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Prevalence of Text-Neck Syndrome in Computer Engineering Students

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Abstract

Background: Text neck syndrome is an injury caused by repetitive strain induced by the continuous use of electronic gadgets. If left untreated, this condition can cause severe and permanent damage to nerves and the spine. College students, especially those in undergraduate computer engineering programs, increasingly use electronic gadgets for personal and recreational purposes, which can lead to neck and shoulder pain and discomfort. This study aims to assess the prevalence of text neck syndrome among undergraduate medical students using the Neck Disability Index (NDI) and craniovertebral angle measurement using photographic methods. **Purpose:** To determine the prevalence of text neck syndrome in computer engineering students. Observational cross-sectional study. **Method:** In this observational study, 164 participants (age: 22.26 ± 0.57) 91 male and 73 female computer engineering students were included. They were assessed for forward head posture by craniovertebral angle measurement using a photographic method and neck pain by using NDI. **Results:** In our study, we found that the prevalence of text-neck syndrome in computer engineering students was 59.75% (98 participants) and the remaining 40.20% (66 participants) were found negative for text-neck syndrome. **Conclusion:** The study conducted among computer engineering students including participants aged from 20 to 25 years in D. Y. Patil College of Engineering and Technology reveals, that there is a higher prevalence of text neck syndrome. We found that text neck syndrome was seen among 59.75% of the study population. Text neck syndrome can be prevented by regularly taking breaks when using electronic devices, engaging in exercises that target posture improvement such as chin tucks, incorporating stretching routines, and practising yoga. These measures are effective in maintaining good posture and preventing text neck syndrome.

Keywords: Computer Engineering Students, Electronic Gadgets, Text Neck Syndrome

1. Introduction

The concept of "text neck" was coined by a United States chiropractor named Dr. Dean L. Fishman. The text neck syndrome is also called turtle neck posture[1]. Text neck, a modern affliction, arises from prolonged use of electronic gadgets such as cell phones or wireless devices. This repetitive stress syndrome stems from the habit of tilting the head forward and downward for extended periods while engrossed in these devices. Over time, this posture triggers a range of discomforts including neck pain, upper back pain, shoulder pain, chronic headaches, and even alterations in the curvature of the spine and discomfort in the head[1]. The term "text neck" encapsulates the consequences of our digital age, where the constant use of electronic gadgets predisposes individuals to a unique set of musculoskeletal issues. Engaging in prolonged periods of head flexion while interacting with these devices leads to a host of symptoms, from localised pain in the neck, upper back and shoulders to chronic headaches

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and postural changes. Recognising and addressing this phenomenon is crucial in mitigating its long-term impact on physical well-being[1,2]. The prevalence of text neck syndrome was high and equal to low back pain, irrespective of age[2]. A recent survey shows that 79% of people aged between 18 to 44 years carry their phones all the time, and spend only two hours without their phones in their hands. It means they spend most of their time with cell phones[3]. The neck's intricate anatomy comprises a sophisticated interplay of bones, muscles, the spinal cord, and nerves. When cervical nerves sustain injury or irritation, it often manifests as neck and shoulder pain. If left unaddressed, this discomfort can escalate, resulting in nerve impingement characterised by symptoms such as tingling and numbness in the hands. In some cases, these issues may extend to temporomandibular dysfunction, highlighting the interconnected nature of neck-related ailments[4]. Appropriate care should be taken for this condition as it may lead to indefinite damage such as spinal degeneration, disc compression, disc herniation, nerve and muscle damage, gastrointestinal issues, and loss of lung volume capacity[4]. The neck's complexity is underscored by its network of bones, muscles, and nerves, which, when disrupted, can lead to a cascade of symptoms. Neck and shoulder pain often serve as the initial indicators of cervical nerve insult or irritation. Without proper intervention, these symptoms may worsen, culminating in nerve impingement that presents as tingling and numbness in the hands. Additionally, the repercussions of such nerve involvement can extend to temporomandibular dysfunction, underscoring the far-reaching impact of cervical nerve disturbances on overall bodily function[4]. An analysis of 15 papers found that the most prevalent musculoskeletal problems among mobile phone users were neck-related[6]. The anatomical structures present in the cervical region are:

There are seven cervical vertebrae and six intervertebral discs out of which the third to sixth are typical, while the first, second and seventh are atypical vertebrae. Joints:

