side through a pain-free range of motion as the subject felt warranted, without raising the head from the table. The 2-time scores were averaged, and the result was recorded [16-18].

2.5. Head-Neck posture by the Web Plot Digitizer Software (WPDS)

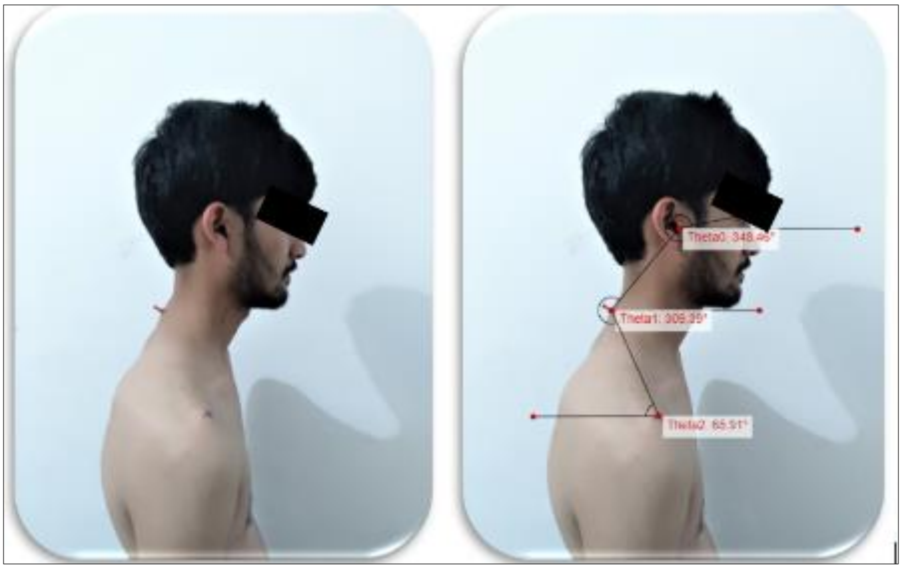

Figure 4 Angles Measurement Using Web Plot Digitizer Software

2.6. Equipment

The equipment consisted of a personal laptop with Windows10 operating system. A camera was used for capturing photographs of upper quarter of the body. Therapist mark the reference bony points (C7 spinous process, acromion process).

2.7. Procedure

2.7.1. Preparation of subjects and recording of images

Each subject was required to stand relaxed on a mark over the floor. The examiner is identified the cutaneous bony points and mark the C7 spinous process and the acromion process. The C7 spinous was identified by palpating the lower cervical spine, while flexing or extending the cervical spine. A picture of the Sagittal view of the upper body was taken using the camera.

2.7.2. Image processing in WPD software

The captured image was uploaded into the WPD software, and the angles of FHP were measured using "angles measure" function. The angle measuring function is a mathematical algorithm which transforms the three dots on the image into Cartesian coordinates axis and auto-calculates the angles [19-21].

Sagittal head angle (SHA)

The SHA is a common measurement for upper cervical extension and flexion. The SHA is formed between the line connecting lateral canthus of eye, middle part of tragus of ear and a horizontal line passing through middle part of tragus (canthus-tragus-horizontal). An increase in the angle measured indicates an extension of the upper cervical spine.

Craniocervical angle (CCA)

The CCA was measured between the line connecting 7th cervical spine (C7), the middle part of tragus of the ear and the horizontal line passing through it (C7-tragus-horizontal). A decrease in angle measured indicates a more forward neck posture. The CCA is the most frequently measured angle to assess FHP, and could discriminate the presence or absence of abnormal FHP.

Shoulder angle (SA)

SA is formed at the intersection of the line between the bony prominence of acromion process and C7 spinous process and the horizontal line through the acromion process. A decrease in the angle measurement indicates forward movements of shoulder in relation to C7 spine.

3. Results

Data analysis was done using SPSS software version 20.0

Results are considered significant at $p<0.05$ and confidence interval of 95%. Data analysis was done by:

- Prevalence rate of Text Neck in college going students by measuring descriptive statistics.
- Correlation coefficient (r) for correlation between NPAD and TNQ and also for validity of TNQ.
- Descriptive Statistics of variables like Range of Motion (ROM), Deep Neck Flexor (DNF) Endurance and Postural Angles of Cervico-Thoracic Spine.

