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ORIGINAL RESEARCH

Relationship between digital mobile device usage duration and neck awareness, neck pain intensity and neck disability among physiotherapy and rehabilitation department students with non-specific neck pain

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Abstract

The aim of this study was to investigate the relationship between daily mobile phone screen time and neck pain intensity, disability, and neck awareness in university students with neck pain. A total of 92 university students (13 males, 79 females) with non-specific neck pain were included in the study. Demographic data and average daily mobile phone screen time (in minutes/day) of the individuals were recorded. Neck pain intensity was assessed using the Numerical Rating Pain Scale (NRPS), neck disability was assessed using the Neck Disability Index (NDI), and neck awareness was assessed using the Fremantle Neck Awareness Questionnaire (FreNAQ). Correlational and linear regression analyses were performed. The mean age of the individuals was 22.78 years and the mean screen time was 336.37 ± 111.51 minutes per day. A weak but statistically significant negative correlation was found between screen time and neck pain intensity ($r=-0.211$; $p=0.044$) and NDI scores ($r=-0.207$, $p=0.048$), while no significant correlation was found between screen time and FreNAQ scores ($r=-0.109$; $p=0.303$). Linear regression analyses supported that higher neck pain or disability was associated with lower screen time ($p<0.05$), but the multiple regression model including both predictors approached, yet did not reach, statistical significance ($p=0.059$). These findings highlight that neck pain and disability may affect mobile phone use, highlighting the need for ergonomic and preventative strategies. Shorter mobile phone screen time was associated with higher neck pain intensity and disability levels. This may be due to individuals with more pain or disability behaviorally limiting screen use. The fact that physiotherapy and rehabilitation students are aware of this issue and have less screen time when they have neck problems may be a guide for future studies that improvements will work when the level of knowledge for the entire population increases. Additionally, the lack of a significant relationship between neck awareness and screen time may indicate that body perception constructs are more strongly associated with cognitive and emotional factors than with behavioral measures.

Introduction

Advances in technology increasingly facilitate daily life through the widespread use of mobile devices in domains such as shopping, education, emerging professional fields, and mobile banking (Resende et al., 2025). Especially with the pandemic, remote working or video remote lessons, which have become more important in our lives, have changed people's preferences and habits in terms of time and space (Pasala et al., 2021; Resende et al., 2025). On the other hand, the increase in the time spent on mobile devices can make individuals more open to some musculoskeletal problems (Is et al., 2025). Studies show

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that smartphone usage is associated with neck pain and functional limitations. A cross-sectional study highlighted that excessive smartphone usage for both work-related and personal purposes among healthcare workers was associated with musculoskeletal problems, particularly affecting the neck, jaw, and elbows (Is et al., 2025). A study conducted among university students reported a positive correlation between smartphone addiction, neck pain, and neck disability, underscoring the importance of raising public awareness (Güloğlu & Yalçın, 2021). Similarly, another study demonstrated a significant association between screen time and musculoskeletal disorder scores, depression, physical activity, and quality of life among associate degree students (Karakoç & Keşim, 2023). Excessive smartphone usage time is positively associated with musculoskeletal problems, particularly in the neck, shoulders, and hands, among university students, emphasizing the importance of public health initiatives to raise awareness of the physical and biological risks of excessive smartphone usage (Alghadir et al., 2025).

In the context of mobile device use, increased cervical flexion and the habitual adoption of a forward head posture may contribute to the development of text neck syndrome (Grasser et al., 2023). Therefore, pain that occurs in the cervical spine over time and disability in daily life activities make it difficult for individuals (Grasser et al., 2023). It is supported by various studies that painful body parts are associated with impaired body awareness and that this impairment increases pain (Erol et al., 2019; Onan et al, 2020; Wand et al., 2011). It is stated that pain and its future consequences may be caused by incorrectly stimulated neuroplastic changes (Erol et al., 2019; Onan et al., 2020; Wand et al., 2011). Increased screen time may cause incorrectly stimulated neuroplastic changes in the brain. Neck awareness refers to perceptions such as the neck being larger, smaller, asymmetrical, and or its location in space (Onan et al., 2020). Considering that these perceptual changes may be influenced by behavioral and environmental factors that could lead to improper use of the neck, the relationship between screen time, neck awareness, and neck pain has not been sufficiently addressed in the current literature. In this context, university students who use digital mobile devices quite intensively for their academic and social lives are a population prone to neck pain.