Craniocervical region- Atlanto-occipital joints which are comprised of occipital bone and 1st cervical vertebra. The main motion of this joint is flexion and extension at the cervical spine. Atlanto-axial joints are comprised of 1st and 2nd cervical vertebrae which are atlas and axial vertebrae respectively. The principal movement is rotation at the cervical spine. Facet joints: there are mainly 2 facets present at the cervical spine namely superior and inferior. The superior facet is pointed upwards, backwards, and medially. The inferior facet is directed downward, forward and laterally. Attachments and Relations: The anterior longitudinal ligament is attached to the upper border of the body of the cervical spine and the posterior longitudinal ligament is attached to the lower border of the body of the cervical spine. On the anterior surface of both the sides of anterior longitudinal ligament vertical part of the longus coli muscle is attached. There are two or more foramina present at the posterior surface for the passage of basivertebral veins. The upper edges and lower portions of the front surfaces of the laminae serve as attachment points for the ligamenta flava. The foramen transversarium allows passage for the vertebral artery, vertebral veins, and a branch from the inferior cervical ganglion. The front protrusions provide the starting point for muscles like the scalenus anterior, longus capitis, and the oblique part of the longus colli. Grooves on the costotransverse bars accommodate the anterior primary rami of corresponding cervical nerves. The rear protrusions serve as attachment sites for muscles such as the scalenus medius, scalenus posterior, levator scapulae, and insertion points for the splenius cervicis, longissimus cervicis, and iliocostalis cervicis. From the spine originate deep neck muscles like interspinal, semispinalis thoracis and cervicis, spinalis cervicis and multifidus. The atlas, the first cervical vertebra, is usually referred to as the cradle because its articulation with the occiput of the skull forms a cradle for supporting the head. The atlas links to the occipital condyles and is mostly used for bending both forward and backwards. In the atlanto-occipital joint, the typical range of motion for bending forward to bending backwards extends from about 15° to 20°. The head's weight is transmitted to the cervical spine via the side connections between the atlas and the axis (C2)[5]. A study done in India found that the prevalence of text neck syndrome was 42.5%[5]. Typically, the angle of the cervical spine while texting ranges from 37 to 47 degrees. The weight of an adult head in a neutral position is approximately 10-12 pounds (4.5 to 5.5kg). However, even a slight forward flexion of the head can significantly increase the force exerted on the neck. For instance, a 15-degree forward flexion can elevate this force to around 12kg, while at 30 degrees, it rises to 18kg, further escalating to 22kg at 45, and a substantial 27 kg at 60 degrees. This phenomenon is particularly pertinent in the era of smartphone usage, where individuals often find themselves with their heads tilted forward, engrossed in their devices[7]. The most common muscles which undergo

weakness are the trapezius, scalenus, rhomboidus as well as sternocleidomastoid. Severe headaches: Irritation in the neck can impact on muscles and nerves of the head. Headaches can be associated with tightness of neck muscles[7].

The habitual use of smartphones and prolonged periods of head-forward posture can lead to detrimental effects on spinal alignment. Specifically, this position promotes an excessive anterior curve in the lower cervical vertebrae and an excessive posterior curve in the upper dorsal (thoracic) vertebrae. This contributes to a range of musculoskeletal issues. Furthermore, maintaining balance in this head-forward position necessitates additional muscular effort, further exacerbating strain on the neck and surrounding structures[7]. These effects are particularly pronounced among students and individuals who spend significant amounts of time engaged with electronic devices. The pervasive nature of smartphone usage exacerbates these issues, as individuals often adopt poor posture habits without even realising it. Over time, the cumulative impact of this strain can lead to chronic neck pain, upper back discomfort, and even structural changes in the spine[7,8]. Awareness of the implications of prolonged smartphone usage on spinal health is crucial for both individuals and healthcare professionals alike. Encouraging ergonomic practices and promoting regular breaks from screen time can help mitigate the adverse effects of text neck syndrome and preserve long-term musculoskeletal health[9]. Multiple studies conducted in many regions of the world reveal that several Work-Related Musculoskeletal Diseases (WRMSDs) have links with the use of computers, with a high prevalence of Work-Related Neck Pain (WRNP) in computer users[10]. Literature shows that studies related to this topic were conducted in the following countries and the prevalence is India (45.2%), Iran (54.9%), Sweden (50%), Estonia (51%), Nigeria (33.9%), Turkey (21.6%), Finland (20.7%), Pakistan (16.8%)[9]. Research shows that neck pain causes notable movement restrictions in computer users in their late 20s. Software specialists in the field of Information Technology (IT) are more likely to experience computer-related neck discomfort[9]. According to signs and symptoms, the majority of neck pain patients are trapezius myalgia (38%), tension neck syndrome (17%), and cervicalgia (17%). Other conditions connected to neck pain include Myofacial Pain Syndrome (MPS) of the neck and shoulder, as well as the formation of Myofacial Trigger Points (MTrPs) on the trapezius muscle[10]. This vicious loop emphasises the necessity of fostering good screen habits and developing solutions to reduce the detrimental impact of excessive electronic device usage on both physical and mental health[11,12].

