

The Relationship Between Using Smartphones and Text Neck Syndrome in Online Learning Among University Students in Jordan: A Survey Study

Mohannad Hawamdeh^{1(A,B,C,D)} (ORCID: 0000-0002-4701-3349)

Saad M. Al-Nassan^{1,2(B,D,E,F)} (ORCID: 0000-0003-1508-3702)

Sakher M. Obaidat^{1(B,D,F)} (ORCID: 0000-0001-9992-8666)

Amjad Shallan^{1(A,C,D,F)} (ORCID: 0000-0002-2669-8780)

Ziad M Hawamdeh^{3(A,F)} (ORCID: 0000-0001-5621-6415)

Owis Eilayyan^{2(A,C,D)} (ORCID: 0000-0001-6191-8745)

Thamer A. Altam^{2(B,E)} (ORCID: 0000-0001-6527-4289)

Fahad Alanazi^{4(E,F)} (ORCID: 0000-0001-6193-2758)

¹ Department of Physical and Occupational Therapy, Faculty of Applied Medical Sciences, The Hashemite University, Zarqa, Jordan

² Department of Physical Therapy, Faculty of Allied Health Sciences, Al-Ahliyya Amman University, Amman, Jordan

³ School of Medicine, The University of Jordan, Amman, Jordan

⁴ Department of physical therapy and health Rehabilitation, College of Applied Medical Sciences, Jouf University, Saudi Arabia

SUMMARY

Background. The use of online learning methods has expanded considerably in many countries since the declaration of COVID-19 as a global pandemic by the World Health Organization. Smartphones are widely used for voice and text messaging, checking emails, and distance learning. The aim of this study was to investigate the relationship between using smartphones and text neck syndrome.

Material and methods. A cross-sectional study was conducted among university students in Jordan between February and March 2023. All undergraduate students were invited to participate. A self-administered online (Google forms) questionnaire was distributed by posting the link to the questionnaire on students' groups through social media websites such as Facebook, Twitter, and WhatsApp.

Results. A total of 171 students responded to the survey. The participants included 103 (60%) females and 68 (40%) males. Approximately 79% of the participants were less than 22 years old. Almost half of the participants reported pain at neck (54%) and shoulder (51%), while about 61% of participants suffered from upper back pain.

Conclusions. 1. Smartphones are widely becoming essential in educational technology, and more concern should be expended to increase the awareness about optimal and healthy usage of smartphones by restricting usage duration in order to reduce neck and shoulder pain and associated poor functioning in daily living activities. 2. Poor patterns of smartphone use increase the likelihood of neck pain. 3. Neck movement limitations are not associated with age or gender. 4. Students who did not report limitation in neck movement were less likely to have difficulty with reading.

Key words: Text Neck Syndrome, smartphone, online education, students

BACKGROUND

The use of online learning methods has expanded considerably in many countries since the declaration of COVID-19 as a global pandemic by the World Health Organization. Smartphones are widely used for voice and text messaging, checking emails, and distance learning. A recent study shows that 79% of the population between the ages of 18-44 have their cell phones with them most of the time, with only two hours without their phones [1]. Prolonged neck flexion during smartphone use leads to what is known as text neck syndrome [2]. Text neck (TN) syndrome was first described by Fishman as neck pain that is caused by repetitive stress injury or overuse that usually accompanies prolonged use of mobile phones or other digital devices such as tablets and laptops [1].

The weight of the head on the spine increases with a forward head posture [3]. An average cervical spine angle in flexion when texting is 37 to 47 degrees [4]. The greater the degree of head flexion, the more the head weight will increase as a result of this prolonged action; inflammation of the ligaments, muscles, and nerves in the neck may occur in addition to permanent arthritic damage with increased curvature of the spine [1].

Adolescents and young adults in USA and Australia are reported as the age groups with the highest percentages of smartphone users, reaching 95% [5]. This large percentage of young people using smartphones has raised the alarm worldwide to seriously consider TN as an epidemic of the modern era of cell phones [6, 7]. However, looking at the literature on the association between smartphone texting and TN syndrome, scientific evidence is still growing and judgments cannot be easily established [5, 8]. The current literature shows gaps in research on the association of TN syndrome and neck pain, for example among distance learners during the COVID-19 pandemic. In addition, the total number of cases of text neck syndrome due to smartphone addiction or prolonged use of smartphones is still unknown [7].

Many universities are currently offering online courses to their students alongside traditional face-to-face teaching methods. The current study set out to determine the level of awareness about text neck syndrome and its prevalence among university students. We believe that the current study will add to the scientific literature concerned with TN syndrome and provide important figures specific to the university society and culture. Furthermore, we hope this study can raise the alarm and increase the awareness about this important health condition in the Jordanian society.

