



Research Article

THE EFFECTS OF E-READING ON NECK AND SPINE

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ABSTRACT

Background: the usage of smart device is increasing. With that, there are more problems with neck and spine. Thus **Aim:** To measure the effects of e-reading on neck and spine. This study is focusing on the effects of these devices on neck and spine. It explains what is the most way that have be the most efficacious, and what is the most problem participants. **Methods:** We collected Data using two methods. First was observe the posture of students while using their smart device. Second, face to face interview to determine the problem they face while using the device **Results and conclusion:** This study found that using smart devices in a wrong posture/position could lead to health problems like neck and spine pain. Also, the results showed that the more time spent on the device, the more susceptible having problems in neck and spine. Not only the posture affects the health, but also increased hours spent on the devices and holding them incorrectly might affect too.

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INTRODUCTION

In modern life, People are becoming more and more dependent on their smart phones. Smartphone's are becoming more involved in almost every aspect of people's lives. They use it to get the world news, and it made communication much faster and easier ^(1, 2). In addition, reading from a tablet is more convenient than paper books. People do not have to carry many books because one tablet is enough to read more than one book ⁽³⁾. Moreover, it is lighter and occupies less space ⁽⁴⁾. However, long reading in a wrong position lead to health problems. It affects the eyes, and its strongest effect would be on neck, shoulders, and spine muscles ^(5, 6). Not only physical body is affected by posture, but also self-concept and mood; thus it is more important than what people think ⁽⁷⁾. It also affects feelings, thoughts, and actions ⁽⁷⁾.

Smartphone's let people look down and flex their heads ⁽⁸⁾. Tissue gets sore and inflamed when it is stretched for a long period of time ⁽⁹⁾. According to Dennerlein's study, people flex their heads and necks while using tablets more than if they are using computers. It puts more stress and results in more pain ^(8, 10, 11). The human head weighs about 10 pounds in neutral position. Which is when ears are over shoulders. For every inch the head tilts forward, 10 pounds of pressure are added on the neck and spine ⁽⁹⁾. What happens when using smart phones, tablets or laptops with the flexed neck is exactly the same when holding a bowling ball with an extended arm ⁽¹²⁾.

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The more increased use of smart phones, the more neck and spine pain happens ⁽¹³⁾. Rate is increased in adolescence ⁽¹³⁾. According to the Kaiser Family Foundation, adolescences spend an average of 7:30 hours using their cell phones ⁽⁹⁾. Moreover, one in four people reporting neck pain is adolescent ^(13, 14). Neck pain is common in the general community with rate of up to 72% ⁽¹³⁾. A research has found that the effect of neck and spine pain on males is stronger than females ⁽¹³⁾. Text neck is an overuse syndrome that consists of pain in neck, spine, and shoulders due to long time usage of smart phones or tablets with flexed head, forward head posture (FHP) ^(15, 20). Text neck is usually diagnosed with neck cricks, headaches, and achy shoulders ⁽¹⁴⁾. Text neck could lead to chronic problems because of the early onset of neck arthritis ^(17, 18). Prevention of text neck is by maintaining good habitual positions of person and tablet or smart phone ⁽¹⁷⁾. Disc hernia ions, muscle strains, and pinched nerves are some of the conditions that FHP cause ⁽⁹⁾. Moreover, it can reverse the natural curve of the neck ⁽⁹⁾. Which leads to tear, wear, degeneration, and surgeries ⁽⁷⁾. Many past researches have focused on vertical position and optimal height of screen to the person, and they forgot about the angle of the screen and the table space ⁽¹⁹⁾. People cannot avoid using smart phones, tablets, and laptops but they should make an effort to take care of their neutral spine and avoid excessive using them as possible ⁽⁷⁾. Wrong positions could be when holding the tablets or smart phones flat or using small tables or inappropriate spaces while typing⁽²⁰⁾. Also, it may be considered when flexing the head or back for a long time while reading. With the excessive use of smart phones, people should learn how to minimize the strain to avoid pain and discomfort. Some tips

include: stretching the front of the neck and the chest; stretching of the back; holding head straight, ears are vertical to the shoulders; rolling the shoulder to the back (posteriorly), holding the smartphone at eyelevel, taking breaks from the smart phone, standing up straight, and changing position every once in a while (13, 17, 18, 21, 22, 23). The pain and structural changes at the neck and shoulder components are obvious and evident. There is lack of data with respect to the volume of this problem, and the most prominent abnormality appears on the heavy users of e-gadget and provide suggestions. Hence the current study is proposed. The results of the study may help to provide recommendations to prevent adverse effects of e-reading on neck and spine.

