

IMPACT OF DIGITAL TECHNOLOGY ON THE POSTURES ADOPTED BY TEENAGERS

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Abstract

Background/Objectives:- Users adopt awkward postures due to the prolonged study/work sessions causing musculoskeletal disorders such Forward Head Posture (FHP), Text Neck Syndrome, Occipital Neuralgia, among others such as eye strain and eye fatigue which are the most common problems experienced.

Methods/Statistical analysis:- A study was conducted among 120 electronic gadget users (aged 14 – 19 years) with the prime objective of analyzing the postures adopted while using gadgets, specifically mobile phones, laptops, and tablets. Self-constructed questionnaire and a measurement scale CMDQ (Cornell Modified Musculoskeletal Discomfort Questionnaire) was used to elicit data.

Findings:- The analyzed data reveals that teenagers spend a large part of the day using the tablet and mobile device each day. Sitting, standing, and slouching postures were adopted commonly while using the e-gadgets. They experienced severe pain in the neck region, lower and upper back. The pain was also experienced in the right shoulder and the base of the right thumb. Headaches, eye fatigue, and redness of the eye are associated with using electronic gadgets in dim light led to headaches. The teens are aware and agreed to the fact that using phones for a very long duration adversely affects them. Advice to stop using these addictive devices will not be taken positively by this age group. Hence, instructions for safe use such as adopting neutrally aligned posture, limiting the use of the gadgets, and appropriate controls/setting modifications are necessary.

Novelty/Applications: In <30 words.

Keywords: Electronic devices, Ergonomics, Eyestrain, Musculoskeletal pain, Posture, Health, Well-being.

1. Introduction

The reliance on the internet and electronic gadgets has multiplied in the current COVID-19 times, which is rapidly becoming the ‘new normal’ as COVID-19 continues further to infuse itself into the normalcy of our daily lives. It is the usual thought among the population that during such times of crisis, social media platforms are a blessing. There is a sharp 40% rise in time spent on messaging services and social media, according to the report by Statista (1). The report dated April 30, 2020 “In-home media consumption due to the coronavirus outbreak

among internet users worldwide as of March 2020” states an additional 51% increase in time spent watching shows/films on streaming services like Netflix; a 36% increase in time spent on computer/video games.

Technology is here to stay and entice us into its expanding grabs with each expanding step (2). It potentially improves our lives positively but also has an equally, if not more negative effect on physical and mental health. Prolonged use of computers, laptops, tabs, and cellphones lead to several disorders, such as:

- Eye strain, collectively known as the ‘Computer Vision Syndrome’ – Screen glare, low lighting, and improper viewing distance, are the major contributing factors. The symptoms include blurred vision, dryness, double vision, redness of the eyes, neck and shoulder pain, headaches, and dry, itchy eyes.
- Sleep disorders – exposure to blue light emitted by the electronic gadgets suppresses melatonin and disrupts the circadian clock; this affects the sleep-wake cycle making the person less alert during work time. The light from electronic gadgets can push back sleep time twice as long as caffeine. It is also proven that by disrupting melatonin and sleep, the smart device light can also confuse the hormones controlling hunger, potentially increasing the risk of obesity.
- Musculoskeletal disorders – improper posture adopted for prolonged periods and repetitive movements damage the tendons, ligaments, nerves, and surrounding tissues of the neck, shoulder, forearm, and hand. The symptoms of which are numbness and tingling sensation. WhatsAppitis, text thumb, text claw (cubital tunnel syndrome), cellphone thumb, text neck (anterior head syndrome) are some of the many disorders due to repetitive stress injuries that occur with trauma due to repetitive movements.
- Nerve damage (occipital neuralgia) is a neurological condition causing chronic pain in the upper neck, back of the head and eyes, which is caused by compressed nerves at the neck due to drooping (3,4).

Ideally, ergonomically appropriate postures are adopted to reduce these disorders. ‘Cellphone thumb,’ a form of repetitive stress syndrome, was standard among teenagers who used mobile phone texting for a longer duration (Karim, 2009;99). Acute Wriitis was the term designated in 2007 and named after the Nintendo Wii tennis video game, categorized by intense pain in the right shoulder (5-8).