Quantitative data shows that 73% of university students and 64.7% of work-from-home employees have neck and back pain[13]. Some cardinal features of text neck syndrome are as follows: Neck stiffness: Difficulty in moving along with soreness when trying to turn the head side to side after prolonged use of the device[14]. Sharp pain: Stabbing or stinging type of pain on one localised spot, most commonly in the lower region of the neck. General soreness: The pain in the entire neck or trapezius muscle. Radiating pain: The pain can radiate along with nerve course which leads to shoulder and arm pain. The suboccipital area is more prone to headaches[14]. Recent studies show that mobile phone or computer users report pain in the neck, shoulder and thumb[15]. The severity of symptoms increases as time spent on the device increases. Neck pain is one of the disabling conditions which shows the symptoms with remission and relapses. Recent investigations have brought to light a concerning aspect of text neck syndrome: its potential impact on mental health. Beyond the physical discomfort associated with prolonged use of electronic devices, such as neck pain and headaches, emerging evidence suggests a link between text neck and mental well-being. Researchers have found that individuals experiencing text neck symptoms may also be prone to sleep disturbances and depression. This correlation underscores the interconnected nature of physical and mental health, highlighting the need for holistic approaches to address the repercussions of excessive screen time[16,17]. Furthermore, the adverse effects of prolonged electronic device usage extend beyond mental health implications to encompass physiological manifestations of stress and anxiety[18,19]. Excessive screen time has been associated with heightened levels of anxiety and stress, further exacerbating the toll on overall well-being[20,21]. The resultant lack of adequate sleep only compounds these issues, leading to feelings of tiredness, fatigue, and diminished energy levels, particularly in the morning[22]. Mousavi-Khatir and colleagues' research uncovered a notable phenomenon: after merely ten minutes of neck flexion, there was a discernible elevation in the range of motion during cervical flexion. This observation led them to propose a significant implication: the possibility of gradual deformation, termed "creep," in the posterior ligaments of the spine due to sustained

forward head posture. Such deformation has implications for the intricate balance of the length-tension relationship within the posterior cervical muscles and the stability provided by the posterior ligaments. This suggests that prolonged periods of forward head posture could potentially compromise the structural integrity of the spine, setting the stage for musculoskeletal issues[23].

Moreover, their findings shed light on the physiological consequences of prolonged forward head posture. The heightened activation of the erector spinae muscle, as noted by Mousavi-Khatir and team, further complicates the biomechanical dynamics of the spine. This increased muscle activation, coupled with compromised ligamentous stability, creates an environment ripe for abnormal movements between vertebral segments. Such aberrant motions may predispose individuals to conditions like disc herniation, highlighting the intricate interplay between posture, muscle activation, ligament health, and spinal stability. These insights underscore the importance of understanding the long-term consequences of posture-related behaviours and the potential for preventive measures to mitigate associated risks[23]. Nowadays, smartphone technology is getting to the point that everybody is becoming addicted to it and spending the majority of their time on mobile devices[23]. Because of the pandemic of Coronavirus, almost all universities and institutions were conducting classes with the use of digital assistants. So electronic devices have been used for educational purposes as well. It may lead to increased curvature of the cervical spine. In addition, it may lead to nagging pain which is sharp and severe to upper back muscles along with spasms. The tightness and pain in the shoulder, possibly result in painful shoulder muscle spasm[23,24].