MATERIALS AND METHODS

The study took place in KSAU-HS, Riyadh campus. The study subjects were the male and female students of College of Applied Medical Sciences at King Saud Bin Abdul-Aziz University for Health Sciences.aged between 19-30, The sample size was estimated to be 215 students. Samples were chosen in a random convenient technique. Inclusion criteria was students from the College of Applied Medical Sciences and Collage of Medicine at KSAUHS who are using smart phones, tablets, and laptops. Exclusion criteria was Students in universities other than KSAU-HS, and students with pain in neck, spine, or shoulders due to medical conditions other than wrong positions of holding smart devices. The study design was observational cross-sectional study based on face to face interviews. Data was collected using two methods. The first one was observation. We observed the students while they were using their devices. We took notes on what device they were using, what is the angle of neck while sitting and standing, and whether or not they were using their device in the right way (Appendix I). The second method was face to face interview with the student to assess back pain while using smart devices, the hours people spend on their devices, and see if they are aware of the right positions, posture. The interview contained questions about the medical condition that caused the pain (appendix II).

RESULTS

Demographic Characteristics of the Subjects

Table 1 Demographic characteristics of the Subjects

Age	N	Minimum	Maximum	Mean	Std.
	215	19	30	21.05	0.931
	Number of subjects		Percentage		
19	3			1.4	
20	40			18.6	
21	127			59.1	
22	41			19.1	
23	3			1.4	
30	1			0.5	
total			215		

215 male and female KSAUHS students in the age group of 19-30 years participated in the study. There were 138 females and 77 male participants. Most of the participants were at the age of 21 (n=127, 59.1%) and only one participant was at the age of 30 (n= 1, 0.5%), Table 1. The subjects' mean values of age were (21.05±0.931) years.

Table 3 Degree of standing and sitting while holding the device

Degree of standing	Number of subjects	Percentage
90°	31	14.4%
45-90°	130	60.5%
0-45°	54	25.1%
Total	215	

Degree of sitting	Number of subjects	Percentage
90°	20	9.3%
45-90°	151	77.2%
0-45°	44	20.5%
Total	215	

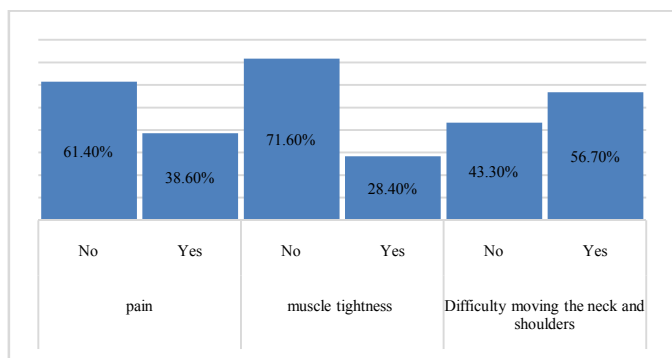
Table 3 shows the degree of participants' neck angle when they were holding their devices while standing and sitting. While standing, the majority of the participants were between 45-90° (63%), and while sitting, the majority were between 45-90° (72.4%).

Experiencing any pain, muscle tightness or difficulty moving the neck and shoulder

Table 4 shows the responses of the participants on the question that looks for any feeling of pain, muscle tightness or difficulty moving the neck and shoulders. 83 of the participants chose "yes" for "pain" (38.6%), 61 chose "yes" for "Muscle tightness" (28.4%), and 122 chose "yes" for "Difficulty moving the neck and shoulders" (56.7%).

Table 4 Experiencing any pain, muscle tightness or difficulty moving the neck and shoulders

Pain	Number of subjects		Percentage
	No	Yes	
Pain	No	132	61.4%
	Yes	83	38.6%
	total	215	
Muscle tightness	Number of subjects		Percentage
	No	154	71.6%
	Yes	61	28.4%
Difficulty moving the neck and shoulders	Number of subjects		Percentage
	No	93	43.3%
	Yes	122	56.7%
	total	215	



The number of people who have experienced pain, muscle tightness or difficulty moving the neck and shoulders and tried to find solution for them

33.9% of the people who have experienced any pain, muscle tightness or difficulty moving the neck and shoulders and tried to find solutions for them (n= 73), Table 5.