A reflective study on the use of handheld devices by reported pain in the thumb, forearm with associated numbness, burning, and tingling sensation by all participants (9). The study specified that handheld devices chiefly endorsed the usage of only one finger and thumb while typing messages was associated with a higher prevalence of musculoskeletal disorders (9).

2. Justification

The COVID-19 pandemic has triggered a seismic wave of online courses, webinars, and teaching-learning sessions, which is positive and innovative but also energizing newer categories of health issues due to excessive time spent with the new technologies and digital media. This

problem is further accentuated by doing so in an ergonomically unfitting method. Users adopt awkward postures due to the prolonged study/work sessions causing musculoskeletal disorders such as FHP (Forward Head Posture), Text Neck Syndrome, Occipital Neuralgia, among others. Strangely, although the issue has been around for long, there is still little data on the scientific characterization of these new postural habits.

3. Objectives

A study was thus conducted among 120 students (aged 14 – 19 years) as the concept of online teaching-learning zoomed up in India to cope with the academic backlog due to the COVID-19 pandemic with the objectives: (i) record the time spent by teenagers while using these electronic gadgets (specifically mobile phones, laptops, and tabs); (ii) analyze the postures adopted while using these gadgets, and (iii) to relate the time spent using the gadgets to symptoms of strain experienced in various body parts.

4. Methodology

A descriptive study was conducted among 120 students using a purposive and convenient sampling technique. Before they were included in the study, they were asked to sign the informed consent. Observation, Pictorial Analysis Method (Ovako Working Posture Analysis System), CMDQ (Cornell Modified Musculoskeletal Discomfort Questionnaire), and a self-constructed validated Questionnaire were used to elicit information. The CMDQ proforma was used to assess the prevalence of musculoskeletal discomfort in fingers and thumb (both proformas - for the right hand and left hand were utilized), which has been developed by Dr. Alan Hedge and ergonomics graduate students at Cornell University (10). They derived it from surveys conducted previously on postural discomfort and thus has high face validity. Descriptive statistics like frequency, percentage, mean is used to analyze and interpret the data.

5. Results and Discussion

5.1 Sample Profile: A total of 120 students were included in the study. 45 (37.5%) were female and 75 (62.5%) male participants [Table 1]. The mean age is 15.9 years. 69 (57.5%) belonged to 10th and 12th grade and were exposed to e-learning for maximum duration. With the lockdown, school authorities, as well as parents, are very anxious to ensure that their ward attended all online classes each day.

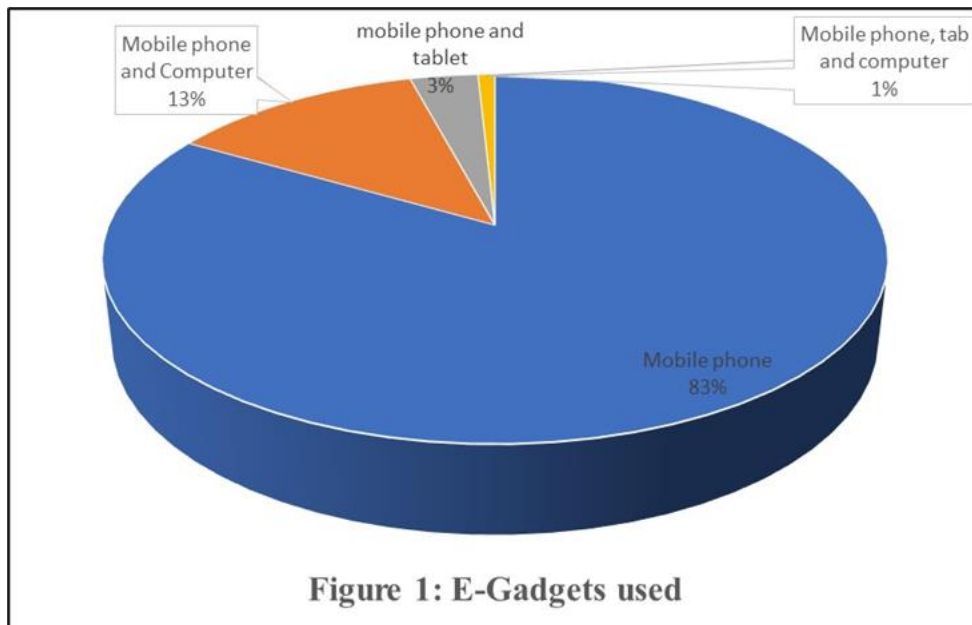
Gender	Age Group	Class				Total
		10th	11th	12th	9th	
Female	14 - 15	9	0	0	7	16
	16 - 17	2	13	8	0	23
	18 - 19	0	0	6	0	6

Female Total		11	13	14	7	45
Male	14 - 15	24	0	0	7	31
	16 - 17	2	24	15	0	41
	18 - 19	0	0	3	0	3
Male Total		26	24	18	7	75
Grand Total		37	37	32	14	120

58 (48%) rated their general health as being good, 31 (25%) rated it as being very good, and the rest rated their health as being average.