The physical manifestations of text neck syndrome, such as forward head posture and rounded shoulders, further underscore the toll of prolonged screen time on musculoskeletal health. This habitual maintenance of the head in a forward-flexed position not only contributes to the development of text neck but also leads to what is colloquially known as turtle neck posture. In severe cases, this posture can exert significant stress on the muscles, ligaments, and joints of the cervical spine and shoulders, potentially culminating in chronic pain and functional limitations. Recognising the multifaceted nature of text neck syndrome is crucial in developing comprehensive interventions to address its physical, mental, and emotional ramifications. Numerous studies have delved into strategies for the prevention and treatment of neck pain stemming from prolonged computer use, with a primary focus on maintaining proper posture. This foundational element is crucial in mitigating the strain on the neck and shoulders that often accompanies extended periods of screen time. Additionally, interventions such as neck exercises, prioritizing adequate sleep, incorporating regular rest breaks, and integrating relaxation techniques into daily routines are essential components of comprehensive neck pain prevention strategies, particularly for individuals, such as computer engineering students, who frequently engage with computers for extended durations. Furthermore, research highlights the significance of external keyboard usage in alleviating neck and shoulder pain associated with computer use. The adoption of an external keyboard helps promote a more ergonomic workspace setup, reducing the need for awkward positioning of the hands and arms, which can contribute to muscular strain. In instances where external devices are not readily available, adjusting the laptop setup to include a 12-degree incline on a standard height desk can also yield benefits in improving head and neck posture. These ergonomic modifications serve to optimise the workspace environment, thereby reducing the risk of neck pain and discomfort among individuals who rely heavily on computer technology in their daily activities[24].

2. Methodology

Materials: Neck disability index, mobile, tripod stand, measuring tape, ECG suction ball electrode, laptop, ruler, consent form, demographic data collection sheet,

Methodology: This study was an observational study which was conducted on computer engineering students, Inclusion and exclusion criteria were considered. The study protocol was presented for approval in front of the institutional ethical committee and protocol committee of D. Y. Patil Education Society, deemed to be University of Kolhapur and D.Y. Patil College of Physiotherapy, Kolhapur and ethical approval was granted by the committee. Potential subjects were approached and provided with an explanation of the study's purpose. Written consent was obtained from those willing to participate. The data was collected from D. Y. Patil College of Engineering and Technology, Kolhapur, this is an observational study design: an observational cross-

sectional study for 6 months done on 20 to 25-year-old computer engineering students.

Using sampling technique: Convenience sampling method. Based upon inclusion criteria: Computer engineering students in 3rd and 4th year, 20 to 25 years computer engineering students, Both male and female participants, Participants using electronic devices for more than 2 years, Electronic device users > 4 hours a day, exclusion criteria: Participants already diagnosed with specific neck related conditions, participants involved in other activities such as yoga and heavy weight lifting, pathological diseases or recent trauma and fracture related to cervical spine, participants having only forward head posture or neck pain. Participants for the study were recruited and they underwent assessment using neck disability index and craniovertebral angle measurement using a photographic method. The study was focused on computer engineering students studying in 3rd and 4th year, including both male and female individuals aged between 20 to 25 years, who had been using electronic devices for more than 4 hours per day. Eligible subjects meeting these criteria were invited to participate in the study. The study excluded participants already diagnosed with specific neck-related conditions, participants involved in other activities such as yoga and heavy weight lifting, pathological diseases or recent trauma and fracture related to the cervical spine, and participants having only forward head posture or neck pain. This exclusion criteria aimed to focus specifically on neck pain along with forward head posture because of prolonged use of electronic devices. The nature of the study was explained to interested subjects, and written consent was obtained from all participants. Demographic data including name, age, and gender were collected using a standardised data collection sheet. The NDI and craniovertebral angle measurement with the photographic method was recorded for 164 participants. To estimate craniovertebral angle, a digital imaging approach was employed to assess head and neck posture while standing. A cell phone (Redmi 50-megapixel) was put on a tripod stand at a distance of 150cm, with the height set to the participant's shoulder level. A level program was used to align the camera with the ground. Participants were instructed to stand in front of the camera, and an ECG vacuum cup was put on their C7 spinous process. The individual was instructed to face straight and laterally to the camera. A photograph was then taken and transmitted to a laptop, where it was opened in jpg format using the MB (Markus Bader) ruler program. The points of the MB ruler were positioned on the picture at the C7 spinous process, where the ECG vacuum cup was inserted. The MB ruler was used to measure distance and angles on the screen as well as distance on the map, resulting in precise and accurate measurements. The craniovertebral angle was determined by drawing a line from the spinous process to the tragus of the ear and measuring it. The lower the craniovertebral angle, the more forward the head position was.

Participants were evaluated for neck pain, forward head posture, neck, shoulder, and upper back pain, and their neck disability index questionnaire scores were recorded. It has ten questions; the minimum score is 0 and the maximum score is 50 for NDI. The statistical analysis was carried out utilising relevant biostatistical methods and master chart data. This study sought to determine the prevalence of text neck syndrome among computer engineering students. Finally, the study presented its findings, discussion and conclusion.