MATERIAL AND METHODS

This cross-sectional study was conducted among university students in Jordan between February and March 2023. All undergraduate students were invited to participate. A self-administered online (Google forms) questionnaire was distributed by posting the link to the questionnaire on students' groups through social media websites such as Facebook, Twitter, and WhatsApp. Students from all faculties were included in this study. Participants were requested to provide general demographic data including age, gender and university name. They were then asked to answer questions related to smartphone usage including the average duration of daily smartphone use and the body position when studying by using a smartphone. In addition, we asked the students about their experiences during the use of smartphones in terms of the severity of the pain using a numerical pain rating scale, type, and location of the pain. After that, the students were asked about neck disability-related variables, and finally, to report if they are seeking medical care or using analgesics to manage their neck pain. The study was evaluated and approved by the Institutional Review Board (IRB) of the Hashemite University on 4 May 2022 (Decision No. 2/6/2021/2022). The objectives and goals of this study were explained at the beginning of the questionnaire. Informed consent was also obtained from all participants prior to their participation in this study.

Inclusion criteria

We included in this study all undergraduate students at universities from all faculties who were willing to participate at the time of the data collection.

Exclusion criteria

Students with musculoskeletal diseases or anomalies or a history of trauma or surgeries in the neck or shoulder regions were excluded from this study.

Statistical analysis

Data from the survey was descriptively analysed in SAS using the variables number (n) and percentage (%). All study variables were treated as categorical variables, either binary or ordinal. Simple binary logistic regression models were run to assess the factors of neck pain, shoulder pain, upper back pain and limitation in neck movement, while ordinal logistic regression models were used to assess the factors of concentration, sleep trouble and difficulty with reading. Significance of the relationship between the variables was accepted at p -value < 0.05 . Beta-coefficients and odds ratios were used to present the rela-

tionship between the outcomes and their factors. There was no missing data to treat.

RESULTS

A total of 171 students responded to the survey. The participants were 103 (60%) females and 68 (40%) males, and approximately 79% of the participants were less than 22 years old. Almost half of the participants reported pain at neck (54%) and shoulder (51%), while about 61% of participants suffered from upper back pain (Tab. 1). Approximately two-

thirds of participants reported dizziness. Changing position was the most frequent method used by participants to relieve the pain. Being male reduced the odds ratio of having neck pain by 0.472 (p-value = 0.017) and being in a younger age group (18-22 years old) increased the odds ratio of having neck pain (p-value = 0.0154). Also, a sitting position with the neck curved down toward the phone increased the probability of having neck pain. On the other hand, neck pain was not significantly associated with the number of study hours and dominant hands (Tab. 2). Left-

Tab. 1. Characteristics of Participants

Variables	N (%)
Gender:	
Female	103 (60%)
Male	68 (40%)
Age group:	
18-22 years	135 (79%)
22-25 years	17 (10%)
25-30 years	19 (11%)
Study Hours:	
2-4 hours	62 (36%)
4-6 hours	68 (40%)
> 6 hours	41 (24%)
Body position:	
Lying on one side, holding your phone with the other hand	19 (11%)
Lying on your back and holding your phone parallel to your head	28 (16%)
Sitting and holding your phone in your hand at eyesight level without bending your neck	41 (24%)
Sitting with your neck curved down toward your phone.	83 (49%)
Dominant Hand:	
Left hand	11 (6%)
Right hand	160 (94%)
Neck pain:	
Yes	92 (54%)
No	79 (46%)
Upper Back pain:	
Yes	105 (61%)
No	66 (39%)
Shoulder Pain:	
Yes	87 (51%)
No	84 (49%)
Limitation in neck movement:	
Yes	75 (44%)
No	96 (56%)

Tab. 2. Output of simple binary logistic models of neck pain

Variables	Beta-coefficient, Odds ratio (p-value)
Gender:	
Female (ref)	0
Male	-0.37, 0.47 (0.018)
Age group: 18-22 years (ref)	
Age 22-25 vs 18-22 years	1.92 (0.02)
Age 25-30 vs 18-22 years	3.9 (0.02)
Study Hours:	
2-4 hours (ref)	0
4-6 hours	0.32, 1.33 (0.14)
> 6 hours	-0.35, 0.69 (0.15)
Body position:	
Sitting with your neck curved down toward your phone. (ref)	0
Lying on one side, holding your phone with the other hand	0.3, 0.78 (0.42)
Lying on your back and holding your phone parallel to your head	-0.6, 0.31 (0.07)
Sitting and holding your phone in your hand at eyesight level without bending your neck	-0.26, 0.44 (0.37)
Dominant Hand:	
Right hand (ref)	0
Left hand	-0.18, 0.7 (0.57)