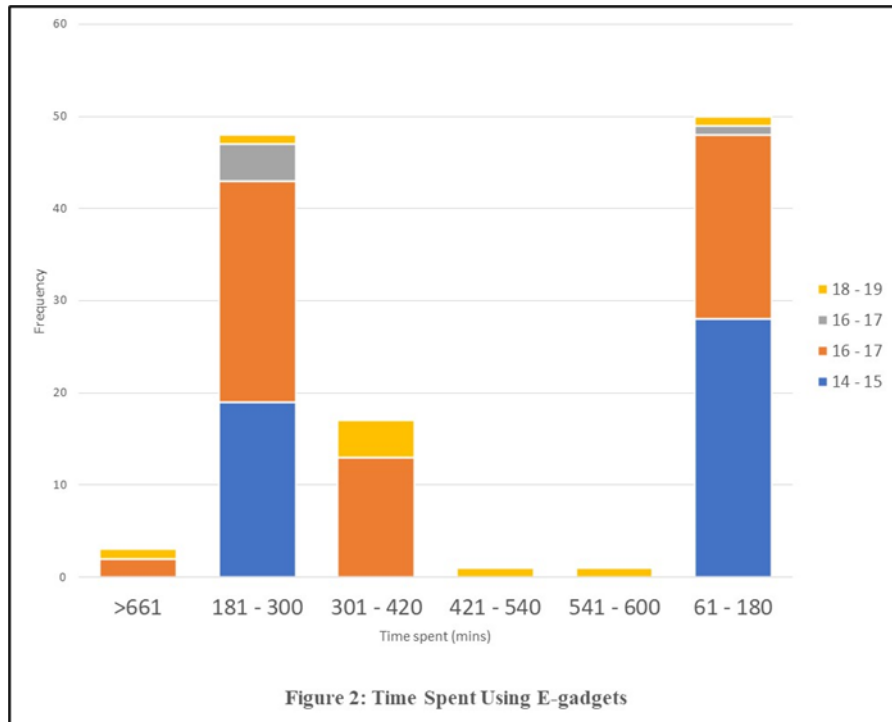
It was observed that the maximum time of the participants was spent using e-gadgets browsing, chatting, and surfing.... to top this, online teaching sessions have increased the total usage time. Interestingly, when the time spent was being recorded using a simple time log datasheet, it was noticed that five (two male and two female) participants used their mobile phones for 15 hours (900 mins) each day.

80 (96%) used mobile phones and computers/laptops most frequently/commonly used by the specific age group [Figure 1].