3. Results

A total of 164 engineering students were involved in this study. The mean age group of the participants were 22.26 ± 0.57 years and the mean NDI score was 12.57 ± 8.61. A maximum of 55% (91) were male and 45% (73) were female (Figure1).

and the maximum population of about 86.59% (142) belongs to final-year computer engineering. In a given population 46.95% (77) students are using electronic devices for 5 to 6 hours, 49.39% (81) are using 7 to 8 hours and only 3.66% (6) are using 9 to 10 hours (Figure 2).

The prevalence of text neck syndrome in computer engineering students was found to be 59.75% (Figure 3).

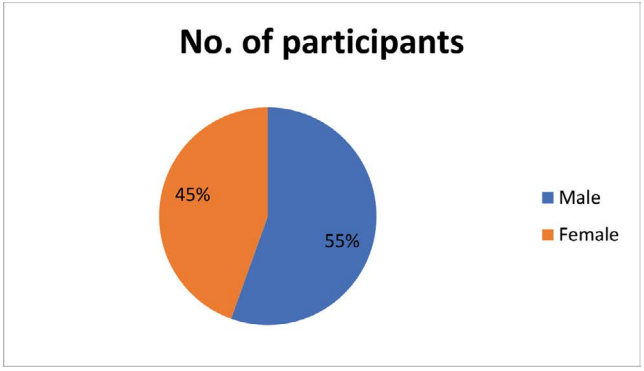


Figure 1. Gender of participants.

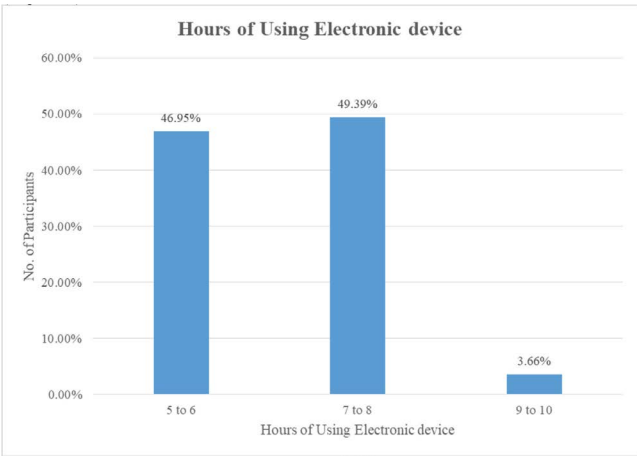


Figure 2. Hours of using electronic devices by participants.

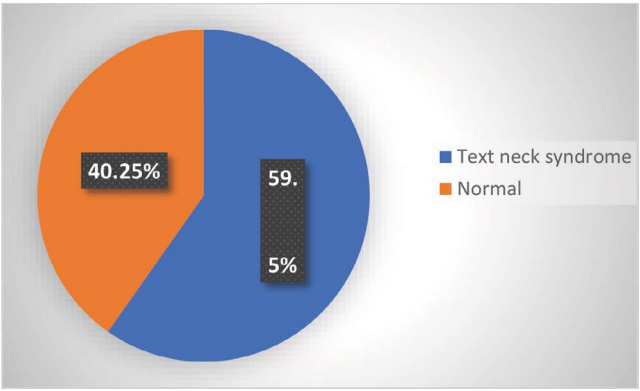


Figure 3. Prevalence of text neck syndrome.

Among 164, 68.30% (112) were found to be positive for forward head posture and 31.70% (52) participants had normal posture which was assessed by craniovertebral angle measurement by photographic method. Along with that among 164, 71.95% (118) participants had neck pain which was assessed with the neck disability index. So, 59.75% (98) of participants reported symptomatic forward head posture and neck pain simultaneously. Among the participants reported with text neck syndrome 4.88% (08) had mild disability, 51.22% (84) had a moderate disability and 3.65% (06) had severe neck disability.

4. Discussion

In the contemporary era, mobile phones have become an indispensable component of individuals' daily routines. Smartphones are relied upon for a myriad of activities essential to modern life, ranging from educational endeavours to entertainment like gaming and music consumption. However, a concerning trend has emerged where certain individuals find themselves increasingly tethered to their smartphones, surpassing reasonable usage limits. This growing dependency on smartphones has led to the identification of a phenomenon known as Nomophobia, signifying a fear or discomfort when separated from one's mobile device[1,4]. The text neck syndrome is a repetitive stress injury induced by extended usage of electronic gadgets.