handed students were 4.69 times (p-value = 0.57) more likely to report upper back pain than right-handed students. The results showed that upper back pain was not significantly associated with age, gender, number of study hours and body position (Tab. 3). The results showed that shoulder pain was not significantly associated with age, gender, number of study hours, body position and dominant hand (Tab. 4). Not ha-

ving neck pain (p-value = 0.0004), shoulder pain (p-value = 0.016), or upper back pain (p-value = 0.0007) reduced the odds ratio of having limited neck movement by 0.32, 0.47 and 0.32 respectively. The results showed that limitation in neck movement was not significantly associated with age, gender, number of study hours, body position (Tab. 5). The level of concentration was only affected significantly by limita-

Tab. 3. Output of simple binary logistic models of upper back pain

Variables	Beta-coefficient, Odds ratio (p-value)
Gender:	
Female (ref)	0
Male	0.24, 1.63 (0.13)
Age group: 18-22 years (ref)	
Age 22-25 vs 18-22 years	-0.34, 0.42 (0.42)
Age 25-30 vs 18-22 years	-0.19, 0.49 (0.64)
Study Hours:	
2-4 hours (ref)	0
4-6 hours	0.22, 2.09 (0.32)
> 6 hours	0.31, 2.29 (0.21)
Body position:	
Sitting with your neck curved down toward your phone. (ref)	0
Lying on one side, holding your phone with the other hand	-0.8, 0.52 (0.07)
Lying on your back and holding your phone parallel to your head	0.38, 1.7 (0.25)
Sitting and holding your phone in your hand at eyesight level without bending your neck	0.57, 2.1 (0.053)
Dominant Hand:	
Right hand (ref)	0
Left hand	0.77, 4.9 (0.03)

Tab. 4. Output of simple binary logistic models of shoulder pain

Variables	Beta-coefficient, Odds ratio (p-value)
Gender:	
Female (ref)	0
Male	0.18, 1.42 (0.26)
Age group: 18-22 years (ref)	
Age 22-25 vs 18-22 years	-0.26, 0.49 (0.49)
Age 25-30 vs 18-22 years	-0.19, 0.53 (0.6)
Study Hours:	
2-4 hours (ref)	0
4-6 hours	0.04, 1.07 (0.86)
> 6 hours	-0.01, 1.02 (0.96)
Body position:	
Sitting with your neck curved down toward your phone. (ref)	0
Lying on one side, holding your phone with the other hand	-0.1, 1.07 (0.79)
Lying on your back and holding your phone parallel to your head	0.007, 1.2 (0.98)
Sitting and holding your phone in your hand at eyesight level without bending your neck	0.25, 1.5 (0.37)
Dominant Hand:	
Right hand (ref)	0
Left hand	0.32, 1.9 (0.33)

Tab. 5. Output of simple binary logistic models of difficulty with neck movement

Variables	Beta-coefficient, Odd ratio (p-value)
Gender:	
Female (ref)	0
Male	0.19, 1.47 (0.23)
Age group: 18-22 years (ref)	
Age 22-25 vs 18-22 years	0.31, 3.02 (0.41)
Age 25-30 vs 18-22 years	0.48, 3.57 (0.2)
Study Hours:	
2-4 hours (ref)	0
4-6 hours	-0.22, 0.77 (0.3)
> 6 hours	0.17, 1.13 (0.49)
Body position:	
Sitting with your neck curved down toward your phone. (ref)	0
Lying on one side, holding your phone with the other hand	-0.23, 1.14 (0.54)
Lying on your back and hold your phone parallel to your head	0.26, 1.8 (0.44)
Sitting holding your phone in your hand to the level of your eyesight without bending your neck	0.32, 1.98 (0.27)

tion in neck movement, where students who did not have difficulty with neck movement were 0.53 times (p -value = 0.023) less likely to have a lower level of concentration. Also, the results showed that concentration was not significantly associated with age, gender, number of study hours, body position, dominant hand, neck pain, shoulder pain, upper back pain or limitation in neck movement.

Work limitations

The present study has a few limitations related to the small sample size. Moreover, many of our students participating in this study are in health schools (medicine, nursing, and physical therapy). Their responses might be influenced by their previous knowledge of the subject.