University students may experience neck problems, including limited movement, difficulty in daily activities, and reduced neck awareness. Investigating the relationship between smartphone usage duration and neck pain, disability, and awareness can inform preventive programs. The hypotheses of our study are as follows: There is a relationship between digital mobile device usage duration and neck pain intensity among university students; there is a relationship between digital mobile device usage duration and the level of neck disability among university students; there is a relationship between digital mobile device usage duration and neck awareness among university students; and there are significant relationships among digital mobile device usage duration, neck pain intensity, neck disability, and neck awareness. The aim of this study is to investigate the relationship between digital mobile device usage duration and neck pain intensity, neck disability and neck awareness in university students.

Methods

Study Design

This study was a prospective, observational, non-blinded, evaluation study conducted to evaluate the relationship between digital device usage times and neck awareness, neck pain intensity, and neck disability among university students. Ethics committee approval for this study was obtained from the Tokat Gaziosmanpaşa University Faculty of Medicine Non-Interventional Scientific Research Ethics Committee in accordance with the principles of the Declaration of Helsinki (24/04/2025, 25-MOBAEK-139).

Participants

Students with nonspecific neck pain studying at the Tokat Gaziosmanpaşa University Physiotherapy and Rehabilitation Department were included in the study. The individuals participating in the study were asked to answer the questionnaires after obtaining their written consent. The study was conducted between 26.04.2025-26.05.2025. The inclusion criteria were being over 18 years old, being a university student, having a smartphone, and having nonspecific neck pain. Exclusion criteria were having a history of chronic neck disease (cervical disc herniation, fibromyalgia, etc.), having musculoskeletal pain other than nonspecific neck pain, having a history of neck trauma/surgery within the last 6 months, having a neurological disease, and filling out the questionnaires incompletely.

Outcome Measurements

All patients were asked for clinical and demographic information such as sex, age, weight, height, number of years of nonspecific neck pain, number of days with neck pain per month, duration of neck pain, and neck

pain localization. The primary outcome measures of this study were digital mobile device usage duration, neck pain intensity, neck disability, and neck awareness; secondary outcome measures were sociodemographic and clinical characteristics of the participants, including age, sex, height, weight, neck pain duration, number of painful days per month, and pain localization.

Digital Mobile Device Usage Duration

Students were asked to indicate their daily screen usage duration in the last week from their smartphone applications.

Assessment of Neck Pain Intensity

The Numerical Rating Pain Scale (NRPS) is a pain intensity assessment method where individuals are asked to indicate the number representing the amount of pain they experience during the assessment, with "no pain = 0" at the far left and "worst imaginable pain = 10" at the far right (Hartrick et al., 2003).

Assessment of Disability

Neck Disability Index (NDI) was developed by Vernon et al. (1991). The Turkish version study was conducted by Aslan et al. The NDI includes a total of 10 questions such as pain, personal care, concentration, work, driving, and sleeping. Each question is scored between 0 and 5 points. A score of 0 means no restriction, a score of 50 means full restriction. A score between 0 and 4 means no restriction, a score of 5-14 means mild restriction, a score of 14-24 means moderate restriction, a score of 25-34 means severe restriction, and a score of 35 and above is evaluated as restriction (Telci et al., 2009; Vernon & Mior, 1991).

Assessment of Neck Awareness

The Fremantle Neck Awareness Questionnaire (FreNAQ) is a simple Likert-type questionnaire (0 = Never/Never feel like this, 1 = Rarely feel like this, 2 = Sometimes or some of the time feel like this, 3 = Often feel like this, 4 = Always or most of the time feel like this) that assesses individual-specific altered perception. The questionnaire asks individuals 9 questions about how they perceive their neck in relation to their body. The questionnaire is a questionnaire whose validity and reliability have been confirmed in neck pain by Onan et al (Onan et al., 2020; Wand et al., 2016).