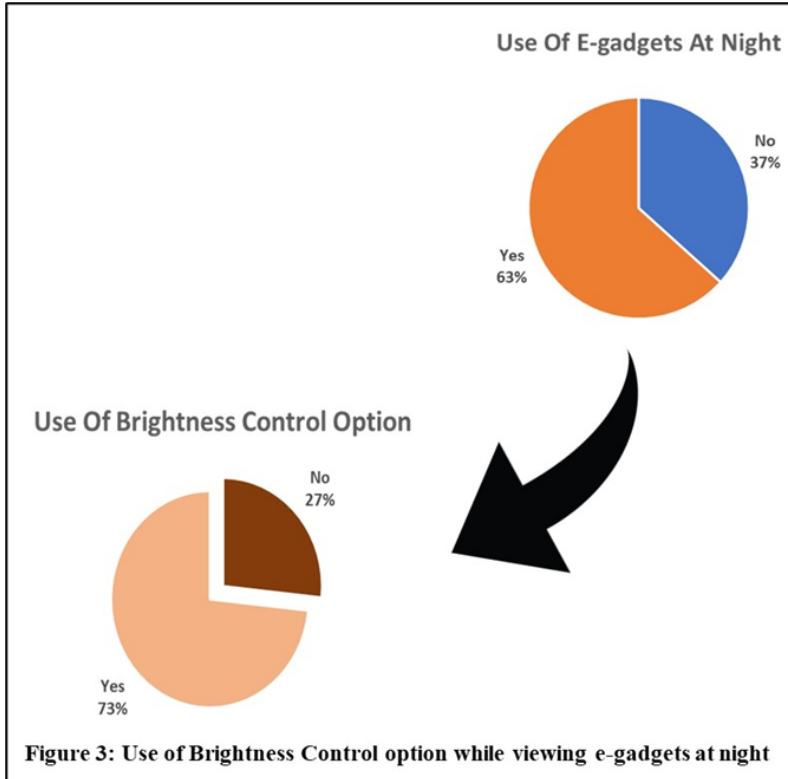
5.2 Use of e-gadgets: On average, the participants spent 251 mins (4 hours 20 mins) each using e-gadgets each day. Few [1 (0.8%)] spent as much as 900 mins (15 hours), and 2 (1.7%) spent up to 720 mins (12 hours), they claimed to use it in the evening - night or morning -night

[Figure 2]. The child using for 15 hours is in 12th std and confessed that after 6 hours or more in teaching sessions (school as well as classes), he required some time where he could choose what he wanted to view or play with this device. Elders agreed, too, that the pandemic has made them more addicted to mobile phones – especially for interaction with friends, relatives, and classmates.

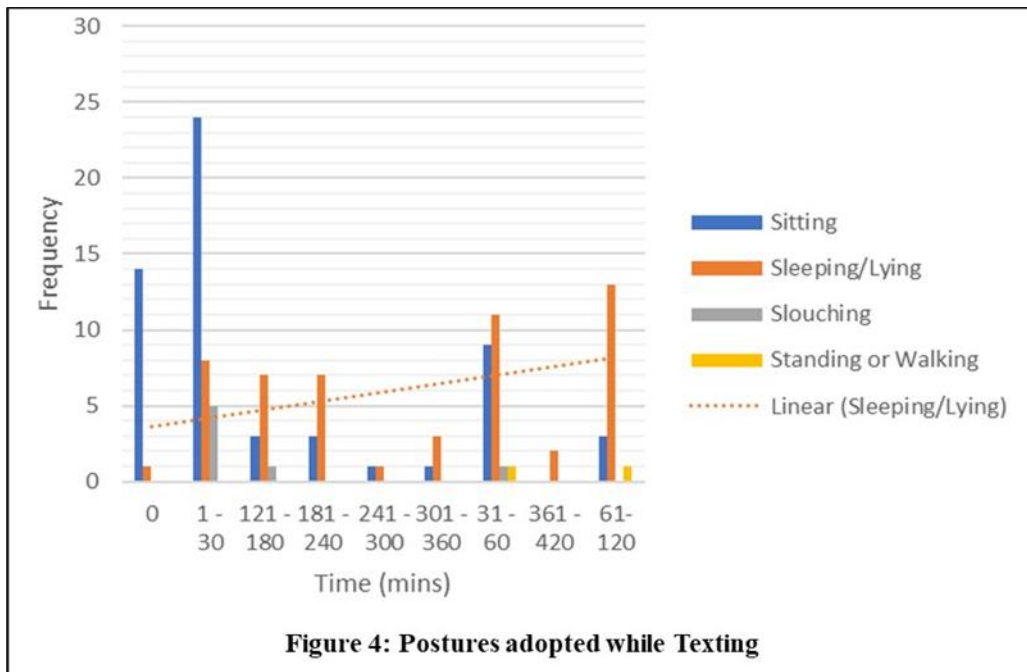


Most of the texting is done at night, and that also explains the sleeping/lying posture adopted. One more health concern with using electronic gadgets, especially mobile phones, is the blue light filter. Blue light emitted from the e-gadgets is known to be dangerous (11,12). Digital strain and retina damage are some of the ill effects of exposure to too much blue light.