DISCUSSION

In this study, about half (54%) of the students surveyed reported general neck pain and (51%) reported shoulder pain, while (61%) reported upper neck pain. Similar results were reported in a study carried out among medical students in Saudi Arabia (68.1%) [2], and another study carried out in Saudi Arabia among smartphone users from medical and dental colleges reported that 71.2% complained of neck pain [9]. Our findings are similar to those reported in South Africa, Australia, Brazil (55.44%), Ethiopia (49.2%), Turkey (71.7%), Pakistan (43.6%) and Iraq (64.5%) [10-16]. Most participants (64%) in our study were addicted to smartphone use, where most students use their phones for more than 4 h per day, mainly for studying. Our findings are consistent with the findings from studies conducted in Saudi Arabia, Korea, Brazil, Egypt and Iraq, which found that 63.1%, 42.1%, 76.6%, 53.6% and 61.5% of students, respectively, spent 4 hours or more using their smartphones per day [2,12,17,18]. Similarly, a study found that 36.3% of Turkish students used smartphones for an average of 4 to 6 h daily [19]. Recently, universities have started to rely on using smart devices and the Internet to communicate with students or to deliver educational materials through different education platforms. Therefore, students have started to be addicted to smartphones or tablets rather than using laptops or desktops for handling educational materials. Another reason for the increase in smartphone use between 2020-2022 is COVID-19-related lockdown. Our findings did not show any association between neck pain or shoulder pain with the number of hours of smartphone use. Similarly, a meta-analysis by Xie et al. found no clear evidence about the relationship between the total number of hours of smartphone use

and musculoskeletal pain or disability [20]. Our study found males had an odds ratio of .472 for developing neck pain less than females. In the literature, neck and shoulder pain has been reported more frequently among females. As in our study, previous studies reported that musculoskeletal pain was more prevalent among female adolescents as compared to male adolescents. Females tend to have more musculoskeletal pain, which can be attributed to a lower pain threshold in females compared to males, in addition to the differences in body structure and physical activity levels between the genders, where females have a weaker body structure and lower physical activity as well as having a higher risk of stress pain resulting from a higher mental and psychological stress compared to males [21-23]. Our study also found that left-handed students are more likely to have neck pain than right-handed students. Similarly, previous literature reported that left-handed individuals usually experience more neck pain than right-handed individuals [24]. It may be suggested that left-handed students made a greater effort than right-handed students. Neck pain and shoulder pain were not associated with body and neck posture in our study, which is also in line with previous studies showing that neck and body posture had no association with pain [25,26]. Our study investigated the effects of neck pain resulting from using smartphone on neck movement, and functional difficulty in daily living such as reading and sleeping. Students with neck pain and shoulder have reported greater limitation in neck movement. Furthermore, Neck movement limitation was significantly associated with the level of concentration, difficulty with reading, and sleep issues. Thus, we can infer that university students have a higher risk of developing neck pain and associated difficulties in activities of daily living because of their smartphone addiction. Previous studies reported that functioning in daily living activities such as sleeping and reading was highly affected by neck pain and disability [9,27,28]. Our study findings suggest that the pain and functioning in daily activities are useful measurements to describe the associated smartphone addiction issues.

CONCLUSIONS

1. Smartphones are widely becoming essential in educational technology, and more concern should be expended to increase the awareness about optimal and healthy usage of smartphones by restricting usage duration in order to reduce neck and shoulder pain and associated poor functioning in daily living activities.

2. Poor patterns of smartphone use increase the likelihood of neck pain.
3. Neck movement limitations are not associated with age or gender.
4. Students who did not report limitation in neck movement were less likely to have difficulty with reading.