Sample Size

Sample size calculation was performed with G*Power (Power Analysis and Sample Size) software. When the sample size was accepted as α=0.05, β=0.80, an acceptable correlation coefficient r=0.70, and a negligible correlation coefficient r=0.20, 16 individuals were sufficient to measure the relationship between two parameters according to the G*Power analysis. Since the relationship between four parameters was evaluated, a total of 64 individuals were required.

Statistical Analysis

The data obtained from the study were analyzed with the JASP statistical program (Version 0.19.2, University of Amsterdam, Amsterdam, The Netherlands). The Kolmogorov-Smirnov test was used to evaluate the normality of data distributions. Continuous variables were expressed as mean ± standard deviation or median (minimum and maximum values), while categorical variables were presented as numbers and percentages. For correlation analysis between variables, Pearson Correlation Analysis was used if the data were normally distributed, and Spearman Correlation Analysis was used if they were not normally distributed. Regression analysis was performed to clarify whether digital device usage (specifically, mobile phone screen time) could be explained by factors such as neck awareness, neck pain, and disability. For all analyses, a significance level of $p<0.05$ was considered statistically significant.

Results

A total of 92 university students were included in the study. Of the individuals included in the study, 13 (14.1%) were male and 79 (85.9%) were female. The individuals had a mean age of 22.78±1.77 years, the mean mean body mass index (BMI) was 22.16±4.05 kg/m². Regarding neck pain-related characteristics, the individuals had 9.97±6.64 monthly neck pain days, and neck pain duration was 2.01±2.02 years. The mean of neck pain intensity was 4.68±1.48, the neck disability 15.55±6.26, and the neck awareness 11.73±5.93. Individuals had moderate neck pain intensity and moderate neck disability levels (Table 1).

According to the findings, a weak but significant negative correlation was found between average mobile phone screen time per day and neck pain intensity (NPRS) (r=-0.211; p=0.04). Similarly, a weak but significant negative correlation was found between average mobile phone screen time per day and the NDI scores (r=-0.207; p=0.04) (Table 2).

In linear regression analyses, higher levels of neck pain or disability were associated with lower mobile phone screen time ($p<0.05$). When both variables were examined together in a multiple regression model

Table 1
Demographic characteristics of the individuals (n=92).

	Mean ± SD
Age *(years)*	22.78 ± 1.77
Weight *(kg)*	61.48 ± 14.40
Height *(m)*	1.65 ± 0.08
BMI *(kg/m^2)*	22.16 ± 4.05
	n (%)
Sex *(Female / Male)*	79 (85.9%) / 13 (14.1%)
Marital status *(Single / Married)*	90 (97.8%) / 2 (2.2%)
Smoking *(Yes / No)*	16 (17.4%) / 76 (82.6%)
Alcohol use *(Yes / No)*	9 (9.8%) / 83 (90.2%)
Neck pain area *(Right / Left / Bilateral)*	34 (37%) / 12 (13%) / 46 (50%)
	Mean ± SD
Neck pain intensity *(NRPS)*	4.68 ± 1.48
Neck pain duration *(years)*	2.01 ±2.02
Monthly neck pain days	9.97 ± 6.64
Mobile phone screen time per day *(minutes/day)*	336.37 ± 111.51
	Mean ± SD (Min-Max)
Neck Disability Index *(NDI)*	15.55 ± 6.26 (3-31)
FreNAQ	11.73 ± 5.93 (1-26)

SD: Standard deviation; BMI: Body mass index; Min: Minimum; Max: Maximum; NRPS: Numeric Rating Pain Scale; FreNAQ: Fremantle Neck Awareness Questionnaire; NDI: Neck Disability Index.

Table 2
Correlations between average mobile device usage duration per day and neck pain intensity, neck disability and neck awareness.

	NRPS$^{\beta}$	**NDI$^{\beta}$**	**FreNAQ$^{\beta}$**
r	-0.211	-0.207	-0.109
p	0.044*	0.048*	0.303

*$^{\beta}$: Pearson correlation analysis; NRPS: Numeric Rating Pain Scale; NDI: Neck Disability Index; FreNAQ: Fremantle Neck Awareness Questionnaire; r: Correlation Coefficient; *p<0.05.*

Table 3
Linear and multiple linear regression analysis results for mobile device usage duration.