Table 1 Prevalence rate of TNQ in 428 participants

Sr.No.	Variables	Participants agreed with variable		Participants not agreed with variable	
		Frequency	Percentage	Frequency	Percentage
1	Use of mobile everyday	425	99.3	3	0.7
2	Continuous use of mobile for 1 hour	295	68.9	133	31.1
3	Use of mobile for 4 hours per day	212	49.5	216	50.5
4	Experience of Neck pain	125	29.2	303	70.8
5	Neck pain during reading, writing or other activity	242	56.5	186	43.5
6	Shoulder Pain	103	24.1	325	75.9
7	Neck discomfort	112	26.2	316	73.8
8	Difficulty in moving head while or after using mobile phone	73	17.1	355	82.9
9	Eye irritation	205	47.9	223	52.1
10	Experience of headache	150	35	278	65

11	Neck pain interfere with work	106	24.8	322	75.2
12	Neck pain while driving a car or bike?	59	13.8	369	86.2
13	Difficulty in concentration during lectures	189	44.2	239	55.8
14	Neck Pain increase during activities like gaming, texting watching movies or using social media	144	33.6	284	66.4
15	Bending head down or forward while using mobile phone in sitting or standing position	271	63.3	157	36.7
16	Habit of forward bending and downward	176	41.1	252	58.9
17	Mobile phone usage while lying in bed	366	85.5	62	14.5
18	Habit of keeping 2 or more pillows during mobile phone use while lying in bed	117	27.3	311	72.7
19	Feeling of neck pain disappearing within few hours after stopping or finishing work on mobile phone	167	39	261	61
20	Sleep getting affected by using mobile phone	122	28.5	306	71.5

Table 2 Prevalence rate of TNQ in 35 Participants

Sr.No.	**Variables**	**Participants agreed with variable**		**Participants not agreed with variable**	
		Frequency	**Percentage**	**Frequency**	**Percentage**
1	Use of mobile everyday	35	100.0	0	0
2	Continuous use of mobile for 1 hour	33	94.3	2	5.7
3	Use of mobile for 4 hours per day	28	80	7	20
4	Experience of Neck pain	32	91.4	3	8.6
5	Neck pain during reading, writing or other activity	35	100	0	0
6	Shoulder Pain	21	60	14	40
7	Neck discomfort	28	80	7	20
8	Difficulty in moving head while or after using mobile phone	21	60	14	40
9	Eye irritation	30	85.7	5	14.3
10	Experience of headache	28	80	7	20
11	Neck pain interfere with work	27	77.1	8	22.9
12	Neck pain while driving a car or bike?	21	60	14	40
13	Difficulty in concentration during lectures	25	71.4	10	28.6
14	Neck Pain increase during activities like gaming, texting watching movies or using social media	34	97.1	1	2.9

15	Bending head down or forward while using mobile phone in sitting or standing position	32	91.4	3	8.6
16	Habit of forward bending and downward	30	85.7	5	14.3
17	Mobile phone usage while lying in bed	35	100	0	0
18	Habit of keeping 2 or more pillows during mobile phone use while lying in bed	26	74.3	9	25.7
19	Feeling of neck pain disappearing within few hours after stopping or finishing work on mobile phone	22	62.9	13	37.1
20	Sleep getting affected by using mobile phone	26	74.3	9	25.7

Table 3 Descriptive statistics of age, gender and BMI among 35 participants

Variables	**Mean**	**SD**	**Minimum**	**Maximum**
Age	20.14	1.441	17	24
Gender	1.77	0.426	1	2
BMI	20.22	2.93	14.70	27.80

Table 4 Pearson Correlation of Total Score of TNQ and Total Score of NPAD

Variables	**Correlation co-efficient**	**Total Score TNQ**	**Total Score NPAD**
Total Score TNQ	Pearson Correlation	1	.635**
	Sig. (2-tailed)		.000
Total Score NPAD	Pearson Correlation	.635**	1
	Sig. (2-tailed)	.000	

**. Correlation is significant at 0.01 level (2-tailed)

Table 5 Descriptive statistics of ROM, Cervical Endurance and Postural Angles

Sr. No.	**Parameters**	**Mean**	**Std. Deviation**
1	Flexion ROM	40.1714	6.68178
2	Extension ROM	46.2286	10.44618
3	Left lateral Flexion	37.2571	8.57868
4	Right lateral Flexion	37.0714	6.77706
5	Left Rotation	56.3429	8.06843
6	Right Rotation	57.9571	10.66631
7	Deep flexor muscle Endurance	22.6453	6.66230
8	Sagittal Head angle (Without Phone)	15.37	4.889
9	Sagittal Head angle (With Phone)	16.18	10.504