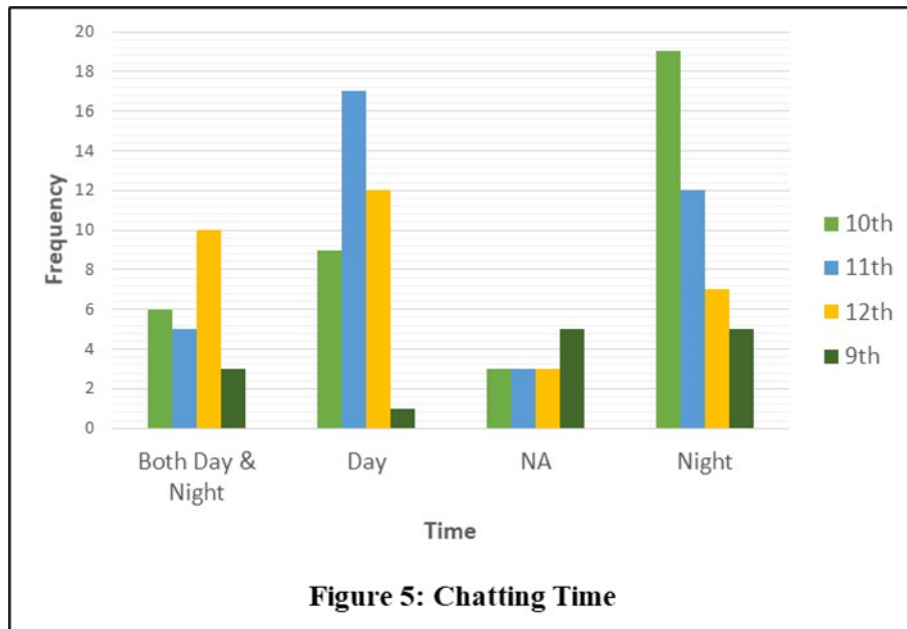
67 (55.8%) use the gadgets at night time just before falling asleep. The fact that using electronic devices before bedtime can be physiologically and psychologically stimulating in ways that can adversely affect one's sleep (13-15). Using e-gadgets in the dark, just before sleep at night suppresses the release of melatonin (sleep-inducing hormone), making it difficult to sleep. Research also suggests that difficulty in falling asleep increases with the increase in time spent using electronic devices in the evening, which is because there is increased alertness at the time when one should be feeling sleepy. Over time this leads to chronic deficiency in sleep.



Almost all good brands of mobile phones and tabs have a blue light filter, which reduces the amount of blue light displayed, and this will inturn reduce digital eye strain. It is believed that the blue light filters work similarly to the anti-glare filters in laptops/desktops [Figure 3]. 38 (73%) were aware of the benefits of blue light filters in their phone and agreed to turn it on while using the device at night.



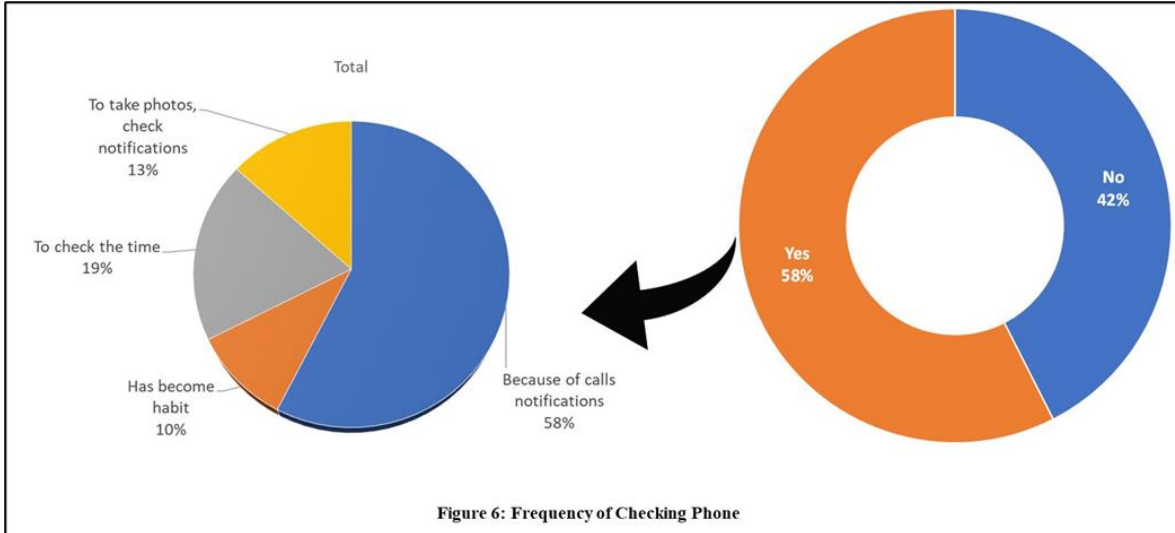
Each new generation of mobile phones brings in efficient multi-purpose built-in functions, which further entices the users leading to more prolonged exposure to the blue light as well as radiation. The mini keypads, too, require finer dexterity skills. Thus, texting for a long duration is the reason for the damage to the musculoskeletal structure (16,17). Along with sustained gripping of the gadget, repetitive movements for texting, especially of the thumb and muscles of the forearm, leading to severe pain not only in the thumb but also increases the risk factors for developing neck, shoulders, and upper extremity musculoskeletal disorders. Postures adopted while texting/chatting affects the entire body. 60 (50%) texted in sleeping/lying or slouching position, and the rest were sitting [58 (48.3%)] and 2(1.7%) walk/stand while sending text messages [Figure 5].