Predictor	**B (Unstd.)**	**SE**	**β (Std.)**	**t**	**p**	**95% CI for B**	**VIF**
Model 1: Linear Regression (Neck pain intensity)							
Neck Pain Intensity (0–10)	-15.770	7.715	-0.211	-2.044	0.044	(-31.097, -0.443)	1.000
$R = 0.211$; $R^2 = 0.44$; Adjusted $R^2 = 0.034$; $F(1, 90) = 4.178$; $p = 0.044$							
Model 2: Linear Regression (Neck disability)							
Neck Disability Index score	-3.680	1.836	-0.207	-2.00	0.048	(-7.328, -0.032)	1.000
$R = 0.207$; $R^2 = 0.43$; Adjusted $R^2 = 0.032$; $F(1, 90) = 4.015$; $p = 0.048$							
Model 3: Multiple Linear Regression							
Neck Pain Intensity (0–10)	-11.304	8.44	-0.151	-1.33	0.184	(-28.082, 5.475)	1.206
Neck Disability Index score	-2.568	2.00	-0.144	-1.27	0.204	(-6.558, 1.422)	1.206
$R = 0.248$; $R^2 = 0.062$; Adjusted $R^2 = 0.041$; $F(2, 89) = 2.921$; $p = 0.059$							

B (Unstd.): Unstandardized Coefficient (B); SE: Standard Error; t: t-statistic; p: p-value; 95% CI for B: 95% Confidence Interval for B; VIF: Variance Inflation Factor.

(a combined model including both predictors simultaneously), the overall model approached but did not reach statistical significance (R^2=0.044; Adjusted R^2=0.023; $F_{(2, 89)}$=2.056; p=0.059). The Variance Inflation Factor (VIF) values were low (1.206), indicating no multicollinearity. The Fremantle Neck Awareness Questionnaire was initially considered a predictor, but because it was not significantly associated with mobile phone screen time in preliminary analyses (p=0.303), it was removed from the multiple regression model to avoid overfitting and multicollinearity issues (Table 3).

Discussion

This study aimed to investigate the relationship between mobile phone screen time and neck pain intensity, neck disability level, and neck awareness among university students. Our findings showed that there were weak but statistically significant negative correlations between screen time and both neck pain intensity and neck disability level. However, the correlation between screen time and neck awareness was not significant.

Our results differ from studies in the literature that have shown a positive association between the duration of mobile device use and neck problems. Al-Hadidi et al. (2019) reported that neck pain intensity showed a low positive correlation with the duration of phone use and age. Ladeira et al. (2023) found a large correlation between neck disability and smartphone addiction and a moderate correlation between neck pain and smartphone addiction in senior physiotherapy students. Smartphone usage can cause neck disability and neck-related problems due to reasons such as the habit of head forward position, increased neck flexion degree, shortness in surrounding muscles and disruption of flexibility balance (AlAbdulwahab et al., 2017). It is possible that neck-related symptoms increase in individuals with increased screen time and phone use. However, we can focus on several possible reasons for the difference in our results. First, we think that disability symptoms such as pain or movement restriction that develop due to mobile device use may lead individuals to voluntarily limit screen time. In other words, the relationship between screen time and symptoms can be explained by the symptoms shaping individuals' behaviors rather than a linear increase. This situation may result in some individuals exhibiting compensatory behavior by reducing screen time as they experience neck pain and disability. These findings suggest traditional assumptions that symptoms increase as screen time increases, and show that neck symptoms cannot be explained solely by linear effects related to screen time. The fact that the students were physiotherapy and rehabilitation students may also support this interpretation, as they are knowledgeable about the situation.

In our results, both neck pain intensity and neck disability scores were found to be significant predictors of screen time in simple linear regression analyses. However, when these two variables were included together in the multiple regression analysis, no statistical significance was observed. This finding may indicate that the relationships between the two variables and screen time have overlapping common variance and that the specific effect of both variables on screen time is weakened by including this common variance in the model. In other words, since neck pain and disability often develop together, changes in screen time may affect these two variables together; this may lead to the effect of each variable becoming dependent on the other in the regression model.