10	Craniocervical angle (Without Phone)	49.29	4.615
11	Craniocervical angle (With Phone)	33.50	8.786
12	Shoulder angle (Without Phone)	62.07	12.442
13	Shoulder angle (With Phone)	67.86	14.496

4. Discussion

The objective of this study was to determine the prevalence rate of text neck syndrome among college students and assess its impact on various postural angles. The study encompassed 428 participants, both male and female, aged between 17 and 24 years. Previous research suggested a prevalence of neck pain in the college student population ranging from 60% to 63%. However, in pain management clinics, the prevalence is reported to be as high as 53% among students experiencing neck pain (1). In our present study, the observed prevalence rate was approximately 30%, which is notably lower. This lower rate can be attributed to the inclusion of first and second-year college students who are not using mobile phones due to parental control imposed during their time in school. Damasceno, G.M. et al. conducted a study on 'Text neck and neck pain in 18–21-year-old young adults.' The results of their study differ from ours, indicating no association between text neck and neck pain in the specified age group. This disparity may be attributed to the fact that their study population consisted of a younger age group compared to ours [22].

In a study conducted among Indian college students by Acharya et al., headaches were identified as the most common symptom, observed in 51.47% of the subjects [23]. In our present study, the rate of headaches is approximately 35%, suggesting a correlation between headache occurrence and smartphone usage. One of the primary reasons for headaches may be the altered postural angles experienced while using mobile devices in both standing and sitting positions. In our study, the prevalence rate for forward bending in standing and sitting positions was found to be 63.3%.

The use of two or more pillows beneath the head, accounting for a rate of 27.3%, emerged as another contributing factor to changes in postural angles. The discomfort stemming from neck and shoulder pain significantly impacted sleep, resulting in insomnia. However, the reasons for sleep disruption may be linked to the relatively low incidence of neck and shoulder pain in our study. Importantly, our research did not delve into the correlation of pain with anxiety or depression, with only 29.2% of cases reporting such conditions. This highlights a dearth of data concerning the potential association between smartphone addiction and anxiety, depression, or other psychosomatic disorders.

Interestingly, the amount of time spent on devices did not show a direct correlation with increased discomfort. This discrepancy may be attributed to the specificity of survey questions, which focused on aspects such as how devices are used, their dimensions, holding methods, weight, position, and flexion degree of the cervical spine while using the phone. These areas warrant further exploration, as highlighted in previous research [24]. In our study, we set a minimum continuous usage time of at least 1 hour for 428 participants, revealing a mobile usage rate of 68.9%. An analysis based on TNQ scores revealed that among the 35 participants scoring between 15 to 20, 94.3% used mobile phones continuously for 1 hour, with 80% using mobiles for more than 4 hours per day. Among these 35 participants, 91.4% reported experiencing neck pain, compared to 29.2% in the overall participant pool of 428. This suggests that individuals with higher TNQ scores are at a greater risk of disability in the neck due to elevated pain levels.

Examining shoulder pain, the rate was 60% among the 35 participants and 24.1% in the larger sample of 428 participants. This discrepancy indicates that individuals with maximum shoulder pain due to mobile use are more susceptible to shoulder pathology. The study also highlighted the impact of prolonged mobile use on the eyes, with 49.7% reporting eye irritation. Additionally, mobile use in bed affected sleep in 85.5% of students, but the overall sleep disruption rate was 28.5%.

Given the scarcity of available scales for assessing text neck in college students, we developed a questionnaire based on text neck symptoms. To validate this questionnaire, we compared it with the Neck Pain and Disability Scale across 428 participants. Normality testing showed no significant difference between the Text Neck questionnaire and the Neck Pain and Disability Scale. The Pearson's Rank Correlation Coefficient indicated a positive correlation between the two scales, with an r-value of 0.65, demonstrating that the Text Neck self-made questionnaire was valid for assessing text neck in college-going students.

After validating the Text Neck self-made questionnaire, we formed a group based on high TNQ scores, ranging from 15 to 20. Abdulrahman Nasser Alzaid emphasized the need for further analysis regarding how devices are used, their dimensions, holding methods, weight, position, and flexion degree of the cervical spine during excessive phone use [24]. Recognizing this limitation, we examined physical parameters such as the range of motion of the cervical spine, cervical muscle endurance, and postural angles of the cervical and shoulder regions in 35 participants with TNQ scores exceeding 15 out of 20. The studies conducted by Dr. KK Hansraj emphasize the direct impact of "text neck" on the spine, particularly when bending the head forward at different degrees. The findings suggest that as the head bends forward, the forces on the neck increase significantly. For instance, at a 15-degree forward bend, the neck forces rise to 27 pounds, increasing to 40 pounds at 30 degrees, 49 pounds at 45 degrees, and reaching 60 pounds at a 60-degree forward bend. The prediction model for a 90-degree forward bend was not accurate [5,10].