28 (23.3%) teenagers, adopted a standing posture for 30 mins, 27 (22.5%) adopted a sitting posture while making phone calls for 30 mins. 96 (80%) teenagers who use their mobile phone to make phone calls. 13 (10.8%) teenagers adopted a standing posture for 120 mins while making phone calls, 4 (3.3%) teenagers adopted a sitting posture for 120 mins for phone calls. 2 (1.7%) teenagers adopted sleeping posture for 300 mins while making phone calls. 2 (1.7%) teenagers adopted sitting posture for 60 mins while making phone calls.

76 (63.3%) teenagers stated that they used their mobile phones to play games as well as study. Similarly, while gaming, 28 (23.3%) teenagers adopted sitting posture for 30 mins, 10 (8.3%) teenagers adopted sitting posture for 60 mins. 14 (11.7%) teenagers adopted slouching posture for 30 mins while playing games, 5 (4.2%) teenagers adopted a slouching posture for 60 mins while playing games. The result also shows that 2 (1.7%) teenagers adopted the sleeping, sitting posture for 300-900 mins.

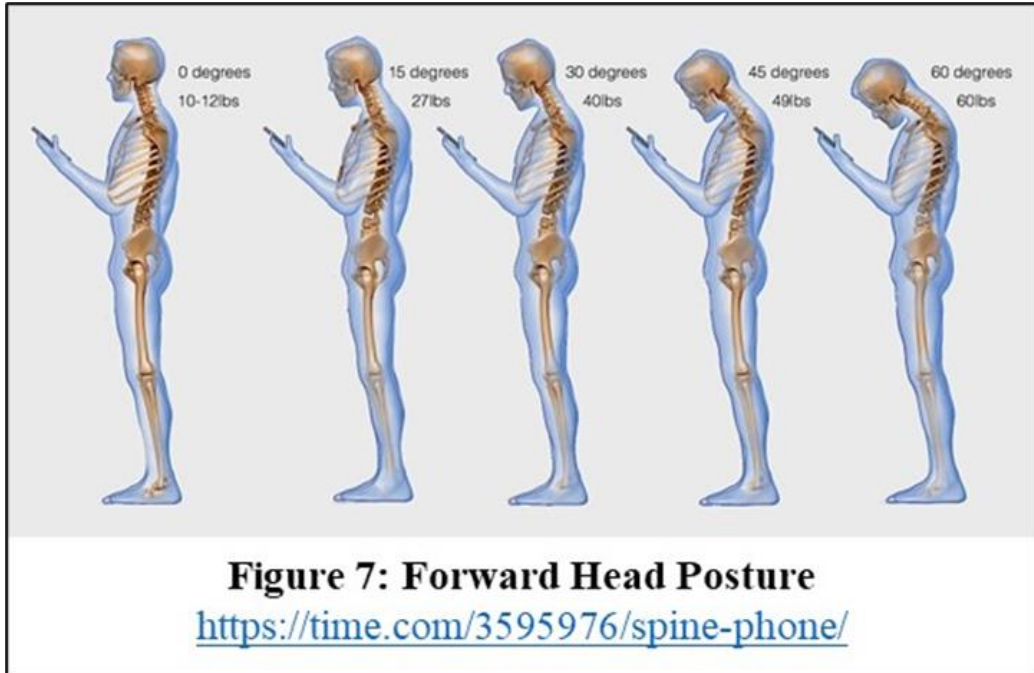
78 (65%) teenagers spent 57.36 minutes only playing games on their mobile phones. On average, teenagers spend almost one hour daily playing games on these electronic devices. 105 (88%) of the sample population spent an average of 143.32 minutes chatting. On average, a teenager spent almost one and a half hours daily chatting in addition to playing games. It was also noticed, 96 (80%) of the sample spent 40.17 minutes for phone calls [Figure 6].