Table 5 Experiencing any pain, muscle tightness or difficulty moving the neck and shoulders and tried to find solutions

Experienced any pain, muscle tightness or difficulty moving the neck and shoulders	Tried to find solutions		Percent age
	Yes		
	73		33.9%

The relationship between experiencing any pain, muscle tightness or difficulty moving the neck and shoulders, and degree of standing and sitting while holding the device, the number of hours that participants spend on the devices, and holding the device correctly:

Table 6 shows Pearson chi-square test between different variables such as: pain, muscle tightness or difficulty moving the neck and shoulders degree of standing, degree of sitting, number of hours that participants spend on the devices. The results demonstrate that there were significant correlation between pain, muscle tightness or difficulty moving the neck and shoulders, and the degree of standing; p-value (0.026). On the other hand, there was positive correlation between pain, muscle tightness or difficulty moving the neck and shoulders, and the degree of sitting; (r=6.87), pain, muscle tightness or difficulty moving the neck and shoulders, and the number of hours that participants spend on the devices; p-value (r=3.975), and pain, muscle tightness or difficulty moving the neck and shoulders and holding the device correctly (r=3.017), the Awareness of the drawbacks/problems of long using smart devices with the number of hours that participants spend on the devices (r=0.936), the participants know how often he\she need breaks during E-reading with the number of hours that participants spend on the devices (r=5.197), headache with the number of hours that participants spend on the devices (r=0.766), visual abnormalities with the number of hours that participants spend on the devices (r=0.006), Know the right position to hold the device with holding the device correctly (r=0.006), and the Knowledge of the right distance between the device and the eyes with holding the device correctly (r=0.979).

Table 6 The relationship between the degree of standing and sitting while holding the device, the hours spent on the device, the way holding the device, the awareness of the right position and space, having headache, having visual abnormalities, and experiencing any pain, muscle tightness or difficulty moving the neck and shoulders

	r- value (Pearson chi-square)	p-value
Test 1	11.06	0.026
Test 2	6.87	0.143
Test 3	3.975	0.409
Test 4	3.017	0.555
Test 5	0.936	0.626
Test 6	5.197	0.074
Test 7	0.766	0.682
Test 8	0.006	0.997
Test 9	0.006	0.939
Test 10	0.979	0.322

1. pain, muscle tightness or difficulty moving the neck and shoulders with the degree of standing
2. pain, muscle tightness or difficulty moving the neck and shoulders with the degree of sitting
3. pain, muscle tightness or difficulty moving the neck and shoulders with the number of hours that participants spend on the devices
4. pain, muscle tightness or difficulty moving the neck and shoulders with holding the device correctly
5. the Awareness of the drawbacks/problems of long using smart devices with the number of hours that participants spend on the devices
6. the participants know how often he\she need breaks during E-reading with the number of hours that participants spend on the devices
7. Headache with the number of hours that participants spend on the devices
8. Visual abnormalities with the number of hours that participants spend on the devices
9. Know the right position to hold the device with holding the device correctly
10. Knowledge of the right distance between the device and the eyes with holding the device correctly

DISCUSSION

Due to the increasing usage of smart devices and longtime using them in a wrong position, people suffer more from neck and spine problems. 215 students participated in the study. Most of them were females. Participants were students at King Saud bin Abdul-Aziz University for Health Sciences. The study showed that the less degree of flexed neck (<60 degrees) while using the device in a wrong way, the more susceptible to suffer from pain, muscle tightness, and difficulty moving neck and spine. Also, more time spent on the device increases the risk of having problems in neck and spine. These problems are caused by tissue sore and inflammation when stretched for a long period of time⁽⁹⁾. One study showed a relationship between time spent on the device and trapezius and cervical erector spinae pain⁽²⁴⁾. Other studies showed similar results to our study, that the wrong position while holding smart devices leads to various health problems like back pain and muscle tightness^(25,26). The strengths of our study are that the participants were selected randomly in a convenient way. Also, survey does not take time to complete it, so people did not get bored doing it. Moreover, we took pictures of the participants while using their devices. However; this study had several

important limitations. First, survey and observation were not tested before. Second, some participant thought that vision abnormalities mentioned in the questionnaire are hereditary abnormalities while we mean vision abnormalities caused by using the smart device for a long period of time. Participants were observed after doing the survey; thus, some of them tried to fix their posture even though they were told not to. Also, participants ages were limited, so it is hard to generalize the result on older or younger population.

CONCLUSION

To conclude, this study found excessive effect on neck and spine due to wrong position while holding the device. Moreover, other studies found that holding devices incorrectly for a long period of time and with a wrong position could lead to a syndrome called Text Neck. Future research should be focuses on a different age group. Participants should be observed before doing the survey to avoid bias.

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