This issue poses a significant concern, particularly for children, as their heads are larger in proportion to their body size compared to adults. Consequently, children have an elevated risk of developing text neck due to their frequent use of cell phones. The potential consequences of untreated text neck can result in severe and permanent damage, akin to workplace overuse or repetitive stress/strain injuries. This underscores the importance of addressing and preventing text neck, especially in younger individuals, to mitigate the risk of long-term spinal damage.

Postural angles, including shoulder-head angles, sagittal head tilt angles, and Craniocervical angles, were assessed in the presence and absence of mobile phones among these participants. Significant differences were observed in Craniocervical angle and sagittal head tilt angle between participants with and without phones, with p-values of 0.00 and 0.023, respectively. The highly statistical difference in the Craniocervical angle indicates that maximum deviation occurred at cervical vertebrae due to forward bending in the cervical region of the spine when using a phone. The angle between the shoulder and head also exhibited a statistically significant difference, suggesting an increased risk of forward head posture and rounded shoulders, contributing to musculoskeletal disorders in the cervical and shoulder regions.

Among the 428 participants, 60% scored 6 in the Text Neck Questionnaire, indicating lower neck pain and fewer associated symptoms. Neck muscle endurance was found to be low in all subjects, whether or not they experienced neck pain. Participants tended to discontinue the endurance test due to muscle fatigue and/or pain. The present study compared the Deep Neck Flexor Endurance test with the normative value (range 35.4±5.4), revealing a reduced endurance of the muscles (24.64±6.66) around the cervical region due to excessive smartphone use. Muscle fatigue was notably high in the 35 participants at an increased risk of compressive and tensile loads in the cervical region, potentially exacerbating their condition.

The cervical range of motion (ROM) was notably affected in the present study, with considerable differences observed when compared to normative data. In flexion, the mean ± SD in the normative data was 60±10.291, whereas in the present study it was 40.17±6.6. Similarly, in extension ROM, the normative data was 75±10.33, whereas in the present study it was 46.22±10.44, indicating a significant impact on ROM in the 35 participants.

Left and right-side flexion also showed considerable reductions in the present study when compared with normative data. Normative data for right-side flexion was 46±7.5, and in the present study, the ROM for left-side flexion was 37.25±8.57. For left-side flexion, the normative value was 45±7.466, and in the present study, it was 37.07±6.77. These findings suggest a noticeable decrease in flexion ROM in the present study.

Rotation ROM was also affected in the 35 participants. In left rotation, the normative value was 78±7.96, and in the present study, it was 56.343±8.06. For right rotation, the normative value was 79±6.32, and in the present study, it was 57.35±10.66.

The significant impact on physical parameters, including endurance, ROM, and postural angles, indicates that the 35 participants are at risk of worsening symptoms with persistent smartphone use without adequate rest. Although the frequency of neck pain was low, this suggests that participants may have a reduced perception of pain but a higher risk for degenerative changes in the cervical region.

5. Conclusion

The prevalence of text neck among 428 school-going students was found to be 29.2%. However, among the subset of 35 participants with a Text Neck Questionnaire score between 15 and 20, the prevalence was much higher at 80%, indicating a significant presence of text neck symptoms in this particular group. Moreover, the physical parameters, including Range of Motion (ROM), endurance, and postural angles, were found to be altered in these 35 participants, who reported a higher rate of neck pain and discomfort. This suggests a correlation between the self-reported symptoms in the Text Neck Questionnaire and objective physical measurements, highlighting the impact of text neck on various aspects of musculoskeletal health in this subgroup of participants.

Limitation of study

- Sample size was less.
- Correlation was not done in age groups.
- Female participants were more than male participants so comparing of normative data was applicable for females only.
- Interpretation of Text Neck Questionnaire was not done.
- Participants whose scores were 15 or more than 15 were only included in assessment.

Future implication

- A study can be done with the use of other more reliable method or instruments.
- Text Neck Questionnaire can be compared with Neck Disability Index for correlation of Neck pain and disability
- Participants with tightness of Pectoralis Major and Minor can be included in the study.
- Manual Muscle Testing of Scapular muscles can be added.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

This study was initiated after the approval of Institutional Ethical Committee.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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