On average, a teenager spent almost an hour behind making phone calls in addition to playing games and chatting. Thus, a teenager spent nearly 260.85 minutes with these various activities on this electronic device [Table 2].

Table 2: Postures adopted while using e-gadgets										
Posture Adopted	Sitting		Sitting/ Lying		Lying		Slouching		Standing/ Walking	
	f	%	f	%	f	%	f	%	f	%
Phone calls	43	35.8	6	5.0	10	8.3	15	12.5	46	38.3
Chatting	58	41.7	31	25.8	22	18.3	7	5.8	2	1.7
Games	43	35.8	10	8.3	42	35.0	25	20.8	0	0

70 (58%) participants also suffered from Phantom Vibration Syndrome, also known as ‘Ringxiety.’ It is a hallucination that the phone is ringing or vibrating even when it is not. Participants confessed to frequently checking the mobile phones as soon as they receive notifications, 12 (10%) confessed that it has now become a habit—other reasons being to see pictures or the time [Figure 7].



Forward Head Posture (FHP) adopted while using the gadgets inappropriately is the compressive loading on the tissues in the cervical region, especially the facet joints and surrounding ligaments [Figure 8]. Texting has become the primary mode of communication among these youth, and the postures adopted while doing so is a catalyst to musculoskeletal pains and aches. The higher the angle of deviation, the greater the weight on the neck.

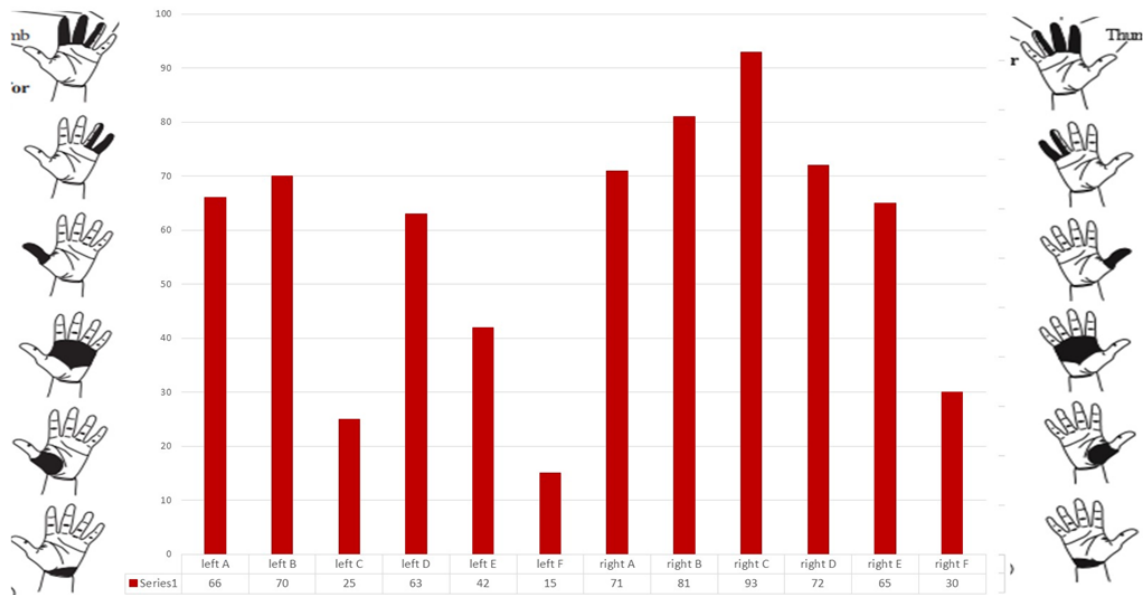


Figure 8 Prevalence of Pains/Aches in Hand

5.3 Prevalence of Body Pains and Aches: Several factors, including excessive repetition, sustained awkward postures, have been identified as important factors associated with musculoskeletal complaints. Eye strain (99.2%) followed by headaches, hand aches, and pain in the neck was reported.