Another important finding of the study is that neck awareness (FreNAQ) does not correlate with screen time. Neck awareness is an important structure that shows how accurately and in detail an individual evaluates proprioceptive and perceptual stimuli related to the neck region. We thought that postural awareness would decrease as screen time increased, and therefore neck awareness could be affected. However, in this study, we found that neck awareness level was not related to screen time. Since neck awareness is affected not only by physical but also by cognitive and emotional factors, a single variable such as screen time may be insufficient to explain the structure of neck awareness. It is reported in the literature that proprioceptive awareness decreases in individuals with spine pain and that this contributes to the continuation of pain (Peng et al., 2021; Stanton et al., 2016; Tsay et al., 2015; Wand et al., 2016). However, the relationship between this awareness and digital behavior patterns is still unclear and more in-depth research is needed. It is stated that body awareness is also significantly related to psychological states such as stress and anxiety, and therefore its direct connection with behavioral variables may be limited (Garfinkel et al., 2015; Mehling et al., 2009). Since other factors that may affect the awareness levels of individuals, such as psychological status or attention level, were not included in our study, these evaluations that may affect neck awareness can also be taken into account.

This study has some limitations. First, the fact that the population consisted only of physiotherapy and

rehabilitation university students and that this population had knowledge about spine problems may limit the generalizability of the findings. The study included only 92 physiotherapy and rehabilitation students, and the age range of the individuals was in a narrow group. This may make it difficult to generalize the results to a larger population. While young individuals in this department may have the ability to quickly regulate screen time when they feel neck pain or disability because they are knowledgeable about spine problems, the situation may not be the same for students in different departments or older age groups. Therefore, the relationship between screen time and symptoms may vary according to factors such as age, occupational group, or the purpose of screen use. Another limitation is that a cross-sectional research design was used in the study. Such designs may be limited in revealing cause-effect relationships. Follow-up studies may provide clearer results to better understand the relationship between mobile phone screen time and neck pain. Additionally, studies that evaluate more variables together to understand how neck pain, device use, and other factors affect each other would be beneficial. Finally, our study used only questionnaire-based assessments and individual questions, which may limit the generalizability of the results due to individual awareness and pain perception being variable.

Future studies with longer follow-up periods and wider age ranges and different demographic characteristics are needed. In addition, supporting future studies with physical assessments (e.g., objective pain assessments, evaluation of neck muscles with tests or imaging methods, sensory-motor test) may provide clearer interpretation of objective data results. In order to examine the effect of mobile devices on the neck in more detail, studies that take into account factors such as posture and sitting positions in addition to screen time can be considered. Finally, examining the effect of psychological factors (e.g., stress, anxiety) on mobile phone use and pain in more depth may affect body awareness and pain perception, and understanding these interactions may contribute to the development of pain management strategies.

Conclusion

The findings of our study indicate that mobile screen time may be associated with neck pain and disability, but this relationship is shaped by complex, bidirectional, and indirect mechanisms. Neck awareness, which is also affected by cognitive perception levels, may have a more independent place in this structure. Undergraduate students of physiotherapy and rehabilitation who are knowledgeable about spinal problems may have the ability to quickly regulate screen time when they feel neck pain or disability. Therefore, prospective, multivariate, different populations, and long-term studies are needed to more clearly reveal the effects of mobile device use on neck health. At the same time, studies can be conducted that address parameters such as awareness, stress, posture, and exercise habits.

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Author Contribution

Concept: D.O; Design: D.O, H.A; Data collecting: H.A; Statistical analysis: D.O; Literature review: D.O, H.A; Writing: D.O; Critical review: D.O, H.A.

Ethical Approval

Ethics committee approval for this study was obtained from the Tokat Gaziosmanpaşa University Faculty of Medicine Non-Interventional Scientific Research Ethics Committee (24/04/2025, 25-MOBAEK-139).

Conflict of Interest

The authors have no conflict of interest.

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