Over time, this posture causes a variety of discomforts, including neck pain, upper back pain, shoulder pain, persistent headaches, and even changes in the curvature of the spine and discomfort in the head[1]. Engaging in prolonged periods of head flexion while interacting with these devices leads to a host of symptoms, from localised pain in the neck, upper back, and shoulders to chronic headaches and postural changes. Recognising and addressing this phenomenon is crucial in mitigating its long-term impact on physical well-being[4]. A prior study indicated that the frequency of text neck syndrome is rather high among young adults. In earlier studies, the prevalence of text neck syndrome ranged from 16.7% to 68.1%1,5. In this study, the prevalence of text neck syndrome was 59.75%. The research comprised 164 computer engineering students in their third and fourth years at the D.Y. Patil College of Engineering and Technology. In the current study, we included the student's age group between 20 to 25 years and the maximum number of participants was of 22 years as about 86.59% belongs to final year computer engineering. The gender of the respondents, from which 55.49% were male and 44.51% were female. The reason could be due to the predominance of the male population in the current study. The current study found that 59.75% of computer engineering students had text neck syndrome, which was virtually identical to the 68.1% observed by Alsiwed *et al* among medical students[5]. According to a recent study conducted by Sohel A *et al*, 42.5% of individuals experienced neck impairment[7]. Another recent research of 100 physiotherapy students in the same age range of 18 to 25 years found that 32% had text neck syndrome[4]. Another research done in Korea among 2353 university students found that 34% had neck impairment[24]. In this study, the majority of patients with text neck syndrome reported having moderate neck impairment (51.22%), a few had a light disability (4.88%), very few had a severe disability (3.65%), and no one had a total disability. As we can see, text neck syndrome is a repeated stress injury

that has little likelihood of causing total impairment, which might explain why there are no individuals with complete disability. There are 46.95% (77) participants who are using electronic devices for 5 to 6 hours solely for academic purposes. Additionally, 49.39% (81) of participants are using electronic devices for 7 to 8 hours for both academic and personal reasons. Lastly, 3.66% (6) of participants are using devices for 9 to 10 hours, indicating a preference for personal use over academic purposes. Among these 59.75% population, 46.94% (46) participants were female and 53.06% (52) participants were male. This could be attributed to the higher proportion of males in the present research. We found that among the positive text neck syndrome population 47.95% (47) participants were using electronic devices for 5 to 6 hours, 50% (49) participants were using them for 7 to 8 hours and 2.05% (2) participants were using them for 9 to 10 hours. According to the neck disability index scale, the total score is 50, with values in the range of 0-4 indicating no impairment. The scores range 5-14 are considered as mild disability which has a 4.88% positive population consisting of 3 male and 5 female participants. Scores ranging from 15 to 24 are considered a significant disability, with 51.22% of the positive population consisting of 46 men and 38 women. Scores ranging from 25 to 34 are deemed significant disability, with 3.65% of the positive population consisting of three men and three women. Scores ranging from 35 to 50 are classified as total disability, which affects 0% of the population. The frequency of text neck syndrome appeared to be particularly high among computer engineering students in our study, possibly because of their intensive use of electronic gadgets for educational reasons. These students often find themselves bending their necks for prolonged periods while engrossed in the screens of smartphones, computers, and laptops. Moreover, the pervasive integration of technology within the field of computer engineering likely exacerbates this reliance on electronic devices among students. Additionally, the abrupt shift to online learning prompted by the COVID-19 outbreak in March 2020 has further compounded the issue. With in-person education suspended, students in India were compelled to engage in excessive usage of electronic devices to adapt to the new online learning environment, potentially exacerbating the prevalence of text-neck syndrome. The combination of these factors underscores the multifaceted nature of the problem, highlighting the need for comprehensive strategies to address the prevalence of text-neck syndrome among computer engineering students. Efforts to promote ergonomic practices and reduce prolonged screen time could prove beneficial in mitigating the impact of this syndrome on the well-being of students in this field.

5. Conclusions

The study conducted among computer engineering students including participants aged from 20 to 25 years reveals, that there is a higher prevalence of text neck syndrome. We discovered that text neck syndrome affected 59.75% of the sample population. Text neck syndrome can be prevented by regularly taking breaks when using electronic devices, engaging in exercises that target posture improvement such as chin tucks, incorporating stretching routines, and practising yoga. These measures are effective in maintaining good posture and preventing text neck syndrome.

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