PIŚMIENICTWO / REFERENCES

1. Ahmed S, et al. Prevalence of text neck syndrome and SMS thumb among smartphone users in college-going students: a cross-sectional survey study. *Journal of Public Health* 2021; 29: 411-6.
2. Al-Hadidi F, et al. Association between mobile phone use and neck pain in university students: A cross-sectional study using numeric rating scale for evaluation of neck pain. *PloS one* 2019; 14(5): e0217231.
3. Alsawed KT, et al. The prevalence of text neck syndrome and its association with smartphone use among medical students in Jeddah, Saudi Arabia. *Journal of Musculoskeletal Surgery and Research* 2021; 5(4): 266-72.
4. AlZarea BK, Patil SR. Mobile phone head and neck pain syndrome: proposal of a new entity. *Headache* 2015; 251: 63.
5. BAVLI Ö, et al. Investigation of smartphone addiction levels among university students. *Uluslararası Kültürel ve Sosyal Araştırmalar Dergisi (UKSAD)* 2018; 4(1): 326-33.
6. Chaudary AA, et al. Frequency of text neck syndrome in medical students due to excessive usage of electronic devices. *Journal of Pakistan Orthopaedic Association* 2019; 31(02): 79-82.
7. Damasceno GM, et al. Text neck and neck pain in 18-21 year old young adults. *European Spine Journal* 2018; 27: 1249-54.
8. David D, et al. Text neck syndrome in children and adolescents. *International journal of environmental research and public health* 2021; 18(4): 1565.
9. Eldesokey S, et al. Smartphone addiction among medical students in mansoura university. *Egypt J Psychiatr* 2021; 42: 50-6.
10. Fillingim RB, et al. Sex, gender, and pain: a review of recent clinical and experimental findings. *The journal of pain* 2009; 10(5): 447-85.
11. Giansanti D, et al. The Text Neck: Can Smartphone Apps with Biofeedback Aid in the Prevention of This Syndrome. *Converging Clinical and Engineering Research on Neurorehabilitation III: Proceedings of the 4th International Conference on NeuroRehabilitation (ICNR2018)*, October 16-20, 2018. Italy(Pisa): Springer; 2019.
12. Güneş S, et al. Musculoskeletal system pain and related factors during online education in the COVID-19 pandemic among Ankara university faculty of medicine students, Turkey. *J Ankara Univ Fac Med* 2022; 75: 36-41.
13. Korpinen L, Pääkkönen R. Physical symptoms in young adults and their use of different computers and mobile phones. *International Journal of Occupational Safety and Ergonomics* 2011; 17(4): 361-71.
14. Lee JI, Song HS. The correlation analysis between hours of smartphone use and neck pain in the Gachon university students. *Journal of Acupuncture Research* 2014; 31(2): 99-109.
15. Lee S, et al. Head flexion angle while using a smartphone. *Ergonomics* 2015; 58(2): 220-6.
16. Jarry J. Text Neck: Is the Epidemic Truly Over? available from: <https://www.mcgill.ca/oss/article/technology-general-science/text-neck-epidemic-truly-over> (accessed 21.3.2021).
17. Mortazavi S, et al. Prevalence of subjective poor health symptoms associated with exposure to electromagnetic fields among university students. *Bioelectromagnetics: Journal of the Bioelectromagnetics Society, The Society for Physical Regulation in Biology and Medicine, The European Bioelectromagnetics Association* 2007; 28(4): 326-30.
18. Neupane S, et al. Text neck syndrome-systematic review. *Imperial journal of interdisciplinary research* 2007; 3(7): 141-8.
19. Ogunlana MO, et al. Prevalence and patterns of musculoskeletal pain among undergraduate students of occupational therapy and physiotherapy in a South African university. *Hong Kong Physiotherapy Journal* 2021; 41(01): 35-43.
20. Rashid MK, et al. Prevalence of text neck syndrome among Iraqi medical students: a cross-sectional study. *Journal of Ideas in Health* 2022; 5(Special1): 693-9.
21. Richards KV, et al. Neck posture clusters and their association with biopsychosocial factors and neck pain in Australian adolescents. *Oxford University Press* 2016; 96: 1576-87.
22. Silva AL, et al. Prevalence of chronic pain and associated factors among medical students." *Revista Dor* 2017; 18: 108-11.
23. Smith D, Leggat P. Prevalence and distribution of musculoskeletal pain among Australian medical students. *Journal of Musculoskeletal Pain* 2007; 15(4): 39-46.
24. SurEsh A, et al. Impact of Smartphone Addiction on Neck Pain and Disability in University Students. *Journal of Clinical & Diagnostic Research* 2021; 15(6): YC01-3.
25. Tezel A, et al. Musculoskeletal disorders in left-and right-handed Turkish dental students. *International journal of neuroscience* 2005; 115(2): 255-66.
26. Toh SH, et al. The associations of mobile touch screen device use with musculoskeletal symptoms and exposures: A systematic review. *PloS one* 2017; 12(8): e0181220.
27. Weleslassie GG, et al. Burden of neck pain among medical students in Ethiopia. *BMC musculoskeletal disorders* 2020; 21(1): 1-9.
28. Xie YF, et al. Spinal kinematics during smartphone texting—A comparison between young adults with and without chronic neck-shoulder pain. *Applied ergonomics* 2018; 68: 160-8.

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Adres do korespondencji / Address for correspondence

Mohannad Hawamdeh, 1 Department of Physical and Occupational Therapy, Faculty of Applied Medical Sciences, The Hashemite University, P.O. Box 330127, Zarqa 13133, Jordan
email: mohannadhawamdeh@hu.edu.jo, Tel: 00962776989494

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