CMDQ was inducted to the participants, and pain mapping was reported in 5 areas of the right hand and left hand (10 sites). 93 (77.5%) stated that they experienced pain in the right thumb. 81 (67.5%) reported pain in the ring and the pinkie finger; the right palm area was the next highest [72 (60%)]. Gripping of the mobile phone requires the muscles of the left hand to be flexed continuously – participants reported pain in the ring-pinkie finger [70 (58.3%)], index-middle-ring finger [66 (55%)] and palm [63 (52.3%)] occurring several times in the week. Incidentally, area F (lower palm near to the wrists) was the least affected. Pain in the right thumb was reported as being very uncomfortable and interfered substantially with their ability to work [figure 8].

Electronic devices, especially mobile phones, combine calculating competence, such as internet communication, information recovery, video, e-commerce, and other features, that make the device highly prevalent among individuals. Prolonged use of these electronic gadgets has led to various pains and aches. (basically headache, eye fatigue, burning sensation in eyes, back pain). Counseling the younger generation to quit using mobile phones is not a practical solution at all. Hence, they should be counseled to adopt the right practices, which will not negatively impact their health.

5.4 Safe Methods of Using Handheld Electronic Devices

Few recommendations based on the observation and findings of the study are:

- Avoid excessive time spent with electronic gadgets, especially mobile phones. While surfing or chatting, they can use the brightness control panel to reduce eye strain. As most of the teenagers were found to be wearing spectacles (though there could be several other reasons), not using brightness panel can indeed affect the vision further.
- Intervals between continuous work are recommended. A short walk or some stretching exercises will help relieve the stress of continuous repetitive movements.
- Developing interest in a creative or sports activity such as reading, painting, fitness training, will take the mind off the virtual world and also boost stamina and good health.
- Regular exercises, especially of the body parts being continuously used, are highly recommended. Exercise improved blood circulation and relieves aches. Suggested exercises are hand rotation, neck rotation, eyeball rotation.
- Adoption of appropriate postures, i.e., keeping the body parts neutrally aligned. Symmetrical postures are endorsed over asymmetrical postures.
- Support the forearms when working on desktops or laptops, as this would reduce pain in the elbows, shoulders, and upper arms.
- Use thumbs of both hands for texting lengthy messages. This will reduce overloading stress on one thumb only.

- Avoid sitting with the head bent forward as that may lead to pain in the nape region for being in that posture for a very long time.
- Also, avoid texting with high velocity to prevent musculoskeletal disorders when using mobile phones for texting. Texting includes chatting on WhatsApp, Facebook, Telegram, Instagram.
- Compose fewer and shorter messages. Use the device dictation/speech-to-text software if available.
- Avoid typing for more than a few minutes at a time.

6. Conclusion

The study revealed that the youth are engaged excessively with their electronic gadgets and adopt awkward postures unknowingly, which affects their health adversely in the later years. Along with the awkward postures, which are the prime reason for musculoskeletal disorders, the blue light emitted from electronic gadgets also affects the vision. Ringxiety is a disorder that most participants confessed to experiencing wherein they feel the vibration or hear the phone ring even when it does not. 7 (5%) of the participants were not particular about the answer. 36 (30%) of the participants wrote that the overuse of mobile phones is the main reason for the pains and aches of the body parts. 9 (7.5%) of the sample size agrees to the fact that the radiation which comes from mobile phones is harmful and creates harmful effects in the body.

This study has helped understand the extent to which electronic gadgets, especially mobile phones, have captivated the youth. Many health issues have surfaced in the recent past, which is attributed to the prolonged use of these gadgets. Many respondents are fully aware of the ill effects of their compulsive habit on their health but are still hopelessly addicted to their gadgets.

The study has some limitations. Larger sample size would help conclude conclusively with the statistical relationship between posture and FHP. Measuring the angle of forward head tilt and the use of the OWAS technique will help understand the extent of damage caused due to prolonged use of e-gadgets.

7. Author Statements

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Informed Consent: A written informed consent was taken from all 120 participants.

Conflict of Interest: The author declares that they have no conflict of interest.

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